Universitat de Lleida

Exercise on Prescription and Exercise Planning in Primary Health-Care Settings. An Approach by the 'Let's Walk Programme' (Programa CAMINEM)

Sebastià Mas Alòs

EXERCISE ON PRESCRIPTION AND EXERCISE PLANNING IN PRIMARY HEALTH-CARE SETTINGS

AN APPROACH BY THE 'LET'S WALK PROGRAMME'

(PROGRAMA CAMINEM)

Sebastià Mas Alòs

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Supervisors: Dr. Xavier Peirau i Terés & Dr. Antoni Planas Anzano

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CONTENTS

ABSTRACT ..... **iii**

RESUM EN CATALÀ ..... **v**

RESUMEN EN CASTELLANO ..... **vii**

FIGURES AND TABLES ..... **ix**

GLOSSARY ..... **xi**

ABBREVIATIONS ..... **xv**

CHAPTER 1 – INTRODUCTION **1**

CHAPTER 2 – BACKGROUND **7**

2.1 KEY CONCEPTS 8
2.1.1 PHYSICAL ACTIVITY AND EXERCISE *8*
2.1.2 PHYSICAL FITNESS *11*
2.1.3 HEALTH-ENHANCING PHYSICAL ACTIVITY *16*
2.2 EXERCISE TRAINING 18
2.2.1 GENERAL PRINCIPLES OF EXERCISE TRAINING *18*
2.2.2 PERIODIZATION AND PLANNING EXERCISE TRAINING *27*
2.3 HEALTH-ENHANCING EXERCISE TRAINING 30
2.3.1 EXERCISE PRESCRIPTION *30*
2.3.2 HEALTH-RELATED EFFECTS OF FITNESS TRAINING *31*
2.4 PHYSICAL ACTIVITY PROMOTION 37
2.4.1 PREVALENCE OF PHYSICAL ACTIVITY IN THE POPULATION *37*
2.4.2 RECOMMENDATIONS FOR PHYSICAL ACTIVITY *41*
2.4.3 PRIMARY HEALTH CARE *45*
2.4.4 PHYSICAL ACTIVITY PROMOTION IN SPAIN *46*
2.5 PHYSICAL ACTIVITY REFERRAL SCHEMES 54
2.5.1 AUSTRALIA. ACTIVE PRACTICE *57*
2.5.2 DENMARK. EXERCISE ON PRESCRIPTION *58*
2.5.3 FINLAND. PHYSICAL ACTIVITY PRESCRIPTION *58*
2.5.4 NEW ZEALAND. GREEN PRESCRIPTION *59*
2.5.5 SWEDEN. PHYSICAL ACTIVITY ON PRESCRIPTION *60*
2.5.6 UNITED KINGDOM. EXERCISE REFERRAL *62*
2.5.7 UNITED STATES, THE NETHERLANDS. PACE *63*
2.5.8 CATALONIA. PAFES *64*
2.6 FROM RESEARCH TO PRACTICE 65
2.6.1 EFFECTIVENESS AND EFFICACY *65*
2.6.2 FEASIBILITY *66*
2.6.3 ECONOMICAL ANALYSES *69*
2.7 THE CITY OF LLEIDA: SOCIAL, DEMOGRAPHICAL AND ENVIRONMENTAL ASPECTS 72
2.7.1 GEOGRAPHY AND DEMOGRAPHY *72*
2.7.2 HEALTH AND EXERCISE SERVICES *76*
2.8 PROGRAMA CAMINEM – LET'S WALK PROGRAMME 77
2.8.1 WALKING *77*
2.8.2 GENERAL PURPOSE OF THE CAMINEM PROGRAMME *78*
2.8.3 FEATURES OF THE CAMINEM PROGRAMME *79*
2.8.4 IMPLEMENTATION OF THE CAMINEM PROGRAMME *80*
2.9 SUMMARY 81

CHAPTER 3 – AIMS OF THE STUDY **83**

3.1 HYPOTHESES 84

CHAPTER 4 – MATERIAL AND METHODS **87**

4.1 STUDY CONTEXT 88
4.1.1 STUDY OBJECTS *91*

4.2 CAMINEM INTERVENTION 94
4.2.1 REFERRAL PROCEDURE *96*
4.2.2 FIRST CONTACT PROCEDURE *99*
4.2.3 FOLLOW-UP PROCEDURE *104*
4.2.4 DISCHARGE PROCEDURE *108*
4.2.5 MAINTENANCE *110*
4.2.6 INTERDISCIPLINARY COMMUNICATION *112*
4.2.7 MATERIAL AND PERSONAL RESOURCES *114*
4.3 DATA COLLECTION 115
4.3.1 EFFECTS *115*
4.3.2 FEASIBILITY *119*
4.4 DATA ANALYSIS 124
4.5 OTHER CONSIDERATIONS 126

CHAPTER 5 – RESULTS 127

5.1 EFFECTS 134
5.1.1 CLINICAL HEALTH OUTCOMES *137*
5.1.2 QUALITY OF LIFE *150*
5.1.3 HEALTH SERVICES DEMAND *153*
5.2 FEASIBILITY 155
5.2.1 REACH *155*
5.2.2 ADOPTION *157*
5.2.3 IMPLEMENTATION *160*
5.2.4 MAINTENANCE *165*

CHAPTER 6 – GENERAL DISCUSSION 169

6.1 SAMPLE OF STUDY OBJECTS 171
6.2 EFFECTS OF THE CAMINEM PROGRAMME 173
6.2.1 THE EFFECTS ON CLINICAL HEALTH OUTCOMES *173*
6.2.2 THE EFFECTS ON QUALITY OF LIFE *178*
6.2.3 THE EFFECTS ON HEALTH SERVICES DEMAND *179*
6.3 FEASIBILITY OF THE CAMINEM PROGRAMME 181
6.3.1 DID THE PROGRAMME REACH THE TARGET POPULATION? *181*
6.3.2 WAS THE PROGRAMME ADOPTED BY THE HEALTH PRACTITIONERS? *183*
6.3.3 DID THE PARTICIPANTS UNDERSTAND AND USE THE INTERVENTION SKILLS? *185*
6.3.4 DID THE PARTICIPANTS SUSTAIN THEIR BEHAVIOUR OVER TIME? *189*
6.4 METHODOLOGICAL CONSIDERATIONS 192
6.5 FUTURE DIRECTIONS FOR RESEARCH 195
6.5.1 FINAL COMMENTS *197*
6.5.2 REFLEXIONS FINALS (in Catalan) *199*
6.5.3 REFLEXIONES FINALES (in Spanish) *201*

CHAPTER 7 – CONCLUSIONS 205

7.1 ENGLISH 206
7.2 CATALÀ 208
7.3 CASTELLANO 210

ACKNOWLEDGEMENTS 213

REFERENCES 216

ANNEXES 239

A. EVIDENCE STATEMENTS AND SUMMARY OF RECOMMENDATIONS FOR THE INDIVIDUALIZED EXERCISE PRESCRIPTION 240
B. SPANISH HEALTH STRATEGIES, PHYSICAL ACTIVITY AIMS AND EVALUATION INDICATORS 242
C. CAMINEM URBAN ROUTE – CORRELATION BETWEEN DISTANCE AND TIME BY AGE 245
D. CAMINEM EXERCISE PRESCRIPTION WRITTEN FORM AND LOGBOOK 246
E. CLASSAF – PHYSICAL ACTIVITY BEHAVIOUR QUICK CLASSIFIER 247
F. PATIENT REFERRAL FORM – CASE EXAMPLE 248
G. DATA COLLECTION REFERRAL FORM 249
H. INFORMED CONSENT FORM 250

ABSTRACT

The main aim of this thesis was to assess the effects and feasibility of a health-enhancing exercise prescription and exercise planning in two public administrated primary health-care settings (PHC), based on the 'Let's Walk Programme' framework (*Programa CAMINEM*). Regular patients suffering from chronic conditions attending their health practitioner (HP), physician or nurse, may be included.

The study was developed as a pragmatic-driven trial for 18 months, with a minimum intervention from non-staffed professionals. Participants who were included in the intervention were assessed from four groups in relation to their physical activity behaviour at baseline and adherence to the intervention for at least six months. The core of the intervention was the interdisciplinary work between primary-care health professionals and the exercise specialist who, during the trial, worked 10 h weekly alongside the HPs in a designated office next to their surgeries.

Exercise effects were assessed through biochemical and body composition parameters (body mass index, waist circumference, blood pressure, resting heart rate, blood lipid profile, fasting plasma glucose, and glycated haemoglobin [for diabetes only]), quality of life (SF-12v2 outcomes and short question for well-being) and health services demand (ratio of monthly visits at the HP). Feasibility was evaluated following the dimensions of the RE-AIM framework (*Reach, Efficacy, Adoption, Implementation, Maintenance*). Effects were assessed instead of efficacy due to the absence of a control group.

The intervention reached 1.49% (n = 229) of the targeted population (N = 15,374), from which 178 (77.73%) were finally included. The sample showed homogeneity at baseline when comparing the four groups, except for age and body mass index. Older people had a lower body mass index and reported being more active at baseline. Data collection included a high number of missing data, which limited the impact of the results. Adhered participants showed overall improvements in health variables for both clinical and quality of life, especially for heart rate, total blood cholesterol, mental health, well-being, and physical health (for those physically inactive at baseline). Non-adhered participants showed improved results in cholesterol, mental health (for the physically inactive at baseline), and physical health (for the physically active at baseline). Mean values in health visits at their HP did not vary

significantly through the intervention. However, interquartile values were broader for non-adhered participants with a maximum value of 11.2 visits per month, compared to 4.2 for adhered participants.

None of the HPs working in the two selected PHC refused participation and 40% (n = 33) of them referred patients. These included both permanent and temporary (at least three months) staff. Nurses referred 81% of the patients and physicians 19%. Three patients had to be referred for one to be retained for six months and one out of four participants was adhered during the whole 12-month intervention. Adherence included programme retention, follow-up meetings attendance and exercise prescription compliance as previously set. Participants who were active six months after the intervention showed better health indicators than inactive participants. All adhered participants assessed after six months of their participation reported high levels of physical activity.

Intervention procedures designed within the framework of the Let's Walk Programme have been found to be feasible in both PHC in the city of Lleida (Catalonia, Spain). Health outcomes indicate positive effects for adhered participants although they were not statistically significant. Also, data collection procedures led to a small sample size. This intervention has probably been the first based on exercise training principles and public health promotion in which exercise specialists were working alongside primary care practitioners.

RESUM EN CATALÀ

L'objectiu principal d'aquesta tesi doctoral fou valorar els efectes i l'aplicabilitat d'un programa de prescripció i planificació d'exercici físic per a la salut, mitjançant el Programa CAMINEM, a dos centres d'atenció primària (CAP) de titularitat pública per a pacients amb patologia crònica reclutats durant visites rutinàries al seu equip d'atenció primària (EAP), metge o infermera.

El disseny de l'estudi fou d'una intervenció pragmàtica (amb una intervenció externa mínima, centrada en més en aspectes pràctics que científics) durant 18 mesos on els pacients participants s'agruparen a posteriori depenent del seu nivell d'activitat física previ a la inclusió i de la seva adherència durant sis mesos al programa. L'eix central de la intervenció és el treball interdisciplinari entre els professionals d'atenció primària i de l'exercici físic, qui durant la intervenció tingué una dedicació de deu hores setmanals pel desenvolupament del programa a una consulta als mateixos CAP.

Els efectes de l'exercici físic es valoraren mitjançant paràmetres de salut clínica: índex de massa corporal, perímetre abdominal, tensió arterial, freqüència cardíaca en repòs, perfil lipídic, glicèmia i hemoglobina glicada (en diabètics); percepció de qualitat de vida mitjançant l'SF-12v2 i una pregunta senzilla; i demanda assistencial als EAP: nombre de visites per mes a l'EAP. L'aplicabilitat del programa s'avaluà seguint les dimensions proposades pel model RE-AIM («Reach» – Atènyer, «Efficacy» – Eficàcia, «Adoption» – Adopció, «Implementation» – Implementació, «Maintenance» – Manteniment»). L'eficàcia es substituí per efectes degut a la manca de grup control en el disseny de l'estudi.

El programa arribà al 1,49% (n = 229) de la població diana (N = 15374), dels quals finalment 178 (77,73%) s'inclogueren per a la intervenció. La mostra fou homogènia en comparar els quatre grups abans de la intervenció excepte en les variables edat i índex de massa corporal, participants menys obesos eren de més edat i manifestaren ser més actius abans de la intervenció. La recollida de dades mostrà un elevat nombre de dades «missing», que limità el poder estadístic dels resultats. Els participants adherits mostraren un patró de millora general de salut, tant clínica com de qualitat de vida, sobretot en una disminució de la freqüència cardíaca, en el colesterol total, salut mental, percepció de benestar i salut física (pels prèviament inactius). Els no adherits mostraren una millora general en el colesterol, en salut mental (els prèviament inactius) i en salut física (els prèviament actius). La mitjana de visites

mensuals als EAP no presentà diferències significatives al llarg de la intervenció, però el rang interquartil fou més ampli pels participants no adherits al programa, amb un valor màxim de 11,2 visites mensuals, comparat amb 4,2 pels participants adherits.

Dels dos centres participants, cap professional sanitari dels EAP rebutjà la seva participació i un 40% (n = 33), incloent-hi fixes com substituts (mínim tres mesos al centre), col·laboraren derivant pacients. Les infermeres derivaren un 81% dels participants en comparació amb el 19% dels metges. Un de cada tres participants inclosos es mantingué un mínim de 6 mesos en la intervenció mentre que un de cada quatre participants tingué adherència als 12 mesos totals d'intervenció. L'adherència contemplà el manteniment dins el programa, l'assistència a les visites de seguiment i el compliment de la prescripció d'exercici físic de la manera prèviament planificada. Els participants actius als sis mesos després de finalitzar la intervenció, mostraren millors valors en relació a la seva salut que els inactius. A més, tots els participants adherits que foren valorats sis mesos després mostraren nivells elevats d'activitat física.

Els protocols establerts per a la intervenció emmarcada en el Programa CAMINEM han demostrat ser aplicables en els dos centres d'atenció primària de Lleida on es portà a terme i els efectes de l'exercici físic pels participants adherits mostraren una tendència favorable, tot i que els resultats no són estadísticament significatius. Els efectes en paràmetres clínics no són concloents degut a la poca mostra obtinguda arrel d'una recollida de dades poc eficient. Aquesta intervenció en prescripció d'exercici físic per a la salut possiblement hagi estat la primera basada en els principis de l'entrenament esportiu i en promoció de salut pública on un professional no sanitari treballà conjuntament amb professionals sanitaris d'atenció primària.

RESUMEN EN CASTELLANO

El principal objetivo de esta tesis doctoral fue valorar los efectos y la aplicabilidad de un programa de prescripción y planificación de ejercicio físico para la salud, mediante el Programa CAMINEM, en dos centros de atención primaria (CAP) de titularidad pública para pacientes con patología crónica reclutados durante visitas rutinarias a su equipo de atención primaria (EAP), médico o enfermera.

El estudio fue diseñado como una intervención pragmática (con una intervención externa mínima, centrada más en aspectos prácticos que en científicos) durante 18 meses en donde los pacientes participantes se agruparon a posteriori dependiendo de su nivel de actividad física previo a la inclusión y de su adherencia durante seis meses al programa. El eje central de la intervención es el trabajo interdisciplinario entre los profesionales de atención primaria y del ejercicio físico quien, durante la intervención, dedicó diez horas semanales para el desarrollo del programa en una consulta de los propios CAP.

Los efectos del ejercicio físico se valoraron mediante parámetros de salud clínica: índice de masa corporal, perímetro abdominal, tensión arterial, frecuencia cardiaca en reposo, perfil lipídico, glicemia y hemoglobina glicada (en diabéticos); percepción de calidad de vida mediante el SF-12v2 y una pregunta sencilla; y demanda asistencial a los EAP: número de visitas mensuales al EAP. La aplicabilidad del programa se evaluó siguiendo las dimensiones propuestas por el modelo RE-AIM (*Reach* – Alcanzar, *Efficacy* – Eficacia, *Adoption* – Adopción, *Implementation* – Implementación, *Maintenance* – Mantenimiento). La eficacia se substituyó por los efectos debido a la falta de grupo control en el diseño del estudio.

El programa alcanzó un 1,49% (n = 229) de la población diana (N = 15374), de los cuales finalmente 178 (77,73%) se incluyeron en la intervención. La muestra fue homogénea al comparar los cuatro grupos antes de la intervención excepto en las variables edad e índice de masa corporal, participantes menos obesos eran de más edad y manifestaron ser más activos antes de la intervención. La recogida de datos reflejó un elevado número de datos *missing*, que limitó el poder estadístico de los resultados. Los participantes adheridos mostraron un patrón de mejora general de salud, tanto clínica como de calidad de vida, sobretodo en una disminución de la frecuencia cardiaca, en el colesterol total, salud mental, percepción de bienestar y salud física (para los previamente inactivos). Los no adheridos mostraron una mejora general en el colesterol, en salud mental (los previamente inactivos) y en salud física

(los previamente activos). La media de visitas mensuales a los EAP no presentó diferencias significativas a lo largo de la intervención, pero el rango intercuartil fue más amplio para los participantes no adheridos al programa, con un valor máximo de 11,2 visitas mensuales, comparado con 4,2 para los participantes adheridos.

De los dos centros participantes, ningún profesional sanitario de los EAP denegó su participación y un 40% (n = 33), incluyendo tanto fijos como substitutos (mínimo de tres meses en el centro), colaboraron derivando pacientes. Las enfermeras derivaron un 81% de los participantes en comparación al 19% de los médicos. Uno de cada tres participantes incluidos se mantuvo un mínimo de 6 meses en la intervención mientras que uno de cada cuatro participantes tuvo una adherencia a los 12 meses de intervención. La adherencia constituía la permanencia en el programa, la asistencia a las visitas de seguimiento y el cumplimiento de la prescripción de ejercicio físico del modo previamente planificado. Los participantes activos a los seis meses después de finalizar la intervención, reflejaron mejores valores en relación a su salud respecto a los inactivos. Además, todos los participantes adheridos que fueron valorados seis meses después mostraron niveles elevados de actividad física.

Los protocolos establecidos para la intervención basada en el Programa CAMINEM han demostrado ser aplicables en los dos centros de atención primaria de Lleida (Cataluña, España) donde se llevó a cabo y los efectos del ejercicio físico para los participantes adheridos reflejaron una tendencia favorable, a pesar de que los resultados no sean estadísticamente significativos. Los efectos en parámetros clínicos no son concluyentes debido a la poca muestra obtenida a raíz de una recogida de datos poco eficiente. Esta intervención en prescripción de ejercicio físico para la salud posiblemente haya sido la primera basada en los principios de entrenamiento deportivo y de promoción de salud pública en la cual un profesional no sanitario trabajó conjuntamente con profesionales sanitarios de atención primaria.

FIGURES AND TABLES

FIGURE 2.1 TYPES OF PHYSICAL ACTIVITY, PHYSICAL ACTIVITY BEHAVIOUR AND EXERCISE COMPONENTS. ... 11
FIGURE 2.2 CLASSIFICATION OF FITNESS CAPACITIES. ... 16
FIGURE 2.3 HEALTH AS CONTINUUM. ... 16
FIGURE 2.4 MAIN EXERCISE COMPONENTS. ... 24
FIGURE 2.5 SPORT AND HEALTH-RELATED EXERCISE PERIODIZATION. ... 29
FIGURE 2.6 GOALS AND NEED FOR PRECISE EXERCISE TESTING AND EXERCISE PRESCRIPTION IN DIFFERENT TYPES OF PEOPLE. ... 30
FIGURE 2.7 CONTRIBUTIONS TO THE FITNESS, PHYSICAL ACTIVITY AND HEALTH ASSOCIATIONS. ... 32
FIGURE 2.8 FITNESS, PHYSICAL ACTIVITY AND HEALTH ASSOCIATIONS. ... 33
FIGURE 2.9 FITNESS AS CONTINUUM. ... 33
FIGURE 2.10 ACTIVITY CATEGORIES AND THEIR RELATIONSHIPS WITH FITNESS AND HEALTH. ... 34
FIGURE 2.11 PHYSICAL ACTIVITY PIE. ... 44
FIGURE 2.12 PHYSICAL ACTIVITY PYRAMID. ... 44
FIGURE 2.13 RESPONSIBILITIES FOR SPANISH PUBLIC AUTHORITIES ON HEALTH. ... 47
FIGURE 2.14 THE GREEN PRESCRIPTION FRAMEWORK. ... 60
FIGURE 2.15 POLITICAL MAPS OF SPAIN AND CATALONIA. ... 72
FIGURE 2.16 GEOGRAPHICAL MAP OF CATALONIA. ... 73
FIGURE 2.17 AVERAGE TEMPERATURES IN AUGUST AND JANUARY IN CATALONIA. ... 73
FIGURE 2.18 TOTAL POPULATION AND DENSITY POPULATION IN CATALONIA. ... 74
FIGURE 2.19 POPULATION PYRAMID OF CATALONIA IN 2007. ... 75
FIGURE 2.20 GROSS DIRECT PRODUCT IN CATALONIA. ... 75
FIGURE 4.1 CAMINEM TIMELINE – ORIGINS, EVOLUTION, AND RESEARCH INTERVENTION PLAN. ... 91
FIGURE 4.2 IDEAL CAMINEM REFERRAL SCHEDULING. ... 97
FIGURE 4.3 CAMINEM REFERRAL PROCEDURE. ... 98
FIGURE 4.4 CAMINEM FIRST CONTACT PROCEDURE. ... 103
FIGURE 4.5 CAMINEM FOLLOW-UP PROCEDURE. ... 108
FIGURE 4.6 CAMINEM DISCHARGE PROCEDURE. ... 110
FIGURE 4.7 CAMINEM INTERVENTION SCHEDULE AND EXERCISE PERIODS. ... 111
FIGURE 4.8 PROFESSIONALS INVOLVED IN THE CAMINEM PROGRAMME. ... 113
FIGURE 4.9 FIVE PARTICIPANT PROFILES FOR DATA COLLECTION. ... 118
FIGURE 4.10 FROM TOTAL POPULATION SAMPLE TO INCLUDED PARTICIPANTS. ... 120
FIGURE 5.1 DATA COLLECTION FLOW CHART INCLUDING PARTICIPANT DROPOUT. ... 133
FIGURE 5.2 FOLLOW-UP ASSESSMENT FLOW CHART. ... 138
FIGURE 5.3 BOX PLOT OF PARTICIPANT ADHERED SUBGROUPS DISTRIBUTION BY AGE. ... 139
FIGURE 5.4 RESTING HEART RATE EVOLUTION FOR ADHERED GROUPS. ... 144
FIGURE 5.5 TOTAL BLOOD CHOLESTEROL EVOLUTION FOR ADHERED GROUPS. ... 144
FIGURE 5.6 TOTAL BLOOD CHOLESTEROL EVOLUTION FOR GROUPS ACCORDING TO THEIR ADHERENCE. ... 149
FIGURE 5.7 HEALTH-CARE PROVIDER VISITS PER MONTH BY INTERVENTION GROUPS. ... 153
FIGURE 5.8 PARTICIPANT'S REACH FLOW CHART AND REASONS FOR EXCLUSION. ... 156
FIGURE 5.9 SETTINGS AND AGENTS FLOW CHART. ... 158
FIGURE 5.10 DISTRIBUTION OF REFERRALS BY HEALTH PRACTITIONER. ... 158
FIGURE 5.11 NUMBER OF CASES IN THE PROGRAMME DURING THE INTERVENTION PERIOD. ... 160
FIGURE 5.12 PARTICIPANTS RETENTION. ... 164
FIGURE 5.13 DROPOUT REASONS. ... 164

TABLE 2.1 CLASSIFICATION OF PURPOSIVE FITNESS CAPACITIES 12
TABLE 2.2 FREQUENTLY USED TERMINOLOGY ON EXERCISE COMPONENTS FROM DIFFERENT FIELDS OF STUDY. 24
TABLE 2.3 PREVALENCE OF PHYSICAL ACTIVITY IN THE SPANISH AND CATALAN POPULATIONS. 40
TABLE 2.4 HEALTH STRATEGIES AND PHYSICAL ACTIVITY EPIDEMIOLOGICAL INDICATORS. 49
TABLE 2.5 THE STAGES OF CHANGE OF THE TRANSTHEORETICAL MODEL 55
TABLE 2.6 THE 5AS CONSTRUCT AND ITS RELATION WITH PRINCIPLES OF EXERCISE TRAINING. 56
TABLE 2.7 RE-AIM DIMENSIONS AND THEIR EVALUATIVE QUESTIONS. 68
TABLE 2.8 LIST OF PUBLIC SPORT FACILITIES IN LLEIDA CITY. 76
TABLE 4.1 STUDY INTERVENTION AND ITS RELATIONSHIP WITH CATALAN AND SPANISH AIMS. 88
TABLE 4.2 PRIMARY-CARE UNITS AND PATIENTS DISTRIBUTION, JANUARY 2010. 92
TABLE 4.3 RELATIONS BETWEEN FIRST CONTACT PROCEDURE, THE 5AS FRAMEWORK AND EXERCISE TRAINING PRINCIPLES. 102
TABLE 4.4 SELF-REPORTED EXERCISE DISCUSSION AND FEEDBACK. 105
TABLE 4.5 CRITERIA TO DETERMINE PROGRESSIVE EXERCISE PRESCRIPTION 107
TABLE 4.6 DATA COLLECTION SUMMARY. 123
TABLE 5.1 PARTICIPANTS PROFILE 129
TABLE 5.2 INTERVENTION GROUPS DISTRIBUTION. 130
TABLE 5.3 REASONS FOR PRESCRIPTION AND ITS CHARACTERISTICS. 131
TABLE 5.4 MAINTENANCE GROUPS DISTRIBUTION. 132
TABLE 5.5 DESCRIPTIVE STATISTICS AT BASELINE (M1). 134
TABLE 5.6 HOMOGENEITY AT BASELINE (M1) AMONG GROUPS FOR CONTINUOUS VARIABLES. 135
TABLE 5.7 HOMOGENEITY AT BASELINE (M1) AMONG GROUPS FOR QUALITATIVE VARIABLES. 136
TABLE 5.8 HOMOGENEITY AT BASELINE (M1) FOR ADHERED GROUPS ONLY. 139
TABLE 5.9 CLINICAL PARAMETERS DURING (M2) THE INTERVENTION FOR ADHERED PARTICIPANTS. 140
TABLE 5.10 CLINICAL PARAMETERS POST-INTERVENTION (M3) FOR ADHERED PARTICIPANTS. 141
TABLE 5.11 SAMPLE FOR MULTIVARIATE ANALYSES OF VARIANCE FOR ADHERED SUBGROUPS. 142
TABLE 5.12 MULTIVARIATE ANALYSES OF VARIANCE FOR ADHERED GROUPS. 143
TABLE 5.13 CLINICAL PARAMETERS DURING INTENTION-TO-TREAT FOLLOW-UP (MOT2). 145
TABLE 5.14 CLINICAL PARAMETERS POST-INTERVENTION INTENTION-TO-TREAT FOLLOW-UP (MOT3). 146
TABLE 5.15 CLINICAL PARAMETERS AT MAINTENANCE INTENTION-TO-TREAT FOLLOW-UP (MOT4). 146
TABLE 5.16 HOMOGENEITY AT BASELINE (M1) BETWEEN GROUPS BY ADHERENCE. 147
TABLE 5.17 INTENTION-TO-TREAT MULTIVARIATE ANALYSES OF VARIANCE. 148
TABLE 5.18 SAMPLE FOR ANALYSES OF VARIANCE FOR QUALITY-OF-LIFE OUTCOMES. 150
TABLE 5.19 SF-12V2 DATA FOR ADHERED PARTICIPANTS. 151
TABLE 5.20 SELF-REPORTED PERCEPTION OF HEALTH FOR ADHERED PARTICIPANTS. 152
TABLE 5.21 PARTICIPANT HEALTH-CARE ATTENDANCE 154
TABLE 5.22 PARTICIPANTS PROPORTION RATE. 157
TABLE 5.23 RANKING OF REFERRALS BY PRACTITIONER. 159
TABLE 5.24 PHYSICAL ACTIVITY BEHAVIOUR AT BASELINE (M1). 161
TABLE 5.25 PHYSICAL ACTIVITY BEHAVIOUR DURING (M2A, M2B) AND POST-INTERVENTION (M3). 161
TABLE 5.26 CAMINEM ADHERENCE DISTRIBUTED BY INTERVENTION GROUPS. 162
TABLE 5.27 CAMINEM ADHERENCE DISTRIBUTED BY REASONS FOR PRESCRIPTION. 163
TABLE 5.28 PHYSICAL ACTIVITY BEHAVIOUR AT MAINTENANCE OVER TIME (MOT4). 165
TABLE 5.29 CLINICAL PARAMETERS AT MAINTENANCE TIME (MOT4) BY PHYSICAL ACTIVITY BEHAVIOUR. 166
TABLE 5.30 QUALITY OF LIFE AT MAINTENANCE OVER TIME (MOT4). 167
TABLE 5.31 SF-12V2 OUTCOMES FROM BASELINE (M1) TO MAINTENANCE OVER TIME (MOT4) 168
TABLE 5.32 SELF-PERCEPTION OF WELL-BEING AT MAINTENANCE (MOT4). 168
TABLE 6.1 HEALTH CONDITIONS REPORTED AND NOT REPORTED BY REFERRAL PRACTITIONERS. 172
TABLE 6.2 NORMAL VALUES FOR BIOCHEMICAL PARAMETERS. 175

GLOSSARY

Active lifestyle: see *lifestyle activities*.

Activity session: see *training session.*

Acute effects: short-term responses to an individual session of exercise or activity linked to the body's recovery from that session.

Adherence: the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider.

Adoption: see *RE-AIM.*

Aerobic capacity: the maximal capacity for aerobic resynthesis of ATP (adenosine triphosphate).

Aerobic training: exercise training that improves the efficiency of the aerobic energy-producing systems and can improve cardiorespiratory endurance.

Anaerobic capacity: the maximal capacity for anaerobic production of ATP (adenosine triphosphate).

Anaerobic threshold: the point at which the metabolic demands of exercise can no longer be met by available aerobic sources and at which an increase in anaerobic metabolism occurs, reflected by an increase in blood lactate concentration.

Body Mass Index: a measurement of body overweight or obesity determined by dividing weight (in kilograms) by height (in meters) squared. Body Mass Index is highly related with body composition.

Cardiorespiratory endurance: the ability of the body to sustain prolonged exercise.

Chronic effects: adaptations to training (exercise progressing in intensity or frequency) acquired over weeks or months and that persist for days or weeks when such a regimen is interrupted.

Compliance: the extent to which a prescription is followed as intended.

Continuous training: training at a moderate to high intensity without stopping to rest.

Density: the exercise to rest ratio, the duration of the bout of exercise relative to rest.

Duration: the number of minutes of activity in each session or, for resistance training, duration may be measured by the number of exercises performed, the number of sets per exercise, the repetitions per set and the rest periods[1]. See *volume.*

Effectiveness: see *RE-AIM.*

Efficacy (trials): a test of whether a program does more good than harm when delivered under optimum conditions.

Enactment: see *treatment enactment.*

Endurance: the psychological and physical capacity to cope with fatigue and the ability to recover from it quickly.

[1] *Volum, volumen* in Catalan and Spanish respectively. (Departament de Salut. Generalitat de Catalunya, 2007; Solé Fortó, 2008)

Excessive training: training in which volume, intensity, or both are too great or are increased too quickly without proper progression.

Exercise: a subcategory of physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is the objective. It generally refers to leisure-time physical activity with the primary purpose of improving or maintaining physical fitness, physical performance, or health.

Exercise planning: methodological, scientific procedure to help participants achieve healthy levels of fitness.

Exercise prescription: individualisation of the prescription of exercise duration, frequency, intensity, and mode.

Exercise training: systematic long-term physical exercises, individually-based, gradually increased and organised pedagogically. Aimed at improving or maintaining physical fitness, physical performance, or health, and based on scientific method. It includes frequency, duration, intensity, type, volume, pattern and progression of exercise as well as resting periods.

External validity: the extent to which we can generalise or apply results of a study to other contexts, settings, and situations outside of the specific situations studied in a given investigation.

Fatigue: general sensations of tiredness and accompanying decrements in muscular performance.

Feasibility: whether an intervention process could be implemented in the local setting, no matter what the outcome is; applicability.

Fitness: see *physical fitness*.

Force: a physics term defined as an instantaneous measure of the interaction between two bodies, force being characterized by magnitude, direction, and point of application.

Frequency: the number of activity sessions per day, week, or month.

Health: state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Health-enhancing physical activity: any form of physical activity that benefits health and functional capacity without undue harm or risk.

Health promotion: the process of enabling people to increase control over, and to improve, their health.

Implementation: see *RE-AIM*.

Intensity: the effort associated with the physical activity in relative or absolute terms. It can be absolute or relative intensity.

Internal validity: the extent to which outcomes of a study can be attributed to an experimental factor rather than to extraneous or confounding factors.

Leisure-time physical activity: physical activities performed by a person that are not essential activities of daily living and are performed at the discretion of the person. These activities include sports participation, exercise training, and recreational activities such as going for a walk, dancing, and gardening.

Lifestyle activities: activities that one carries out in the course of daily life that can contribute to sizeable energy expenditure, for example, taking the stairs instead of using the lift, walking to do errands instead of driving, getting off one bus stop earlier, or parking further away than usual to walk to a destination.

Maintenance: see *RE-AIM*.

Muscular endurance: the ability of the muscles to sustain repeated muscular contractions or a single static contraction.

Muscular power: the rate of performing work as the product of force and velocity.

Muscular strength: see *strength*.

Occupational physical activity: physical activity associated with the performance of a job, usually within the time frame of an 8-h work day, including housekeeping.

Overtraining: the attempt to do more work than can be physically tolerated.

Physical activity: any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal level.

Physical fitness: the ability to carry out daily tasks with vigour and alertness without undue fatigue and with ample energy to enjoy leisure-time pursuits and meet unforeseen emergencies. It also helps to avoid sedentary-related illnesses and to develop maximum levels of intellectual capacity and living joyfully.

Physical inactivity: the absence of physical activity or exercise.

Public health: the science and art of promoting health, preventing disease, and prolonging life through the organised efforts of society.

Rating of perceived exertion: a person's subjective assessment of how hard he or she is exercising.

Reach: see *RE-AIM*.

RE-AIM: framework for intervention evaluation.
- **Reach:** the percentage of potential participants who are exposed to an intervention and how representative they are.
- **Effectiveness:** the extent to which the intended effect or benefits that could be achieved under optional conditions are achieved in practice.
- **Adoption:** the participation or rate of both settings and agents participating in an intervention and their representativeness.
- **Implementation:** the extent to which point an intervention has been delivered as intended in real-world situations.
- **Maintenance:** the long-term results of the intervention at both individual and setting levels.

Receipt: see *treatment receipt*.

Rehabilitation programs: programs designed to re-establish health or fitness following a disability or illness.

Resistance training: the exercise training primarily designed to increase skeletal muscle strength, power, endurance, and mass. It may be strength training, muscle-strengthening activities, or muscle strength and endurance exercises.

Resting period: planned time without exercising. Resting periods may be complete or pauses. Complete resting periods leads the organism to recover from stimuli meanwhile pauses are of shorter length and usually between repetitions of sets of exercise. At these times recovery and physiological adaptations to stimuli take place.

Retention: the action of keeping something rather than losing or stopping it.

Sedentary: non-active behaviours.

Session: see *training session*.

Specificity of training: the principle that physiological adaptations in response to physical training are highly specific to the nature of the training activity. To maximise benefits, training should be carefully matched to an athlete's specific performance needs.

Strength: the ability of a muscle to exert force and create intramuscular tension under specific conditions.

Training effects: physiological adaptation to repeated bouts of exercise.

Training load: the quantity of effects to the body through selected exercises. It is the product of volume (frequency, duration) and intensity.

Training session: lesson comprised of rest periods no longer than thirty minutes.

Treatment enactment: the degree to which the participant applies the skills during a programme.

Treatment receipt: the degree to which the participant understands and is able to use the intervention skills.

Ventilatory breakpoint: the point at which ventilation increases disproportionately compared with oxygen consumption. Previously known as *ventilatory threshold*.

Ventilatory threshold: see *ventilatory breakpoint.*

Volume: quantity of exercise (frequency, duration).

Workout: see *training session.*

ABBREVIATIONS

1RM: One repetition maximum
5As: Assess, Advice, Agree, Assist, Arrange
ACSM: American College of Sports Medicine
AD-AC: Adhered participants and sufficiently active at baseline
AD-IN: Adhered participants and insufficiently active at baseline
AFPAN: African Physical Activity Network
ANOVA: Analysis of variance
APPAN: Asia Pacific Physical Activity Network
BMI: Body mass index
CHO: Total blood cholesterol
CI: Confidence interval
ClassAF: *Classificador ràpid de l'Activitat Física* – Physical activity behaviour quick classifier (in Catalan)
COPD: Chronic Obstructive Pulmonary Disease
DBP: Diastolic blood pressure
ES: Exercise specialist
EU: European Union
FaR®: *Fysisk aktivitet på Recept* – Physical Activity Referral (in Swedish)
GAPA: Global Advocacy for Physical Activity
GLY: Fasting plasma glucose
GP: General practitioner
GRx: Green Prescription
HbA_{1c}: Glycated haemoglobin
HDL: High-density lipoprotein cholesterol
HEPA: Health-enhancing physical activity
HR: Resting heart rate
ICS: *Institut Català de Salut* – Catalan Health Institute
INEFC: *Institut Nacional d'Educació Física de Catalunya* – National Institute of Physical Education of Catalonia
IPAQ: International Physical Activity Questionnaire
ISCA: International Sport and Culture Association
LDL: Low-density lipoprotein cholesterol
LTPA: Leisure-time physical activity
MCS: Mental summary scale (SF-12v2 score)
NA-AC: Non-adhered participants and sufficiently active at baseline
NA-IN: Non-adhered participants and insufficiently active at baseline
PA: Physical activity
PAAS: *Pla Integral per a la promoció de la salut mitjançant l'Activitat Física i l'Alimentació Saludable* – Integral Plan for Health Promotion through Physical Activity and Healthy Eating (of Catalonia)
PACE: Physician-based assessment and counseling for exercise
PAFES: *Pla d'Activitat Física, Esport i Salut* – Plan for Physical Activity, Sport and Health (of Catalonia)
PCS: Physical summary scale (SF-12v2 score)
PCU: Primary-care unit
PEFS: *Prescripció d'Exercici Físic per a la Salut* – Exercise Prescription for Health (in Catalan)
PEPAF: *Programa Experimental de Promoción de la Actividad Física* – Experimental Program for Physical Activity Promotion (in Spanish)
PHC: Primary health care
PIP: *Pla d'Implantació Progressiva per a la prescripció de l'activitat física a l'atenció primària de salut a Catalunya* – Progressive Plan for Physical Activity Prescription in Primary Health-Care Settings in Catalonia
Prex: Physical Activity Prescription (Finnish approach)
QALY: Quality adjusted life year
RAFA-PANA: *Red de Actividad Física de las Américas* - Physical Activity Network of the Americas
RCT: Randomised controlled trial
RE-AIM: Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance
RPE: Rating of perceived exertion
SBP: Systolic blood pressure
SD: Standard deviation
SF-12: Short Form 12 Health Survey
SF-36: Short Form 36 Health Survey
TG: Blood triglycerides
UK: United Kingdom
US: United States of America
WC: Waist circumference
WHO: World Health Organization
χ^2: Person's chi squared

CHAPTER 1 – INTRODUCTION

Regular physical activity has many health benefits. However, physical inactivity is nowadays identified as the fourth leading risk factor for global mortality (World Health Organization, 2002, 2004, 2010). Several papers show different levels of evidence of the role of physical activity and exercise on prevention or treatment of cardiovascular diseases, respiratory diseases, musculoskeletal problems, metabolic disorders, weight control, mental health problems and some cancers (American College of Sports Medicine, 2010; Catenacci & Wyatt, 2007; Dishman, Washburn, & Heath, 2004; Keegan et al., 2006; Kesäniemi et al., 2001; Kohl, 2001; Lacasse, Goldstein, Lasserson Toby, & Martin, 2006; Nelson et al., 2007; Pedersen & Saltin, 2006; Puhan Milo et al., 2011; Quist et al., 2006; Rolland et al., 2007; Sattelmair et al., 2011; Task Force on Community Preventive Services, 2002; Thune & Furberg, 2001; US Department of Health and Human Services, 1996; Vuori, 2001; Wei, Gibbons, Kampert, Nichaman, & Blair, 2000).

Even low levels of physical activity may reduce morbidity, all-cause mortality and length life expectancy (Paffenbarger, 1988; Wen et al., 2011). A recent paper by Weiler and colleagues points out that physical activity promotion features in 39 British national guidelines, even excluding physical activity-specific guidelines (Weiler, Feldschreiber, & Stamatakis, 2011).

Exercise for the protection and rehabilitation of health was already an issue in the ninth century BC with the ancient Indian system of medicine, the *Ayurveda*, recommending exercise and massage for the rheumatism. Prophylactic exercise was recommended in Ancient Greece by some of the great philosophers, such as Plato (*c.*427-347 BC) who stated that, *'Lack of activity destroys the good condition of every human being, while movement and methodical physical exercise save it and preserve it.'*, or Hippocrates (*c.*460-370 BC) who stated that:

> *All parts of the body which have a function, if used in moderation and exercised in labours in which each is accustomed, become thereby healthy, well-developed and age more slowly, but if unused and left idle they become liable to disease, defective in growth and age quickly.*
>
> *If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health.*
>
> *Exercise should be many and of all kinds, running on the double track increased gradually (…) sharp walks after exercises, short walks in the sun after dinner, many walks in the early morning, quiet to begin with, increasing till they are violent and then gently finishing (Dishman, et al., 2004; Hardman & Stensel, 2009).*

The Persian Avicenna (980-1037) defined exercise as '*a voluntary movement for which large and deep breathing is needed',* differentiating between proper exercise and short walks. In the Middle Age, Avicenna influenced Christian physicians such as the Spanish physician Cristóbal Méndez (1553). Although Méndez never mentioned Avicenna in his *Book of bodily exercise*, his influence is considered obvious by authors studying his work. Méndez stated the importance of several aspects concerning exercise and two of them are still valid even today: exercising focused on health rather than leisure and performing the exercise with continuity (Álvarez del Palacio, García López, & Zapico García, 1997; Rodríguez Rodríguez, 2003). Sixteen years later, Hieronymus Mercurialis (1569), born in what is now Italy, recommended special exercises based on diagnoses rather than passive exercises (Dishman, et al., 2004).

It was not until the 20th Century when scientists began epidemiological studies taking physical (in)activity as a risk factor as well as systematic studies of the effects of exercise on the human body, mainly from the physiology field. The early work of Morris and colleagues (Morris, Heady, Raffle, Roberts, & Parks, 1953a, 1953b) demonstrated that heart attacks were less likely to be fatal and the onset of coronary heart disease was delayed in bus conductors compared with bus drivers. The first climbed 500 to 750 steps a day while the latter sat for 90% of their working time. They concluded that '*physically active work'* offered a protective effect. In another set of studies described by Pate (2007), McKenzie, Hill, Krogh or Dill lay the foundations of exercise physiology that would be later drawn upon by Haskell and Tipton. In 1984, Haskell identified some positive effects of exercise on plasma blood lipids, and Tipton made the connection between lower blood pressure and exercising, both in 1984 (Pate, 2007). In 1969, Dr. Cooper, a US Air Force Army physician, advocated for the use of aerobic exercise as a preventative measure and as a base for a good fitness condition (Cooper, 1979).

Nowadays, health organisations and public health policies include recommendations on the promotion of physical activity and exercise either for the prevention or treatment of some illnesses in combination with other prescriptions and health-related behaviours (Agencia Española de Seguridad Alimentaria y Nutrición, 2005; Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008; Task Force on Community Preventive Services, 2002; World Health Organization, 2010). Childhood is the best time in the human life cycle to educate and ingrain habits (Telama, Yang, Laakso, & Viikari, 1997). Therefore, active lifestyles should be highlighted in terms of leisure, commuting and everyday activities. Epidemiological studies show that the older the

population gets, the less physical activity is performed (European Commission, 2003, 2006; Katzmarzyk, 2007). Although, there may be some studies which overestimate this decline by taking the absolute intensity of activity into account rather than relative intensity to ageing (Dishman, et al., 2004). There is a need to focus on the re-education of the adult population, reinforcing the habit of physical activity and exercise.

While the best setting for habits education for children and teenagers are education centres, since compulsory education in Spain, as in many other countries, lasts until the age of sixteen, the suitable environments for adults may be less obvious. Glanz et al. defined seven major settings where health education may have great incidence: schools, communities, worksites, healthcare settings, homes, the consumer marketplace and the communications environment (Glanz, Rimer, & Viswanath, 2008). Primary health-care settings have been targeted for the promotion of physical activity habits because they reach a substantial number of people, overall those that may have lower levels of physical activity and therefore may benefit more (Aittasalo, 2008a; Glanz, Rimer, & Lewis, 2002). In Spain, roughly 87% of the population visited their primary health-care providers at least once a year (Ministerio de Sanidad y Consumo, 2006). A recent study in Sweden showed that adults expect healthcare providers to promote physical activity (Leijon, Stark-Ekman, et al., 2010).

The promotion of physical activity from health-care providers is being done within national frameworks, for example, Green Prescription in New Zealand (Swinburn, Walter, Arroll, Tilyard, & Russell, 1998), Physical Activity Prescription in Finland (Aittasalo, Miilunpalo, Kukkonen-Harjula, & Pasanen, 2006), Sweden on the Move (L. V. Kallings, Leijon, Hellénius, & Ståhle, 2008) among others. There are regional schemes, like the Catalan Integral Plan for Health Promotion through Physical Activity and Healthy Eating *(Pla Integral per a la promoció de la salut mitjançant l'Activitat Física i l'Alimentació Saludable,* PAAS) which is the result of the recommendations issued by the World Health Organization (WHO) Global Strategy on Diet, Physical Activity and Health, and by the Spanish Strategy on Diet and Nutrition (*Estrategia NAOS)* (Agencia Española de Seguridad Alimentaria y Nutrición, 2005; Government of Catalonia, 2006; World Health Organization, 2004). Finally, local activities from municipalities, leisure centres, sport organisations, private institutions or health-care settings are also common.

Despite the number of campaigns aimed at promoting health-enhancing physical activity and exercise, both at national and local levels, many of them rarely follow-up and carry out

evaluations to assess their effects, feasibility, dissemination or adoption. Nor are proper methods used to develop scientific research studies or indicators of evaluation. This lack of evidence is a general trend in non-English-speaking countries (except Nordic countries) and at local level.

Systematic work and time expenditure are needed to achieve habit change, especially among people with sedentary behaviours (Laitakari & Miilunpalo, 1998). A mixed quantitative-qualitative study by Puig et al. showed that general practitioners in Catalonia who were categorised as non-promoters of physical activity rarely saw its promotion as a priority in 5-minute consultations. Moreover, 55% of the physicians who were already promoting physical activity thought there was not enough time or no time at all (Puig-Ribera, McKenna, & Riddoch, 2005). Time constraints, together with other selected reasons for not prescribing physical activity, coincide with results from other countries (Aittasalo, et al., 2006; Calfas et al., 1996; McKenna, Naylor, & McDowell, 1998; Petrella & Wight, 2000). A recent systematic review by Sørensen and colleagues showed that motivated general practitioners are eager to have more exercise on prescription (seen as a more intensive intervention than just simple advice on physical activity) schemes (J. B. Sørensen, Skovgaard, & Puggaard, 2006). However, the feasibility of the approaches may not be universal due to cultural and environmental aspects as well as the fact that political and legal frameworks differ between countries, and even between regions within the same country (e.g., Spain). Many systematic reviews and updates of physical activity programmes include the English language as inclusion criteria which decreases the dissemination of possible practices in non-English speaking countries (Hoehner et al., 2008; Morgan, 2005; Pavey et al., 2011; Smith, 2004; J. B. Sørensen, et al., 2006; World Health Organization, 2009).

In conclusion, it is assumed that inactivity and sedentary behaviour has a big impact on health, and that citizens of industrialised countries, including Spain and Catalonia[1], show low levels of physical activity. Furthermore, the effects of many health-enhancing physical activity or exercise on prescription programmes from primary health-care settings are unknown.

[1] Throughout the text references concerning Catalonia/Catalan or Spain/Spanish might be used. Catalonia is one of the autonomous regions of Spain; therefore Catalonia must abide by Spanish laws as well. However, some regulations apply only to Catalonia and may not affect other Spanish regions as each autonomous community is responsible for some policy areas. The topic is further explained in Chapter ..

This thesis provides new knowledge about the application of an exercise-on-prescription approach in public primary health-care centres in the city of Lleida (Catalonia, Spain), a context far from the Anglo-Saxon and Nordic countries.

CHAPTER 2 – BACKGROUND

2.1 KEY CONCEPTS

The terms physical activity, exercise, fitness and sport are commonly used interchangeably for the general population, the media and even health and exercise professionals. There are a variety of definitions concerning physical activity and exercise, not only in English but in Catalan and Spanish also. Definitions taken for this study are related to physiological aspects rather than pedagogical or psychological, and are commonly used for health-related or sport-related studies.

2.1.1 PHYSICAL ACTIVITY AND EXERCISE

Physical activity (PA) is defined as *'any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal level'* (Caspersen, Powell, & Christenson, 1985; Departament de Salut. Generalitat de Catalunya, 2007a; US Department of Health and Human Services, 1996). For health promotion studies, physical activity can be categorised by time, intensity or purpose. Regarding the classification by purpose, physical activity may be categorised by the context in which it is performed: occupational, leisure-time or recreational, household, self-care, and transportation or commuting activities (Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008). **Leisure-time physical activity** (LTPA) refers to:

> *physical activities performed by a person that are not required as essential activities of daily living and are performed at the discretion of the person. These activities include sports participation, exercise training, and recreational activities such as going for a walk, dancing, and gardening (Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008, p. C2).*

Occupational physical activity is *'that associated with the performance of a job, usually within the time frame of an 8-h work day'* (Edward T. Howley, 2001), including housekeeping. **Lifestyle activities**, or active lifestyle, describe:

> *the activities that one carries out in the course of daily life that can contribute to sizeable energy expenditure, e.g., taking the stairs instead of using the elevator, walking to do errands instead of driving, getting off one bus stop earlier, or parking further away than usual to walk to a destination* (Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008, p. C2).

Two terms may be considered antonyms of physical activity: physical inactivity and sedentary. **Physical inactivity** may be defined as '*the absence of physical activity or exercise' (World Health Organization, 2010, p. 53)*, while Rosenberg, Bull, Marshall, Sallis, and Bauman (2008) suggest the term **sedentary** *'should be used to refer to behaviors that are sedentary rather than people who are inactive'* (p. S41). *Non-active* might be used instead of the term *sedentary* when referring to people. Then, people may be inactive because they have sedentary behaviours or may be active because they have active behaviours.

Exercise is defined by Caspersen et al. (1985, p. 128), included in the US PA Guidelines mentioned above, as *'a subcategory of physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective'*. Caspersen and colleagues suggest that situations of occupational or household physical activities which are planned and structured in a less efficient manner to develop muscular strength, as opposed to labour-saving, are exercise as well. However, the Catalan Guide for Exercise Prescription for Health *(Guia de Prescripció d'Exercici Físic per a la Salut,* PEFS*)* takes the most restrictive definition focusing on the objective of physical fitness as *the* goal as well as the ACSM and WHO define in recent published documents (American College of Sports Medicine, 2011; World Health Organization, 2010).

Exercise and **exercise training** are frequently used interchangeably and generally refer to leisure-time physical activity with the primary purpose of improving or maintaining physical fitness, physical performance, or health (Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008; World Health Organization, 2010). García Manso and colleagues compile several definitions from the perspective of competition and sports (García Manso, Navarro Valdivieso, & Ruiz Caballero, 1996): Matveyev (1983) defines **training** as *'the basic form to prepare athletes, based on systematic exercises, which essentially represents pedagogically organized processes aimed to the athletes' evolution'* (García Manso, et al., 1996, p. 17). Bompa (1983) sees training as *'systematic long-termed sport activities, individually-based, gradually increased, aimed to module human functions – psychological and physiological- to solve demanding tasks'* (García Manso, et al., 1996, p. 18). Sánchez Bañuelos (1993) adds a scientific perspective defining training as *'a permanent searching of physical limits under sport competition that human beings can get following the*

scientific method and systematically abandoning the empiricism' (García Manso, et al., 1996, pp. 18-19).

Skinner (1993) summarises training as *'the product of frequency, duration and intensity of exercise'* (p. 32) where product is equivalent to training load. These terms will be further developed in chapter 2.2.1.

When focused on health instead of sport performance, a broader definition could be taken into account by changing athletes to participants, sport activities to physical exercises, and sport competition to daily life activities. As such, for the purpose of this study, exercise training is understood as systematic long-term physical exercises, individually-based, gradually increased and organised pedagogically, aimed to improve or maintain physical fitness, physical performance, or health, and based on the scientific method. It includes frequency, duration, intensity, type, volume, pattern and progression of exercise which characterise the *dose* (level) of activity, as well as resting periods (American College of Sports Medicine, 2006; Bouchard, Blair, & Haskell, 2007). Figure 2.1 shows the associations between key concepts regarding physical activity and exercise.

Exercise may be seen as the vaccine that preserves health outcomes and the components of exercise to be the dose of this vaccine.

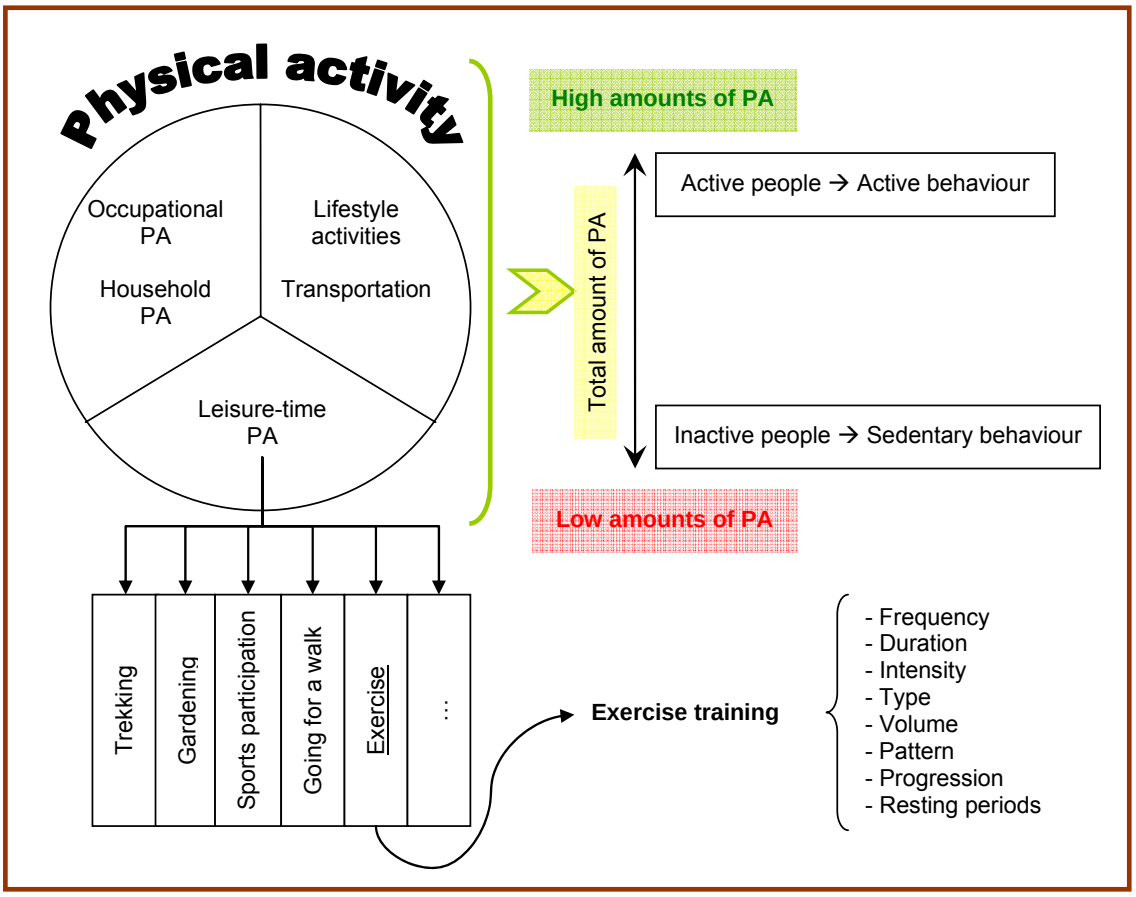

Figure 2.1 Types of physical activity, physical activity behaviour and exercise components.

Note. PA = Physical activity.

2.1.2 PHYSICAL FITNESS

The generally accepted definition of **physical fitness** is *'the ability to carry out daily tasks with vigor and alertness without undue fatigue and with ample energy to enjoy leisure-time pursuits and meet unforeseen emergencies'* (Caspersen, et al., 1985; Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008; US Department of Health and Human Services, 1996). The Catalan guide PEFS uses the above definition, adding that *'[physical fitness] also helps to avoid sedentary-related illnesses and to develop maximum levels of intellectual capacity and joyful living'* (Departament de Salut. Generalitat de Catalunya, 2007, p. 11). WHO's definition of fitness is *'the ability to perform muscular work satisfactorily'* (Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008, p. C4). This definition, however, seems too simple as it does not take fatigue into account which is a key concept for exercise planning.

Fatigue may be defined as general sensations of tiredness and accompanying decrements in muscular performance (García Manso, et al., 1996; Wilmore, Costill, & Kenney, 2008). Fatigue can be general or local, where both objective and subjective sensations are generated (Åstrand, Rodahl, Dahl, & Strømme, 2010).

As regards physical activity components, health promotion guidelines agree on making a distinction between health-related fitness (i.e., cardiorespiratory fitness, muscular strength and endurance, body composition, flexibility, and balance) and performance-related fitness (i.e., aerobic power, muscle strength and power, speed of movement and reaction time) (Caspersen, et al., 1985; Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008; US Department of Health and Human Services, 1996). See Table 2.1. A recent position stand by the American College of Sports Medicine (ACSM) lists the following components with no discrimination between health and performance: cardiorespiratory fitness, muscular strength and endurance (muscular fitness), body composition, flexibility, and neuromotor fitness (i.e., balance, coordination, gait, agility and proprioceptive training) (American College of Sports Medicine, 2011; World Health Organization, 2010).

Table 2.1 Classification of purposive fitness capacities

HEALTH-RELATED FITNESS	PERFORMANCE-RELATED FITNESS
Cardiorespiratory fitness	Aerobic power
Muscular fitness (strength and endurance)	Muscular power
Body composition	Speed of movement
Flexibility	Reaction time
Balance	

The following definitions are taken from Wilmore et al. and the PEFS handbook. However, the classification used for this thesis is based on the Catalan PEFS handbook which in turn is based on sport background but also offers a health perspective. It is suggested to be useful for clinical practice and may be more familiar to exercise specialists than definitions from health promotion guidelines. Fitness components may be categorised as Basic or Motor capacities, Coordinative or Perceptive-Motor capacities, Facilitative capacity, and Outcome capacity.

Basic or Motor capacities

Strength

The muscle's ability to exert force, to create intramuscular tension under specific conditions (Departament de Salut. Generalitat de Catalunya, 2007; Wilmore, et al., 2008). Strength and force have different definitions[1]. Force is a physics term defined as *'an instantaneous measure of the interaction between two bodies, force being characterized by magnitude, direction, and point of application'* (Zatsiorsky & Kraemer, 2006, p. 229).

Strength can be classified depending on the external longitude variation a muscle has during its contraction:

— **Isometric, static strength:** There are no external length variations within the muscle's insertion points.

— **Dynamic strength:** External muscle length varies. Variations can be **concentric**, where the muscle length decreases when it is contracted; **eccentric**, when the muscle length increases when is contracted.

Maximal strength is the maximal ability to exert force (García Manso, et al., 1996; Wilmore, et al., 2008). **Muscular power** might be seen as '*the neuromuscular capacity to overcome a resistance at the greatest velocity of contraction possible'* (García Manso, et al., 1996, p. 171), or *'the rate of performing work, thus the product of force and velocity*' (Wilmore, et al., 2008, p. 188). **Muscular endurance** may be defined as *'the ability of the muscles to sustain repeated muscular contractions or a single static contraction'* (Wilmore, et al., 2008, p. 189). Strength training for health purposes should be focused firstly on muscular endurance and then on maximal strength (American College of Sports Medicine, 2006), with both more related to daily life activities than muscular power.

Endurance

The psychological and physical capacity to cope with fatigue and the ability to recover from it quickly. It can be classified in different ways (García Manso, et al., 1996): by number of muscles (i.e., local vs. global), by energy suppliers (i.e., aerobic vs. anaerobic) or by sports

[1] The terms for strength and force are the same in Catalan and Spanish: *força* and *fuerza* respectively.

specificity (i.e., basic vs. specific). Currently, the most used for exercise training, which may also be suitable for health-related purposes, is based on the cardiorespiratory capacity which sets the energy suppliers:

— **Aerobic endurance:** muscles are supplied with enough oxygen and muscular contraction occurs through the oxidation of sugar and fatty acids. Improving aerobic endurance permits continuous activity at moderate intensity.

— **Anaerobic endurance:** muscles are not supplied completely with the oxygen required for the work intensity. Depending on duration and intensity it can be lactic anaerobic endurance or alactic anaerobic endurance.

Endurance exercise is also known as *'the ability of the whole body to sustain prolonged exercise involving relatively large muscle groups'*, **cardiorespiratory endurance** (Wilmore, et al., 2008, p. 223).

Velocity

The capacity to perform motor actions in the least time possible (Departament de Salut. Generalitat de Catalunya, 2007) with efficacy (García Manso, et al., 1996).

Resistance training refers to strength training and should not be mistaken for endurance training.[1]

Coordinative or Perceptive-Motor capacities

Coordinative capacities require a complex process involving the senses and are dependent on the maturation and participation of the nervous system. Several classifications and categories of coordinative capacities can be found, including orientation, balance, rhythm and relaxation (García Manso, et al., 1996).

Coordination

It refers to movements executed by a large number of body segments (dynamic general coordination) or shorter and analytical movements (specific coordination).

[1] The Catalan and Spanish terms for "resistance training" are *entrenament de força* and *entrenamiento de fuerza* respectively; meanwhile "endurance training" is *entrenament de resistència* and *entrenamiento de resistencia* respectively.

Balance

The ability to keep a static or dynamic position against gravitational force (Departament de Salut. Generalitat de Catalunya, 2007; García Manso, et al., 1996).

Facilitative capacity

Flexibility

It may be defined as the range of movement of a specific joint and the ability of any object to strengthen, lengthen, and fold without breaking (Departament de Salut. Generalitat de Catalunya, 2007; García Manso, et al., 1996). Flexibility includes:

- **Muscular elasticity:** the ability of a muscle to deform and elongate without rupture as well as to return afterwards to its initial form.
- **Joint mobility:** the ability to move on one, two or three planes with relation to joints bone surfaces.

Outcome capacity

Agility

The ability to move the body quickly in three dimensions. Agility is the result of the use of motor and coordinative capacities together.

Figure 2.2 shows the association between the major fitness components (Peirau Terés, 2010).

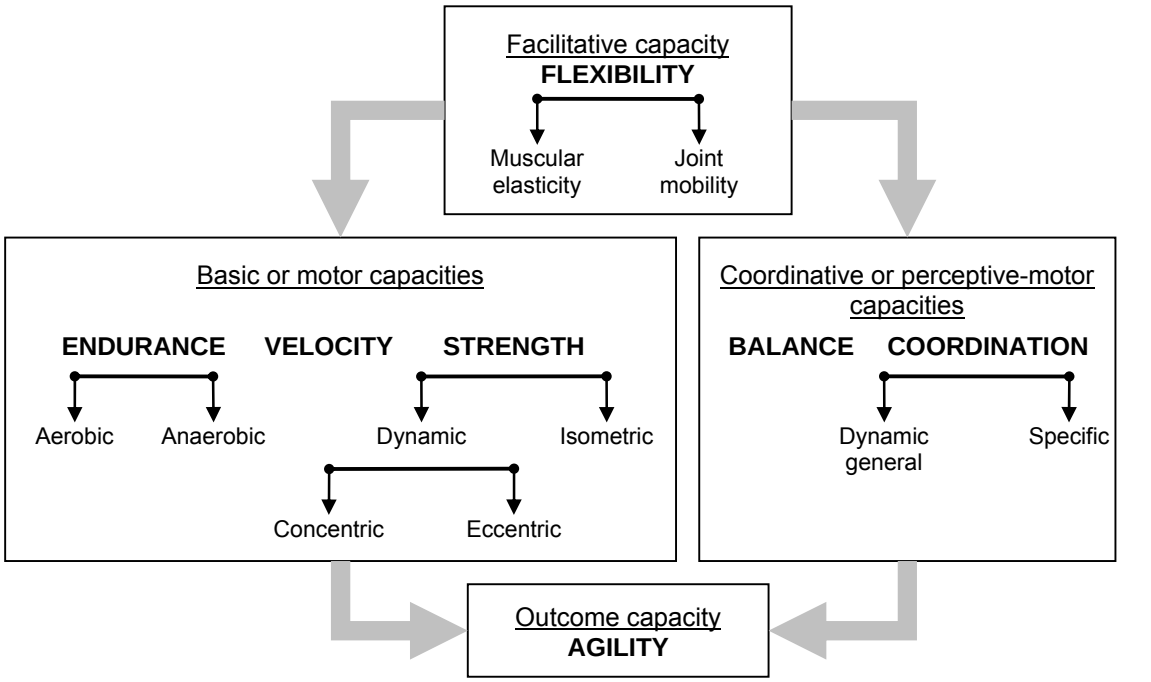

Figure 2.2 Classification of fitness capacities.

Translated and modified, with permission, from X. Peirau Terés. (2010). *Activitat física, condició física i salut*. Unpublished lecture. Institut Nacional d'Educació Física de Catalunya. Lleida.

2.1.3 HEALTH-ENHANCING PHYSICAL ACTIVITY

The most accepted definition of **health** was stated by WHO in 1948, *'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'* (World Health Organization, 2003b). The US PA Guidelines (2008, p. C6), quoting WHO's definition, adds that:

> *[Health conditions are] characterized on a continuum with positive and negative poles. Positive health is associated with a capacity to enjoy life and to withstand challenges; it is not merely the absence of disease. Negative health is associated with morbidity, and in the extreme, with premature mortality.*

Figure 2.3 represents the health as continuum.

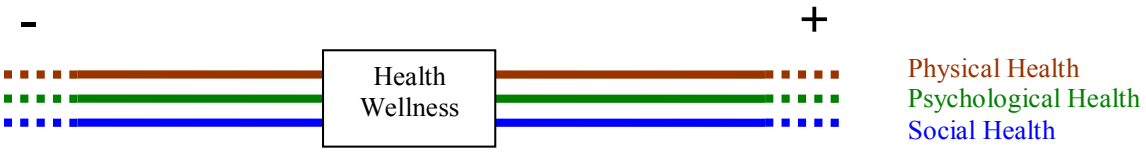

Figure 2.3 Health as continuum.

Given the definitions of physical activity and physical fitness explained above, it can be assumed that both may be directly related to health in all its perspectives: as physical, mental and social well-being.

Health-enhancing physical activity (HEPA) can be defined as *'any form of physical activity that benefits health and functional capacity without undue harm or risk'* (Foster, 2000, p. 9). Thus, exercise training may be included within the framework of HEPA, and exercise programmes must be adapted and planned according to different populations to reduce harm or risk.

2.2 EXERCISE TRAINING

2.2.1 GENERAL PRINCIPLES OF EXERCISE TRAINING

2.2.1.1 GENERAL ADAPTATION SYNDROME

When training, the body tries to adapt to the habitual demands placed on it and the outcome is a form of adaptation to the repeated stimulation of exercise. Adaptation may be achieved when there are no difficulties adjusting to these demands, meanwhile the adaptation will be incomplete when the demands are too great or are applied too rapidly, too often, or too long. This partial adjustment is usually manifested in the form of fatigue, soreness, pain or even injury (Skinner, 1993).

The **General Adaptation Syndrome**, stated by Selye in 1956 and adapted to exercise conditioning by Garhammer in 1979, defines a three-stage response to stress: alarm, resistance, and exhaustion. The *alarm phase* occurs when the body experiences a new or more intense stress than it is used to. This phase may last several days or even weeks, during which the person may experience symptoms of adjustment to the new condition: soreness, stiffness and so on. *Resistance phase* occurs when the body adapts to the stimulus and returns to a more normal functioning during which the body demonstrates its ability to withstand stress. This is the moment when the person relies on neurological adaptations to continue exercising while other tissues adapt by making biochemical, structural and mechanical adjustments that lead to increased performance, and thus fitness level. This phase of adaptation is called **supercompensation** which is of great importance for exercise training and conditioning. The subsequent phase is the *exhaustion phase*. It occurs when the stress persists for an extended time during when either the body adapts or some of the symptoms experienced during the first alarm phase reappear (i.e., fatigue or soreness) and the person cannot adapt to the demands (García Manso, et al., 1996; Wathen, Baechle, & Earle, 2000).

Training effects vary in relation to the moment in which they occur. Zatsiorsky (2006, p. 14) classifies these effects as acute, immediate, cumulative, delayed, partial and residual. Hardman (2007) divides them into acute and chronic effects.

- **Acute effects** are the changes that occur during exercise.

- **Immediate effects** are those that occur as a result of a single training session and that manifest soon after the workout.

- **Cumulative effects** occur as a result of continued training sessions or even seasons of training.

- **Delayed effects** are those manifested over a given time interval after a performed training routine.

- **Partial effects** are changes produced by single training means (e.g., local strengthening exercise).

- **Residual effects** are defined as the retention of changes after the cessation of training beyond time periods during which adaptation can take place.

Hardman's definition of acute and chronic effects (Hardman, 2007, p. 81) include Zatsiorsky's a) acute and immediate, b) cumulative, delayed, partial and residual, respectively:

- **Acute effects** are the short-term responses to an individual session of exercise or activity linked to the body's recovery from that session.

- **Chronic effects** are the adaptations to training (exercise progressing in intensity or frequency) acquired over weeks or months and that persist for days or weeks when such a regimen is interrupted.

2.2.1.2 PRINCIPLES OF EXERCISE TRAINING

The following list of principles of exercise training is based on several international authors (Bompa, 1999; García Manso, et al., 1996; Harre, 1987; Skinner, 1993; Wilmore, et al., 2008) and adapted for the purposes of health-related fitness and exercise prescription. This list is not exhaustive but it contains physiological, and psychological and pedagogical principles.

Physiological principles

These affect organic adjustments: overload and progressive load, specificity, reversibility and maintenance, hard/easy, individuality, functional unit, multilateral development, and regression.

Principle of overload and progressive load

The body needs to be stimulated at higher levels than those it habitually encounters. Safe and effective training programs progressively overload the body and allow adequate time for adaptation to each level of stimulation. There are two thresholds to consider: the minimal amount of exercise that is effective to start the adaptation and the upper limit at which adaptation cannot occur, resulting in unsafe exercise. As a person adapts to a higher level of activity, these limits also rise.

Principle of specificity

The effects of training are specific to the systems and parts of the body that are overloaded (e.g., muscle groups or energy-producing systems). The effects depend on the activities that are selected. Wilmore et al. (2008) and García Manso et al. (1996) consider this principle to be one of the most important for performance, however it should be considered for health purposes as well, as Skinner does. Wilmore's definition is '*a theory that a training program must stress the physiological systems critical for optimal performance in a given sport to achieve desired training adaptations in that sport'* (Wilmore, et al., 2008, p. 529). When changing *sport* for *aim* this definition can be applied to health-related exercise activities.

Principle of reversibility and maintenance

The effects of training are reversible, it means that the body adapts to its habitual level of stimulation. When the stimuli decrease the body also adapts to inactivity, but the level of fitness may be maintained by continuing to do a similar amount of training. Wilmore defines it clearly as *'the theory that a training program must include a maintenance plan to ensure that the gains from training are not lost'* (Wilmore, et al., 2008, p. 529).

Principle of hard/easy

This principle is connected to supercompensation and recovery. Moderate or high-intensity workouts near the upper threshold mentioned above ensures that the body adapts. Continuous stimuli produce structural alterations which, coupled with correct recovery times and pauses, increase fitness levels. Recovery is a basic process of cell regeneration and physiological rebalancing that occurs after exercising (García Manso, et al., 1996), thus a training program

must alternate high-intensity workouts with low-intensity workouts to help the body recover and achieve optional training adaptation (Wilmore, et al., 2008).

Principle of individuality

Every individual not only has unique morphologic and functional characteristics but everyone's adaptations vary along the lifespan. Therefore, exercise plans should be designed according to each participant's needs.

Principle of functional unit

The body works as a unit where all systems are interrelated with each other. That means that stimuli induce adaptations not only in one part of the body (e.g., slow-twitch muscle fibres) but also in other parts which must be considered (e.g., mineral bone density).

Principle of multilateral development

This principle describes exercising as a general principle rather than specific to any system or organ as more efficient results appear when exercising different fitness capacities within the same plan. García Manso et al. (1996) state that there is a strong connection between multilateralism and functional unit for sport performance. However, health-related fitness and lifestyle activities are not focused on analytic and local exercises, so the principle affects them.

Principle of regression

Again, García Manso et al. (1996) explain this principle in reference to athletes. They explain that performance levels may show a plateau-shape or a decrease on its evolution graphics instead of peaks. Fitness and performance increase rapidly at the beginning of the exercise plan while gains are more difficult to achieve after years of training. Also, fitness condition decreases with age, so exercise programmes should take ageing and previous exercise experience into consideration when setting specific aims.

Psychological and pedagogical principles

These principles draw together the methods to develop the training plan and to explain how the specific skills are taught.

Principle of periodization

It is *'the gradual cycling of specificity, intensity, and volume of training to achieve peak levels of fitness for competition'* (Wilmore, et al., 2008, p. 529).

Principle of awareness

Participants should know the goals of tasks and specific exercise plans, as well as the reasons for them: what, why and how. The following rules are adapted from the original nine developed by Harre which are based on general didactics (Harre, 1987, pp. 113-114):

- To guide towards the aim. Participants need to know what the final aim is.
- To provide exercise information. Exercise trainers should teach connections between exercises and the final aim.
- To ask for thoughts and responsibilities toward exercises. Discussions help future independence.
- To make participants part of exercise planning and monitoring. Participants should be responsible for making sure they follow their exercise plan, as long as their cognitive condition permits it.
- To teach participants how to self-assess their fitness plan.
- To delegate pedagogic instructions to selected participants. Advanced participants should be given a leader-role and more responsibilities by the trainer.
- To make participants aware of their own activities. By observing and being aware of their own patterns and evolution, participants should develop better knowledge about exercising.
- To monitor results and compare them with the initial planning. This feedback may increase knowledge of the plan when: a) the aims are previously properly set; b) the educational plan can be controlled; c) exercises can be easily monitored and recorded, and d) techniques for taking measurements are easily understandable.

— To vary pedagogic methods. Once participants achieve a great level of awareness and autonomy, the trainer's role may become more indirect so participants can increase their responsibilities and autonomy.

Principle of feasibility

The planned training load must be realistic: neither too low nor too challenging because when demands are beyond the reasonable capability of the participant his/her progress will be psychologically affected (Harre, 1987).

Principle of transference

Exercising may affect specific skills and abilities. García Manso (1996) considers this influence as positive, negative or inexistent. Transference is positive or negative depending on whether performing specific exercise creates improvements or interferes with a second task, respectively. However, the transference will be inexistent when there is no connection between two different tasks. Health-related fitness benefits from a physically active lifestyle and vice versa (Bouchard, et al., 2007).

2.2.1.3 DOSE OF EXERCISE

Traditionally, the four components of exercise programmes are **frequency, duration** (both included in **volume**), **intensity**, and **type** of exercise (Skinner, 1993). The characteristics of these components are used to describe the dose of physical activity or exercise needed to bring about a particular response (Edward T Howley, 2001). Two more components are of great importance to exercise planning: resting periods and density, which are the equivalent of **pattern** (American College of Sports Medicine, 2011; World Health Organization, 2010).

More recently, terms such as *activity profile*, *activity volume*, and *accumulation* have been used as well (Haskell, 2007) although these terms do not differ greatly from the traditional terminology, except with the latter accumulation. Activity profile refers to the type/mode of activity and activity volume refers to frequency, duration and intensity. This means that a wide range of activity profiles may have the same activity volume. It should be noted that there are differences in meaning of the term *volume* from different scopes. See Table 2.2 to compare frequently used terminology from different fields of study: PA promotion and exercise physiology, and fitness training.

Table 2.2 Frequently used terminology on exercise components from different fields of study.

PHYSICAL ACTIVITY PROMOTION EXERCISE PHYSIOLOGY	FITNESS TRAINING
Activity volume$_1$ (frequency, duration, intensity)	Training load (volume$_2$, intensity)
Frequency (session per week) Duration (activity session duration)	Volume$_2$ (stimuli duration and frequency, training session duration and frequency)
Intensity	Intensity
Pattern, accumulation	Routine, resting periods, density
Type of exercise	Type of exercise
Progression	Progression

Note. Different meanings of the term volume.

Training load

Instead of activity volume, Soviet exercise scientists introduced the term **training load** or **workload** as the quantity of effects selected exercise have on the body. It is the product of volume (i.e., frequency, duration) and intensity, which is broadly used in sport planning but not in health-enhancing physical activity promotion (see Figure 2.4) (Departament de Salut. Generalitat de Catalunya, 2007; Matveyev, 1977; Zatsiorsky & Kraemer, 2006). Exercise training literature also considers resting periods and density as a main factor for performance-related fitness. However, neither training load, resting periods nor density are common in literature concerning health-related fitness; although, the last ACSM position stand includes the pattern as well as **progression** of the tasks for individualised exercise prescription (American College of Sports Medicine, 2011; World Health Organization, 2010).

Figure 2.4 Main exercise components.

Type

Type or mode of activity is strongly connected with fitness capacities and the parts of the body involved. Exercise sessions may include endurance- and strength-type activities for the lower-body.

Frequency

Frequency is the number of activity sessions per day, week, or month (Edward T Howley, 2001). Frequency may also be understood as the number of stimuli during a training session (e.g., sets and repetitions of swim lanes, or resistance exercises) (Solé Fortó, 2008).

Duration

Duration is the number of minutes of activity in each training session or, for resistance training, duration may be measured by the number of exercises performed, the number of sets per exercise, the repetitions per set and the rest periods (Departament de Salut. Generalitat de Catalunya, 2007; Haskell, 2007; Edward T Howley, 2001; Solé Fortó, 2008).

Intensity

Intensity describes the effort associated with the physical activity in relative or absolute terms. As Haskell (2007) defines **absolute intensity** as *'either the magnitude of the increase in energy required to perform the activity (endurance exercise) or the force produced by the muscle contraction (resistance or strength exercise)'* (p. 306). Absolute intensity is usually expressed in units of oxygen (litres or METs), heat production (kilocalories), energy expense (kilojoules), movement speed (for cycling activities), or work rate (watts) for endurance activities. Strength absolute intensity is measured in kilograms of the weight moved (for dynamic contractions) or the force exerted against an immovable object (for isometric contractions). Neuromotor intensity (i.e., balance, coordination among others) has not been determined yet (American College of Sports Medicine, 2011), while intensity of flexibility exercises is measured by subjective feelings of tightness or slight discomfort.

Relative intensity of the activity is expressed in relation to the capacity of the person performing the activity and as a result, takes the exercise capacity of the person into consideration. Relative intensity for endurance activities is usually measured by the *percentage of the participant's maximal oxygen uptake* (%VO_{2max}) or the *percentage of*

oxygen uptake reserve (%VO_2R). The VO_{2max} can be stated by maximal exercise testing or estimated by submaximal exercise testing, while the VO_2R is the difference between VO_{2max} and resting VO_2. In submaximal exercise testing, the heart rate response has to be determined to one or more work rates. The *percentage of maximum heart rate* (%HR_{max}) and the *percentage of heart rate reserve* (%HRR) are also used to state intensities for endurance activities because of the relatively linear relationship between heart rate and oxygen consumption, for example, percent values of HRR are approximately equal to percent values of VO_2R (American College of Sports Medicine, 2006).

The main advantage of assigning relative intensities is that the recommended value (e.g., 40% to 85% VO_2R for apparently healthy people) can stay the same as the person becomes more fit, although the absolute intensity of the activity would increase.

Relative intensity for strength activities is usually expressed as a percentage of the maximal force that can be generated for that specific activity or movement, known as *percentage of maximum voluntary contraction* or *percentage of a 1-repetition maximum* (Haskell, 2007, p. 306).

Subjective methods to measure relative intensity include the *Talk Test* (Brawner et al., 2006), or the rating of perceived exertion (RPE), defined as '*a person's subjective assessment of how hard he or she is exercising*' (Edward T Howley, 2001; Wilmore, et al., 2008). Lee and Paffenbarger Jr. (2001) pictured a good practical example to differentiate between absolute and relative intensities:

> *For exercise, brisk walking usually is assigned a value of 4METs, or moderate intensity, regardless of subject fitness. This might actually represent a vigorous activity for an older, unfit person, but only a light effort for a young, fit marathoner (p. 49).*

Resting period

Resting periods may be complete or pauses. Complete resting periods allow the body to physiologically recover from stimuli, while pauses are shorter in length and are usually taken between sets of exercise. During a resting period, recovery and physiological adaptations to stimuli take place (Departament de Salut. Generalitat de Catalunya, 2007; Solé Fortó, 2008; Zatsiorsky & Kraemer, 2006).

Density

Density is the exercise to rest ratio; the duration of the bout of exercise relative to rest (Departament de Salut. Generalitat de Catalunya, 2007; Solé Fortó, 2008; Zatsiorsky & Kraemer, 2006).

Accumulation

Accumulation refers to the total amount of physical activity performed throughout a day or a week by performing multiple short bouts of 8-10 minutes each (Haskell, 2007). Currently, the concept of accumulation is valid to measure the dose-response relationship between exercise and health and it is used for many health promotion guidelines (Departament de Salut. Generalitat de Catalunya, 2007a; William L. Haskell et al., 2007; Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008; Swedish National Institute of Public Health, 2010; US Department of Health and Human Services, 1996).

2.2.2 PERIODIZATION AND PLANNING EXERCISE TRAINING

Exercise training provides acute and long-term effects, as explained in the previous chapter. Long-term effects are outcomes of the supercompensation phase of adaptation mentioned in the previous section and are strongly connected with the dose of exercises performed. Planned programmes must be established to achieve the aims set for specific training programmes and are defined by Bompa (1999) *'The planning process is a methodical, scientific procedure to help athletes achieve high levels of training and performance' (p. 150)*. **Exercise planning** may include health-related objectives by adapting the last part of Bompa's definition 'The planning process is a methodological, scientific procedure to help *participants* achieve *healthy* levels of *fitness*'.

Traditionally, sport-related exercise planning is organised around plans of different lengths: session, short term, mid term, long term. The shortest possible plan is the **session, activity session, training session or workout**, which is comprised of an exercise session and rest periods no longer than thirty minutes (Zatsiorsky & Kraemer, 2006). Frequency is usually set at once a day for non-professional or amateur athletes, although performance athletes may perform several workouts a day.

The former USSR sport scientists developed exercise training plans according to the objectives of the periods of competition or cycles (Matveyev, 1977; Platonov, 1988). Short-term plans are called **microcycle** and last over a week (3-4 days up to 10-14 days). Microcycles may be considered as the main element of training organisation and are constituted by a limited number of training and rest days (Viru, 1995). Mid-term plans are called **mesocycle** and last from 2 to 6 weeks (Bompa, 1999; Platonov, 2001). **Annual plans** may be comprised of one or more **macrocycles** or training phases with the final aim to achieve the peak of performance in a selected period(s) of time.

Periodization refers to the organisation of the training plan into small divisions of time called phases of training (Bompa, 1999). It includes specific aims for session, microcycle, macrocycle, and annual plan. Periodization takes the evolution of physiological and psychological components into account when developing sport performance over long periods of time.

The Catalan guide for exercise prescription (Departament de Salut. Generalitat de Catalunya, 2007) adapts the aforementioned structure on sport-related exercise training into the following health-related exercise periods:

Period of conditioning or initiation

It is aimed at making the participant physically active for further workouts, to pursue **pleasure** while exercising and to achieve self-conscience and awareness of one's own body. The length of this period takes over a month although it varies between people and it mainly depends on the participant's fitness level.

Period of improvement

The purpose of this period is to exercise within the selected **workload** (i.e., dose of exercise) for the participant's particular needs. Its duration cannot be defined since it depends on each individual.

Period of maintenance

This period is focused on keeping participants active within the proper workload range. The **type of activities** are of greater importance than technical issues (e.g., intensity), with the final aim of being motivated for exercising. The length of this period is for an indefinite time

because the health benefits of a training program are reversible (see the principle of reversibility and maintenance).

Similarities and differences between performance- and health-related periodization are shown in Figure 2.5.

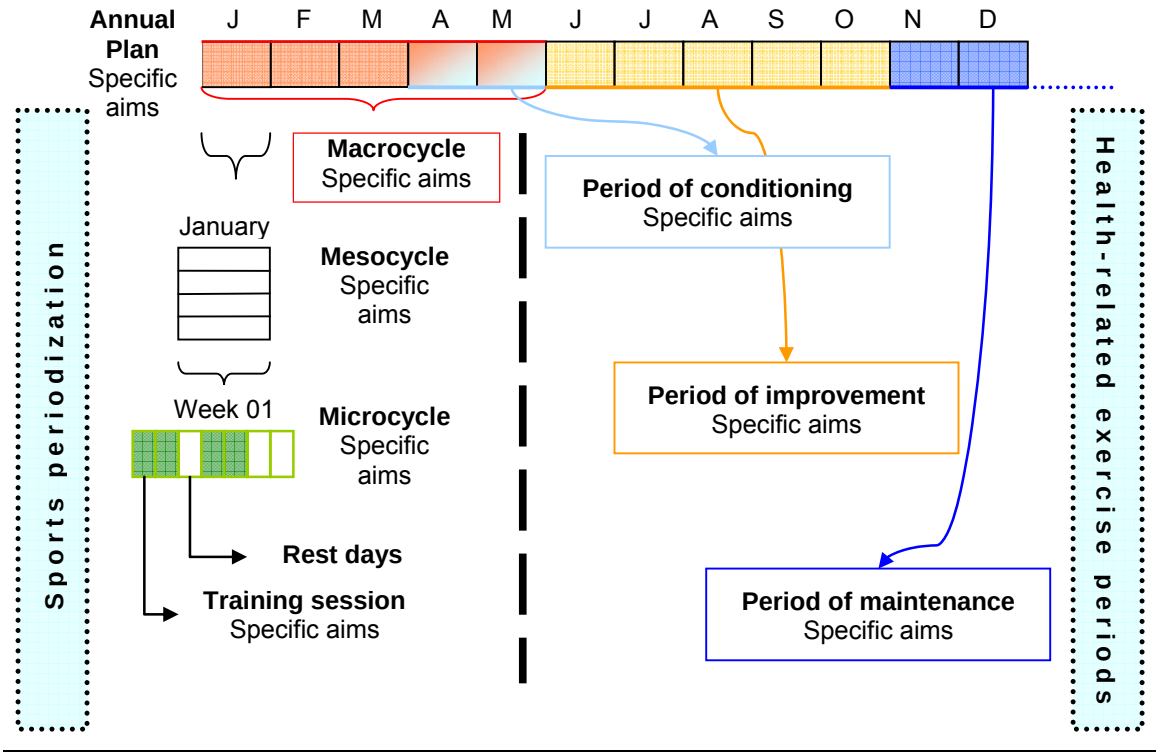

Figure 2.5 Sport and health-related exercise periodization.

The biggest training phase, and most common, in sports periodization is the annual plan, which includes specific long-term aims. The macrocycle, in the example, includes five mesocycles with four weekly microcycles each. 'Week 01' is comprised of four training sessions and three rest days.

A training plan following the same goal could also be structured differently. In the example, it starts with a period of conditioning which has specific aims and is split into monthly and weekly plans (mesocycle and microcycle, respectively). Then, a new macrocycle which increases the work load follows and again (i.e. period of improvement), it is split into several mesocycles and microcycles. Finally, the long-lasting period of maintenance includes macrocycles which have long-term aims and are split into mesocycles, microcycles and training sessions, each with specific aims.

2.3 HEALTH-ENHANCING EXERCISE TRAINING

2.3.1 EXERCISE PRESCRIPTION

The American College of Sports Medicine's (ACSM) specific definition of **exercise prescription** was '*the process whereby a person's recommended regimen of physical activity is designed in a systematic and individual manner'* (as cited in Skinner, 1993, p. 29). More recently, the ACSM extended its definition:

> *Exercise prescriptions are designed to enhance physical fitness, promote health by reducing risk factors for chronic disease (…), and ensure safety during exercise participation. Based on individual interest, health needs, and critical status, these common purposes do not carry equal or consistent weight* (American College of Sports Medicine, 2006, p. 135).

Wilmore and colleagues (2008) summarise the term as *'individualization of the prescription of exercise duration, frequency, intensity, and mode'* (p. 522). Figure 2.6 shows the importance of exercise prescription in different types of people.

Figure 2.6 Goals and need for precise exercise testing and exercise prescription in different types of people.

Modified, with permission, from J. S. Skinner (1993). *Exercise Testing and Exercise Prescription for Special Cases. Theoretical Basis and Clinical Application* (2nd ed.). Philadelphia: Lea & Febiger, 22.

The authors of the Catalan PEFS guidelines define the action of prescribing exercise as '*to suggest doing activities or exercise in a responsible and individualised way based on individual characteristics and limits with the aim of improving health and fitness'* (Departament de Salut. Generalitat de Catalunya, 2007, p. 29).

2.3.2 HEALTH-RELATED EFFECTS OF FITNESS TRAINING

> *To maximize the health outcomes of an activity dose, the benefits need to be optimized while the medical risks are kept to a minimum (Haskell, 2007, p. 314).*

In his chapter in Bouchard and colleagues (2007), Haskell compares the relative risk of all-cause mortality outcome from six studies, three reporting physical activity in men and three assessing level of cardiorespiratory fitness in men determined by exercise testing. Results show a similar pattern of decrease of risk of mortality for more fit or active people but the relative risk is consistently lower for men in the higher fitness categories compared with the men reporting higher levels of physical activity. Also, the gradient across fitness levels is steeper than the gradient across physical activity levels. Haskell suggests that the association between fitness and death may be stronger than physical activity and death because *'fitness is a more accurate and reliable measure than physical activity, and fitness is influenced by factors other than physical activity that can affect health and mortality'* (Haskell, 2007, p. 315). Other factors, such as inherited, lifestyle behaviours, personal attributes, and social and environmental factors influence the previous relationship, as is shown in Figure 2.7.

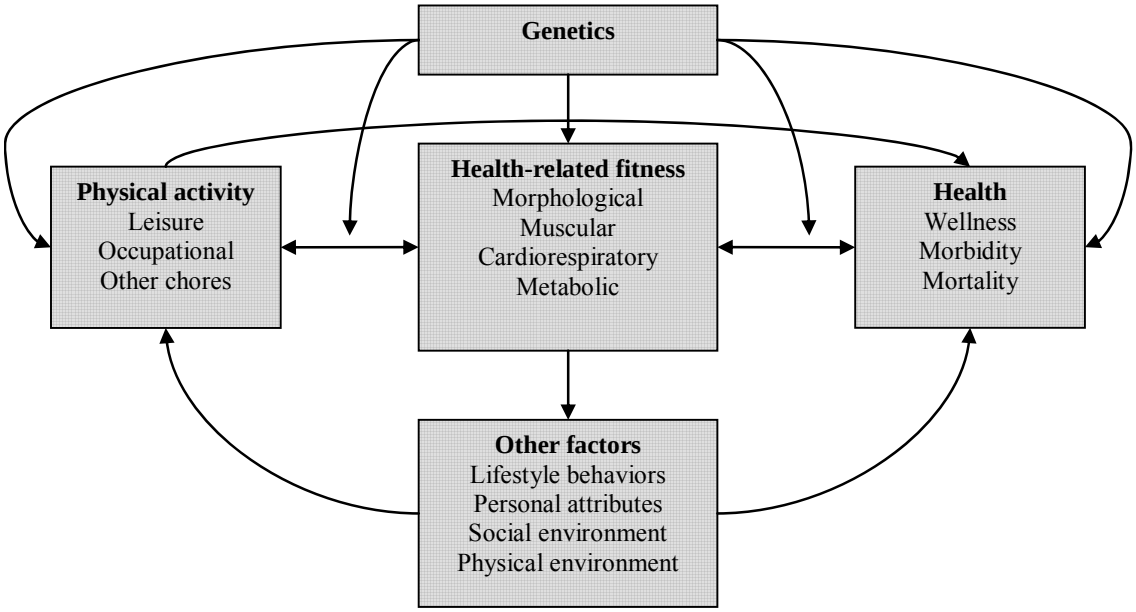

Figure 2.7 Contributions to the fitness, physical activity and health associations.

Retrieved, with permission, from C. Bouchard, S.N. Blair, and W. Haskell, 2007, Why study physical activity and health? In *Physical activity and health*, edited by C. Bouchard, S.N. Blair, and W.L. Haskell (Champaign, IL: Human Kinetics), 17.

Six years before, Blair and colleagues concluded that fitness was usually more objectively measured than physical activity and that was reason for obtaining better results. Furthermore, they suggested it was more reasonable to encourage inactive persons to increase physical activity than to increase fitness because the former would translate into the latter (Blair, Cheng, & Holder, 2001).

The recent ACSM Position Stand on guidance for prescribing exercise states that:

> *A program of regular exercise that includes cardiorespiratory, resistance, flexibility, and neuromotor exercise training* beyond *activities of daily living to improve and maintain physical fitness and health is* essential *for most adults* (American College of Sports Medicine, 2011, p. 1334).

The physical activity-fitness-health paradigm is seen by Bouchard (2001; 2007) as a positive relationship between fitness and health, and also between health and physical activity because fit people tend to be healthier and more physically active as well (see Figure 2.8). This paradigm shows two paths on how physical activity links health outcomes. Firstly, variation of physical activity is thought to have an impact on health. Secondly, variation in physical

activity levels translates into changes in health-related fitness, which in turn influence health outcomes (Bouchard, 2001).

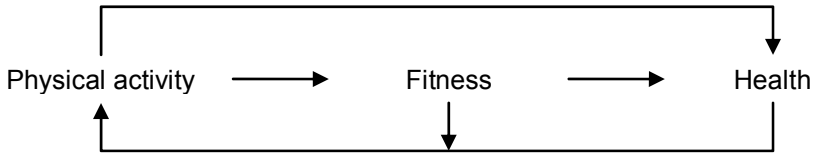

Figure 2.8 Fitness, physical activity and health associations.

Retrieved, with permission, from C. Bouchard, S.N. Blair, and W. Haskell, 2007, Why study physical activity and health? In *Physical activity and health*, edited by C. Bouchard, S.N. Blair, and W.L. Haskell (Champaign, IL: Human Kinetics), 17.

Different fitness activities mean different health outcomes. So, fitness may be seen as a continuum with subcategories, as well as health (see Figure 2.9).

Figure 2.9 Fitness as continuum.

As more exercise components are controlled the more the fitness outcomes are optimised and consequently, their relationships with health parameters. Peirau & Gordillo (2010) categorise different levels of physical activity by their degree of incidence towards fitness capacities and health, as observed in Figure 2.10. Low levels of physical activity leads to decreased levels of fitness and health and high levels of physical activity leads to increased levels of fitness and health. In other words, more intensive activities lead to greater cardiovascular benefits than lighter activities (American College of Sports Medicine, 2010). Intentional physical activity for improving health and fitness (i.e., exercise) increases fitness more than regular physical activity, and sport activities even more despite the risk of injuries. However, very high levels

of physical activity for long periods of time (i.e., sport performance) is not linked to health-related fitness, so there is a broad framework of activities related to fitness and health with minimum and maximum levels, training load or dose.

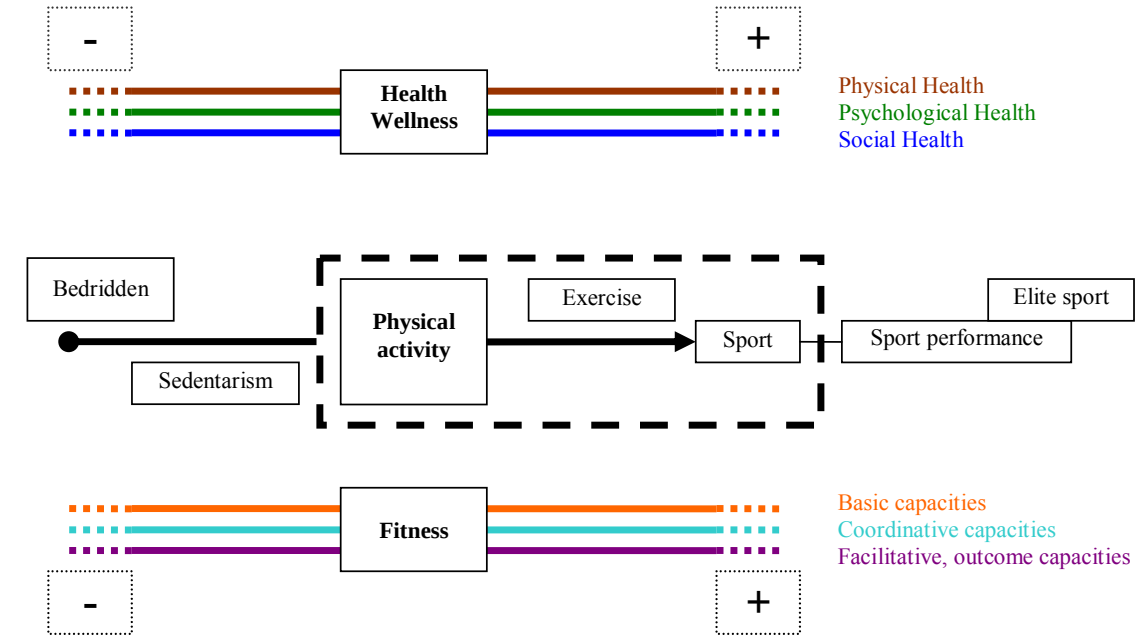

Figure 2.10 Activity categories and their relationships with fitness and health.

Translated and modified, with permission, from X. Peirau Terés & Á. Gordillo Molina. (2010, May 20-22). *Luces y sombras del deporte escolar.* Paper presented at the 37º Curso de Pediatría Extrahospitalaria, Barcelona.

Fitness capacities cannot be developed independently from others: typical patterns of endurance exercises influence strength; strength workouts may improve balance; stretching exercises to improve flexibility affects agility. These improvements are higher for less fit people or people with a sedentary behaviour. However, classifications of capacity training focus on the most developed capacity.

Endurance

The main health benefits of endurance exercise include developing aerobic capacity by improving the ability of the heart to deliver oxygen to the working muscles and in the muscle's ability to generate energy with oxygen (American College of Sports Medicine, 2006). Endurance exercising also reduces the risk factors of several cardiovascular diseases

such as, lipid profile, hypertension, insulin resistance, glucose intolerance and weight control (American College of Sports Medicine, 2011).

Strength

A review by Winett & Carpinelli (2001) suggests that resistance training may develop health-related benefits by improving muscular function. Resistance training can have an impact on cardiorespiratory fitness and more specifically on the risk factors associated with cardiovascular disease due to two effects. Firstly, the heart rate at submaximal rates of exercise is generally reduced, thus cardiorespiratory fitness is improved. Secondly, the heart can be enlarged (i.e., left ventricular wall hypertrophy) which can increase the contractility of the left ventricle and enhance stroke volume (Wilmore, et al., 2008). Also, it has been shown that resistance training promotes the retention of skeletal muscle mass during periods of energy restriction, which is useful for obese persons undergoing weight loss. However, resistance training alone is not recommended for high blood pressure because it usually increases during high intensity muscle contraction, although chronic effects show diverse results from studies (McCartney & Phillips, 2007).

Resistance training should be done at high volume and low intensity, 50-70% of individual's 1-repetition maximum (1RM) (Departament de Salut. Generalitat de Catalunya, 2007). To improve insulin activation concentric exercise is better than eccentric because it is suggested that muscle damage after eccentric exercise may decrease insulin action (Hardman & Stensel, 2009). Strengthening muscles and connective tissue affects bone mineral density which is beneficial especially for, but not only, postmenopausal women (American College of Sports Medicine, 2006). Also, strength training stabilizes joints and prevents muscle weakness which helps osteoarthritis-affected joints (McCartney & Phillips, 2007; Pedersen & Saltin, 2006).

Flexibility

Regular training of flexibility exercises improves joint range of motion. Lack of flexibility combined with a reduced musculoskeletal strength often contributes to a reduced ability to perform daily life activities (American College of Sports Medicine, 2006). Flexibility may enhance postural stability and balance, with greater effects when combined with resistance exercises (e.g., by combinations of strengthening a group of muscles and stretching their antagonists) (Drezner & Herring, 2001). Surprisingly, no consistent link has been shown

between regular flexibility exercise and a reduction of musculotendinous injuries, prevention of low back pain or delayed-onset muscular soreness (DOMS) (American College of Sports Medicine, 2011; Fields, Sykes, Walker, & Jackson, 2010).

Coordination, balance, agility

Coordination, balance, agility as well as gait and proprioceptive training are considered beneficial as a part of a varying exercise program for older persons, especially to improve balance, agility, muscle strength, and reduce the risk of falls. However, few studies have studied quantitative aspects either of exercise training or these capacities as outcome. A recent review of exercise to improve balance by Howe and colleagues concluded that there is weak evidence that some types of exercises (i.e., gait, balance, co-ordination, strengthening) are moderately effective, immediately post intervention, in improving clinical balance in older people. These activities, though, were considered safe (Howe, Rochester, Neil, Skelton Dawn, & Ballinger, 2011). By the time of this study, health and fitness benefits of training these capacities are uncertain because of the variability of the quality and methods used in the available studies such as the frequency, duration, and intensity of exercise training (American College of Sports Medicine, 2011).

Annex A summarises the evidence-based recommendations for individualized exercise prescription by fitness components for apparently healthy adults (extracted from American College of Sports Medicine, 2011).

2.4 PHYSICAL ACTIVITY PROMOTION

2.4.1 PREVALENCE OF PHYSICAL ACTIVITY IN THE POPULATION

Surveys are used to measure PA in large populations, hence questionnaires with answers self-reporting levels of PA. However, PA can present itself in many different forms. Its component of type, intensity, frequency, and duration, among others, makes comparison difficult. In addition,, measures of PA are different among different studies (Hardman & Stensel, 2009).

The European Commission Eurobarometer survey assesses health status in people over 15 years old in the European Union (EU). The 2002 Special Eurobarometer showed that 57.4% and 40% of people never engaged in vigorous PA and moderate PA (excluding walking), respectively. Spain was the country where most people never performed vigorous PA (71.7%) and where the lowest percentage of people engaged in moderate PA (51.3%). However, Spanish citizens headed the list of walking five times a week for at least thirty minutes (51.3%), which was clearly above the EU average (36.8%) (European Commission, 2003; Sjöström, Oja, Hagströmer, Smith, & Bauman, 2006).

Another survey taken in several EU countries showed similar results and found that inactive citizens from Mediterranean countries, including Spain, were the least willing to become active (Varo Cenarruzabeitia et al., 2003).

The 2006 Eurobarometer showed a geographic pattern going from north to south and east to west in the results of citizens who reported not engaging in moderate PA during a typical week: Malta (78%) and Spain (60%) were the first not engaging in moderate PA, whilst The Netherlands, Slovakia and Slovenia showed the most active rates, with less than 25% of the adult population not engaging in moderate PA (European Commission, 2006; Hardman & Stensel, 2009; Regidor, Gutiérrez-Fisac, & Alfaro, 2009).

The most recent Eurobarometer measuring PA items was released in 2010 (European Commission, 2010). Items were different compared to 2002, although some trends were similar: Northern countries and the Netherlands were the most active countries while the Mediterranean and the most recent 12 member states were the least active. An average of 14% in the EU and 10% in Spain never engaged in leisure-time PA or PA related to lifestyle.

Regular PA (≥5 days a week) was achieved by 27% and 33% in the EU and Spain respectively. 39% of EU citizens and 42% of Spanish citizens never exercised or played sports. The most common reason cited for why people fail to exercise is, by far, shortage of time (45% for EU and Spain).

More Spanish citizens showed indifference towards exercising than the EU average, with 50% in Spain compared to 42% in the EU. This percentage increases the older the people get. Other items also follow the same pattern:

- 61% of people of all ages and 67% of people over 70 years old cited improving health and fitness are the main reasons for engaging in PA or exercise.
- 48% of people all ages and over 56% older than 55 years old cited parks and places out in the nature as the preferred sites for PA.

However, lack of time as a reason for not exercising is a factor which decreases with age. Two other socio-demographical data are of interest for the scope of this thesis:

- Citizens with difficulty in paying the bills are less likely to exercise to improve their health.
- Just 5% of Spanish citizens volunteer in sport, compared with the EU average of 7% and 18% in Finland or Sweden.
- The Spanish Ministry of Health and Social Affairs showed the evolution of self-reporting PA from 2001 to 2007 and exercise in 2007 for people aged 16 and over: the results were a decrease in the number of people who did not report any type of PA.

A surveillance using the International Physical Activity Questionnaire (IPAQ) in twenty countries showed that 75.8% of a Catalan sample of the adult population was categorised either as performing moderate activity or being highly active in 2002 (Bauman et al., 2009). This result is similar to those from the 2002 Catalan health check in which 21.7% of people where shown to be inactive during their leisure time. The same assessment showed 60.5% of people who walked did so at least thirty minutes a day (Roure, Vallbona, Tresserras, Taberner, & Salleras, 2003). However, by measuring their LTPA, the Catalan Nutrition Survey showed that 54.6% of people had a sedentary behaviour (Román-Viñas et al., 2007).

A survey within the framework of sports facilities plan in Catalonia showed that 77.1% of citizens engaged in regular physical activity and/or sports, and 47.4% walked purposively as a way of exercising regularly (Fàbregas Bosch, Bordas Mon, López-Jurado González, Giralt Grau, & Martí Pi, 2005). Walking was the leading activity followed by swimming activities and gymnastics, especially for people above 64 years of age. The survey also showed which the reasons for exercising were, and the results are similar to the posterior 2010 Eurobarometer: 55.9% exercised to improve health, to maintain fitness or by medical recommendation. This percentage increases to 73.4% for the elderly. Lack of time was also shown to be the main reason for not exercising.

A recent summary of sport habits edited by the Spanish High Council of Sport *(Consejo Superior de Deportes)* highlights that a common trend among the Spanish population is to practice non-institutionalized sport in outdoor spaces, placing more importance on this than on doing institutionalized sport (Consejo Superior de Deportes, 2010a). Table 2.3 summarises all previous data concerning Spain and the region of Catalonia.

To sum up, comparison of results is difficult due to differences in data collection even though specific outcomes are similar concerning participants and activities profile: physical activity levels decrease the older people get and walking is the most popular activity in Spain and in the region of Catalonia including when the specific aim is to exercise. Also, walking has been reported as the most popular physical activity among the population of other EU countries, for example, Sweden (Leijon, 2009).

Table 2.3 Prevalence of physical activity in the Spanish and Catalan populations.

SOURCE	YEAR OF DATA COLLECTION	SCOPE	POSITIVE OUTCOMES	NEGATIVE OUTCOMES
(Román-Viñas, et al., 2007)	1992-93	Catalonia		52.7% sedentary work-related PA 59.16% sedentary LTPA
(Ministry of Health and Social Policy, 2010 [Internet monograph])	2001	Spain		42.9% do not perform physical activity
(European Commission, 2003; Sjöström, et al., 2006)	2002	Spain	51.3% walk 5 d/wk at least 30 min	71.7% never engaged in vigorous PA 51.3% never engaged in moderate PA
(Bauman, et al., 2009)	2002	Catalonia	75.8% of moderately or highly active	
(Roure, et al., 2003)	2002	Catalonia	60.5% walk at least 30 min a day	21.7% sedentary during leisure time
(Román-Viñas, et al., 2007)	2002-03	Catalonia		55.8% sedentary work-related PA 54.6% sedentary during LTPA
(Varo Cenarruzabeitia, et al., 2003)	2003?	Spain		The least willing to become active within EU
(Fàbregas Bosch, et al., 2005)	2004	Catalonia	77.1% of regular physical activity and/or sports 47.4% walk regularly for exercise	
(European Commission, 2006)	2005	Spain		60% not engaging in moderate PA
(Ministry of Health and Social Policy, 2010 [Internet monograph])	2007	Spain	39.9% perform all physical exercise considered to be desirable	36.4% do not perform physical activity
(European Commission, 2010)	2009	Spain	33% engaged in regular PA (≥ 5 d/wk)	10% never engaged in LTPA or lifestyle activities 42% never exercise by playing sports
(Consejo Superior de Deportes, 2010a)	2010	Spain	55% consider sport to be important	

Note. d = days, wk = week, min = minutes, PA = physical activity, EU = European Union, LTPA = leisure-time physical activity.

2.4.2 RECOMMENDATIONS FOR PHYSICAL ACTIVITY

Throughout this study, physical activity will be looked at from the physiological perspective. However, promotion of PA as behaviour is a key issue from a public health perspective. The general definition of public health is, *'the science and art of promoting health, preventing disease, and prolonging life through the organized efforts of society'* (World Health Organization, 1998, p. 3). Public health can be developed through clinical services as well as social intervention such as income distribution, industry production, consumer goods, housing, labour and environment, among others (Navarro López, 1998).

PA promotion is part of health promotion. A suitable definition can be found in the Ottawa Charter of Health Promotion (World Health Organization, 1986):

> *Health promotion is the process of enabling people to increase control over, and to improve, their health. To reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment.*

The WHO's Global Strategy on Diet, Physical Activity and Health (World Health Organization, 2004) reported the importance of co-operation between partners such as public governments, professional associations, research institutions and private sector entities among others to achieve the main purpose of the Strategy:

> *The overall goal of the Global Strategy on Diet, Physical Activity and Health is to promote and project health by guiding the development of an enabling environment for sustainable actions at individual, community, national and global levels that, when taken together, will lead to reduced disease and death rates related to unhealthy diet and physical inactivity (World Health Organization, 2004, p. 3).*

One European example of a collaborative project working for better health through physical activity is the European network for the promotion of health-enhancing physical activity (HEPA Europe), which collaborates with WHO and is supported by the European Commission (Martin et al., 2006; World Health Organization). HEPA Europe is also part of the *Agita Mundo* network, a global PA promotion network launched in Brazil (Agita Mundo Network; S. M. Matsudo & Matsudo, 2006; V. R. Matsudo et al., 2002).

Other international networks whose scope fall within WHO's goal are: the Global Advocacy for Physical Activity (GAPA) (Bull, Pratt, Shephard, & Lankenau, 2006; GAPA), the *Red de*

Actividad Física de las Américas - Physical Activity Network of the Americas (RAFA-PANA), the African Physical Activity Network (AFPAN), the Asia Pacific Physical Activity Network (APPAN), and the International Sport and Culture Association (ISCA, 2011a). Recently, a new call for action has been launched by the Toronto Charter for Physical Activity (Global Advocacy Council for Physical Activity & International Society for Physical Activity and Health, 2010).

In 2005, the Spanish Ministry of Health launched the NAOS Strategy for Nutrition, Physical Activity and Prevention of Obesity *(Estrategia NAOS)* to adapt the WHO's strategy to the Spanish social and cultural environment (Agencia Española de Seguridad Alimentaria y Nutrición, 2005). On the other hand, one year later, the Catalan Department of Health launched the Integral Plan for Health Promotion through Physical Activity and Healthy Eating *(Pla Integral per a la promoció de la salut mitjançant l'Activitat Física i l'Alimentació Saludable,* PAAS) in line with the *NAOS* and WHO's strategies (Government of Catalonia, 2006).

Nowadays, it is recognised that the lack of regular PA or exercise is one of the fourth leading risk factors of global mortality through non-communicable diseases. Several papers show evidence at different levels of the role that physical activity and exercise have on the prevention or treatment of cardiovascular diseases, respiratory diseases, musculoskeletal problems, metabolic disorders, weight control, mental health problems and some cancers (American College of Sports Medicine, 2010; Catenacci & Wyatt, 2007; Dishman, et al., 2004; Keegan, et al., 2006; Kesäniemi, et al., 2001; Kohl, 2001; Lacasse, et al., 2006; Nelson, et al., 2007; Pedersen & Saltin, 2006; Puhan Milo, et al., 2011; Quist, et al., 2006; Rolland, et al., 2007; Sattelmair, et al., 2011; Task Force on Community Preventive Services, 2002; Thune & Furberg, 2001; US Department of Health and Human Services, 1996; Vuori, 2001; Wei, et al., 2000). Even low levels of PA may reduce morbidity, all-cause mortality and length life expectancy (Paffenbarger, 1988; Wen, et al., 2011). A recent paper by Weiler and colleagues points out that PA promotion features in 39 British national guidelines, and that excludes physical activity-specific guidelines (Weiler, et al., 2011).

A big challenge for researchers, practitioners and policy makers is to bridge the gap between science and practice. International and national recommendations have been published recently summarising the benefits of PA, exercise and health for specific age populations

(Canadian Society for Exercise Physiology, 2011; Department of Health, 2011; Department of Health and Ageing, 2010; Office of Disease Prevention & Health Promotion & US Department of Health and Human Services, 2008; World Health Organization, 2010). Professional organisations have been developing guidelines to implement exercise on prescription, like the American College of Sports Medicine, Swedish Professional Associations for Physical Activity, and Catalan fitness and health professionals (American College of Sports Medicine, 2010; Departament de Salut. Generalitat de Catalunya, 2007; Swedish National Institute of Public Health, 2010).

All these documents, with minimum variations, recommend adults engage in at least 150 minutes of moderate-intensity aerobic physical activity throughout the week, which can be performed in bouts of at least 10 minutes, 75 minutes of vigorous-intensity aerobic physical activity throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity. Furthermore, the last ACSM Position Stand recommendations including exercise training *beyond* activities of daily living to improve and maintain physical fitness and health (American College of Sports Medicine, 2011). Pyramid- and pie-shaped images are broadly used to disseminate these guidelines, see Figure 2.11 and Figure 2.12 (Departament de Salut. Generalitat de Catalunya, 2006; The UKK Institute for Health Promotion Research. Finland, 2009).

Recently, there has been increased interest in studying the balance between light-intensity activities and sedentary behaviours during waking hours, as opposed to minutes of moderate- to vigorous-intensity physical activity (Owen, Bauman, & Brown, 2009). People may complete the recommended amounts of time doing physical activity but then have a sedentary behaviour for the rest of the day. These are colloquially known as ‘active couch potatoes’.

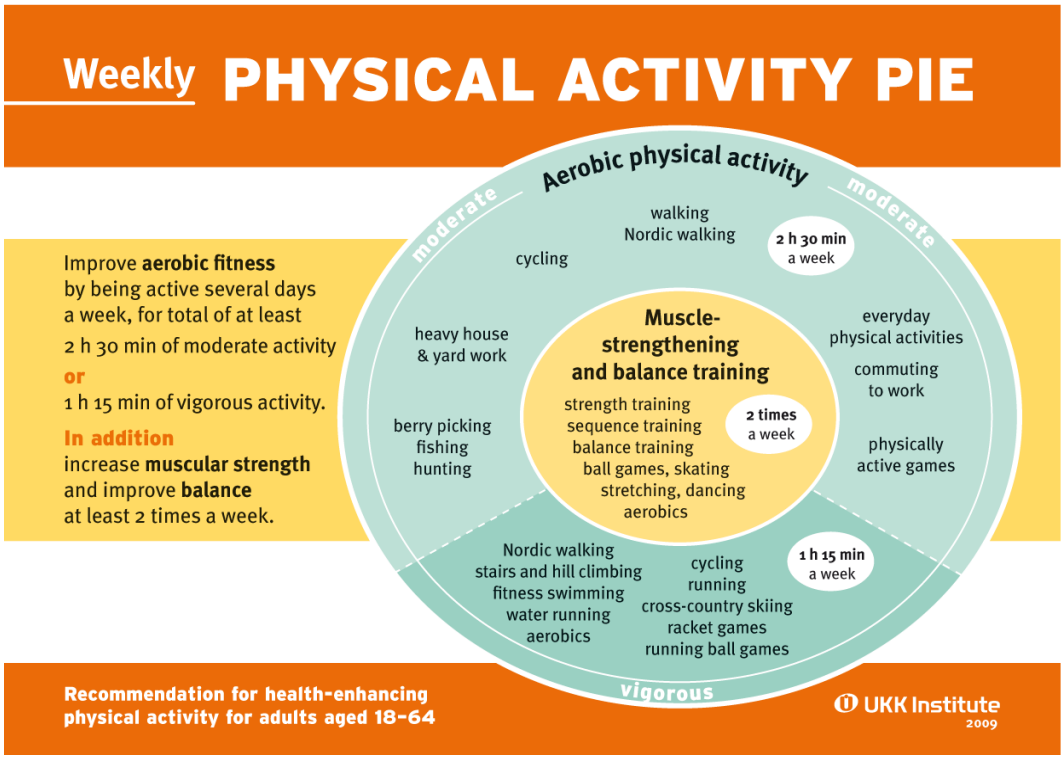

Figure 2.11 Physical Activity Pie.

Reprinted, with permission, from The UKK Institute for Health Promotion Research, Finland, 2009.

Figure 2.12 Physical Activity Pyramid.

Reprinted, with permission, from © 2006 Departament de Salut. Generalitat de Catalunya.

2.4.3 PRIMARY HEALTH CARE

Primary health-care (PHC) settings are one of the best settings for health promotion and health education. Their wide population reach, the perceived influence that GPs and other health professionals can have on health behaviours are, and in most cases, the gateway for those who may benefit the most (Aittasalo, 2008a; Bull, Bauman, Bellew, & Brown, 2004; C Raina Elley, Kerse, Arroll, & Robinson, 2003; Glanz, et al., 2002; Patrick et al., 1994; Tulloch, Fortier, & Hogg, 2006). Hardman suggests that physicians can give advice, offer educational materials and/or refer patients to exercise specialists (Hardman & Stensel, 2009). These general actions should be contextualised because the healthcare system varies between countries, for example, the average time for general practitioner (GP) consultation (Deveugele, Derese, van den Brink-Muinen, Bensing, & De Maeseneer, 2002).

In Spain roughly 87% of the population visit their primary health-care providers at least once a year (Ministerio de Sanidad y Consumo, 2006). Many of the health problems reported to practitioners include some kind of exercise prescription as part of their treatment together with diet, environmental aspects, harmful habits and medication (Ortega Sánchez-Pinilla, 1992). These are the reasons why the Spanish physician Ortega encouraged health practitioners to prescribe exercise even though they themselves may not be active, for the same reason practitioners recommend healthy diet and smoking cessation even though they may smoke or follow an unhealthy diet. Several papers from other countries are published by scientists and practitioners supporting PA interventions in PHC settings (Aittasalo, 2008a; Chakravarthy, Joyner, & Booth, 2002; Dugdill, Graham, & McNair, 2005; Leijon, Stark-Ekman, et al., 2010). However, systematic work and time expenditure are needed to achieve habit change, especially among people with sedentary behaviours (Laitakari & Miilunpalo, 1998). A mixed quantitative-qualitative study by Puig et al. showed that general practitioners in Catalonia who were categorised as non-promoters of physical activity rarely saw its promotion as a priority in 5-minutes consultations. Moreover, 55% of the physicians who were already promoting physical activity thought there was not enough time (Puig-Ribera, et al., 2005). Other barriers physicians had to cope with included a lack of institutional support, lack of education about the proper exercise dose for health and lack of a community network. These findings coincide with similar studies in other countries (McKenna, et al., 1998; Patrick, et al., 1994; Petrella, Lattanzio, & Overend, 2007; Petrella & Wight, 2000). A recent systematic review by Sørensen and colleagues showed that motivated general practitioners are

eager to have more exercise on prescription schemes (seen as more intensive intervention than just simple advice on physical activity) (J. B. Sørensen, et al., 2006). However, it seems that advice on its own is not enough to improve fitness in patients attending practitioners' consultations and more intensive interventions are needed (Conselleria de Salut i Consum, 2003; Estabrooks & Glasgow, 2006; Lawlor & Hopker, 2001; Petrella, Koval, Cunningham, & Paterson, 2003; Tulloch, et al., 2006). A review by Tulloch and colleagues shows that programmes where physicians started interventions for increasing PA in combination with allied health professionals were the most effective in the short and long term compared to physician interventions only. They suggest three reasons why PA counsellors address many of the barriers faced by physicians:

> *First, physical activity counselors may save the valuable time of physicians and allow more long-term, intensive counseling required for behavior maintenance. Second, physical activity counselors have the pre-requisite of specialized knowledge and relevant qualifications about health-related physical activity that physicians feel they lack. Third, (…) physical activity counselors specialized in healthy behavior adoption and maintenance (…) it is likely safe to presume a high level of enthusiasm about their profession, and could potentially provide more impressive results. (…) Finally, physical activity counselors come at a minimal financial expense as compared to physicians (Tulloch, et al., 2006, p. 17).*

Nowadays, demand for PA promotion seems to be increasing in the general population whose knowledge of PA benefits has been made a priority by policy makers. A recent study in Sweden showed that adults expect health-care providers to promote physical activity (Leijon, Stark-Ekman, et al., 2010).

2.4.4 PHYSICAL ACTIVITY PROMOTION IN SPAIN

2.4.4.1 HEALTH ADMINISTRATION

Spain is organised into seventeen autonomous regions and two autonomous cities. Each region has its own parliament and its government regulates competences such as health, education, social services and urban development among others. These responsibilities vary between regions and are not permanent. As an example, the Spanish government shares different health-care policies with different regions (see Figure 2.13). The Spanish Ministry of Health edited the National Health System report stating that:

> *The National Health System is comprised by both the Central Government Administration and the autonomous regions public healthcare managements working in coordination to cover all the healthcare duties and benefits for which public authorities are legally responsible (Ministry of Health and Social Policy, 2010 [Internet monograph], p. 8).*

The Department of Health is the administrative and management body responsible for all health centres, services and facilities of Catalonia as well as its intra-community administrations.

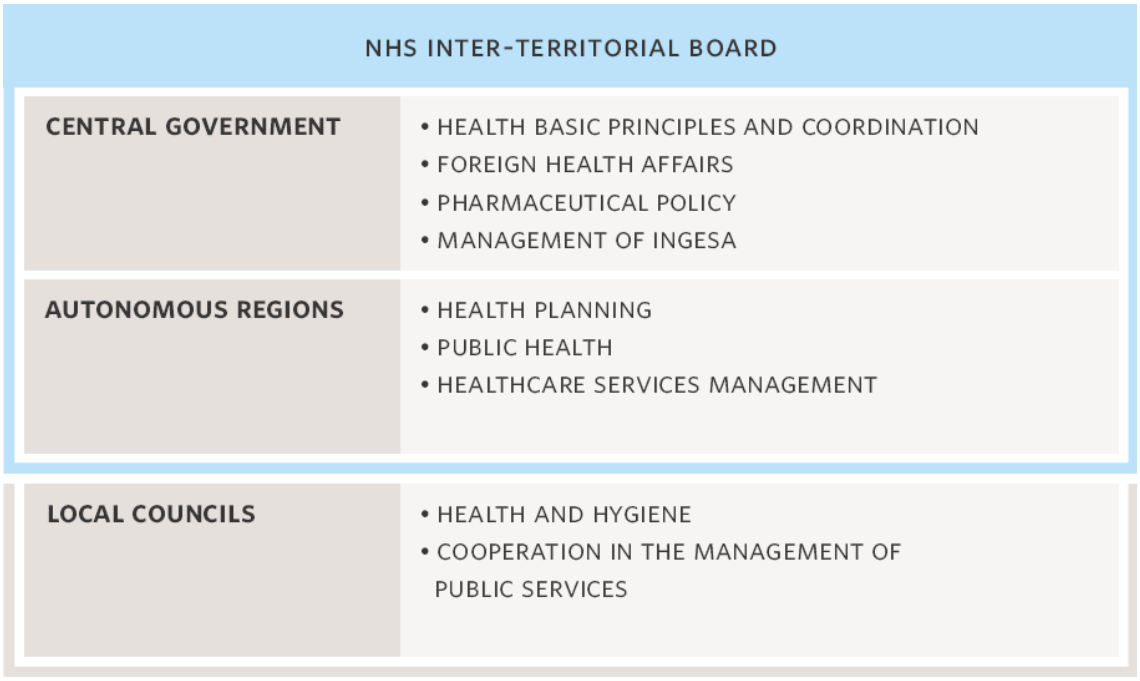

Figure 2.13 Responsibilities for Spanish public authorities on health.

Reprinted, with permission, from National Health System of Spain, 2010 [Internet monograph]. Madrid: Ministry of Health and Social Policy, Health Information Institute, 8. Available at: http://www.msps.es/en/organizacion/sns/libroSNS.htm.

Primary health-care concerns basic health-care services as well as health promotion and disease prevention, while specialist care is provided in specialist care centres and hospitals. Primary health-care centres staff general practitioners (GP), paediatricians, nurses and administrative staff, and, in some cases, social workers, midwives and physiotherapists (Ministry of Health and Social Policy, 2010 [Internet monograph]). Not many Catalan primary health-care centres offer physiotherapy services. If so, physical therapists attend patients after being referred by the GP and work primarily on rehabilitation and health

promotion, not fitness exercising (e.g., aerobic conditioning or muscular strength after rehabilitation) (Consejo General de Colegios de Fisioterapeutas, 2007; "Real Decreto 1001/2002, de 27 de septiembre, por el que se aprueban los Estatutos Generales del Consejo General de Colegios de Fisioterapeutas," 2002). This differs to the role physical therapists have, or may have, in other countries such as the Netherlands (Verhagen & Engbers, 2008).

Most exercise specialists holding a university degree (bachelor or master) do not have specific education on health-related benefits of exercise or physical activity. However, even exercise specialists with a Masters Degree in Fitness and Health are not categorised as health professionals by Spanish regulations. Such a situation makes the development of interdisciplinary approaches even more difficult due to issues such as patient data accessibility, participant data communication and data protection, and work-site disparities.

2.4.4.2 REGIONAL POLICY DOCUMENTS – HEALTH STRATEGIES

Spanish Autonomous Regions are responsible of health planning. Health strategies documents include epidemiological data, previous aims and future strategies concerning general health promotion, specific populations with health conditions, age categories and others.

Most documents include physical activity and/or exercise as outcome on their epidemiological data (see Table 2.4). Although regional surveys have been done, many regions include the Spanish health survey as the main source of data. However, interpretation of results varies (e.g., using PA and exercise interchangeably, and different criteria to classify sedentary behaviour). All health strategies include either PA or exercise as, at least, one of the main aims or secondary objectives, usually as behaviour which should be improved together with diet. Objective indicators to measure the achievement of the aims set are scarce or too ambiguous.

Table 2.4 Health strategies and physical activity epidemiological indicators.

AUTONOMOUS REGION	DOCUMENT NAME	PHYSICAL ACTIVITY INDICATORS
Andalusia	III Plan Andaluz de Salud (2003-08)	50% men engage in regular PA 39% women engage in regular PA
Aragon	Plan de Salud de Aragón (1999-?)	59% never engage in LTPA (1993) 11% do regular PA 89% sedentary at work
Asturias	Plan de Salud para Asturias 2004-2007. La salud como horizonte	65% sedentary LTPA 34% never exercise
Balearic Islands	Pla de Salut de les Illes Balears 2003-2007	31% sedentary most of the time 43% sedentary men 46% sedentary women 33% of the population engaged in regular PA or exercise
Basque Country	*Plan de Salud 2002 (2002-10)*	**Previous objectives to increase LTPA have been achieved** 29% men exercise in their leisure time 20% women exercise in their leisure time High socioeconomic populations show higher levels of LTPA Low socioeconomic population show higher levels of occupational PA
Canary Islands	Plan de Salud de Canarias 2004-2008. Más salud y mejores servicios	NA
Cantabria	Plan de Salud de Cantabria 1996-2000 (1996-2000)	26.7% sedentary at work 49.3% sedentary LTPA
Castile and León	*III Plan de Salud de Castilla y León (2008-12)*	70.8% sedentary at work
Castile La Mancha	*Plan de Salud de Castilla - La Mancha (2001-10)*	NA
Catalonia	*Pla de salut de Catalunya a l'horitzó 2010 (Vol I & II) (2009-10)*	23.9% sedentary at work and leisure 7.5% very active Low education and low socioeconomic status show lower levels of PA **Increase of inactive people from 1994-2006**
Extremadura	*Plan de Salud de Extremadura 2009-2012*	45.9% sedentary LTPA 45% engage occasionally LTPA 7.3% engage in regular LTPA 1.9% do regular sports exercise **All percentages of activity are higher than in 2001** 72.3% children engaged in PA 25.1% children never engaged in LTPA
Galicia	*Estrategia SERGAS 2014. La sanidad pública al servicio del paciente (?-2014)*	NA
La Rioja	*II Plan de Salud de La Rioja 2009-2013*	40.7% do LTPA 23.8% of children do not exercise
Madrid	NA	
Murcia	*Plan de Salud 2010-2015 de la Región de Murcia*	**Achievement of previous aim of developing campaigns to promote healthy lifestyles (including exercise)** 51.34% of population exercise 68.41% of children exercise
Navarre	*Plan de Salud de Navarra 2006-2012*	NA
Valencian Community	II Pla de Salut de la Comunitat Valenciana (2005-09)	NA

Note. PA = physical activity, LTPA = leisure-time physical activity, NA = not available. Bold: comparison with previous aims, italics: up-to-date documents by 2010.

A review of the latest version of health strategies' documents published in December 2010 showed a total of 105 objectives related to PA, exercise and/or sport, of which 46 (44.2%) had no indicators of measure (see Annex B). 7 documents include objective indicators focused on people participation rather than number of activities launched, of which 4 documents were updated in 2010 (Basque Country, Castile and León, Catalonia, La Rioja) (Burriel Martínez, 1999; Consejería de Salud y Servicios Sanitarios. Gobierno del Principado de Asturias, 2004; Consejería de Salud. Junta de Andalucía, 2003; Consejería de Sanidad y Consumo, 2010; Consejería de Sanidad. Junta de Castilla y León, 2008; Conselleria de Salut i Consum, 2003; Conselleria de Sanitat, 2006; Departament de Salut. Generalitat de Catalunya, 2009a, 2009b; Departamento de Sanidad. Gobierno Vasco, 2002; Ferrer Aguareles et al., 2009; Gálvez Zaloña, 2001; Gobierno de Cantabria, 1996; Gobierno de La Rioja, 2009; Parlamento de Navarra, 2007; Servicio Canario de la Salud. Consejería de Sanidad del Gobierno Canario, 2004; Servizo Galego de Saúde. Xunta de Galicia, 2010).

Data collection was done by searching the terms *physical activity, physical activities, physical exercise* and *sport* within the reports in the language of the document, Spanish or Catalan. Documents were downloaded from the official website of the correspondent Health Department or through links from the Spanish Society of Public Health and Health Administration *(Sociedad Española de Salud Pública y Administración Sanitaria, SESPAS)* website (Sociedad Canaria de Salud Pública, Sociedad Española de Salud Pública y Administración Sanitaria, & Ministerio de Sanidad y Consumo, 2006). The Health Strategy document of the Region of Madrid was not found even after phone contact with the Health Department, so access to the document was not possible.

Nine of the 16 documents were updated in 2010. Four included a revision of previous aims or compared previous epidemiological data with the most recent data used in the document (Basque Country, Catalonia, Extremadura, and Murcia).

2.4.4.3 THE NATIONAL PLAN A+D

The Spanish Government through the High Council of Sports is working on a General Plan of Physical Activity and Sport *(Plan Integral para la Actividad Física y el Deporte, Plan A+D)* aimed at developing EU policies and WHO recommendations on PA and health (Consejo Superior de Deportes, 2010b). The Plan A+D main aims are:

- To increase levels of sport participation.
- To generalise sport among the school age population.
- To promote sport as a way for social inclusion.
- To lead towards gender equality.

The following PA and health indicators are to be achieved by the year 2020:

- 50% of people over the age of 15 engaged in sports participation (currently 39.9%).
- 35% of people with a sedentary behaviour.
- 20% of childhood overweight and obesity (currently 38%).
- 50% of school-aged people engaged in 1 hour of sport activities 5 days a week and 50% for 1 hour 5 days a week.
- 30% of people over the age of 65 engaged in PA and sports (currently 18.8%).
- 90% of sport facilities with disabled access (currently 68%).
- 50% of sport facilities with accessible changing rooms.

Aims for the specific PA health promotion programme are:

- To increase levels of HEPA and sport among the whole population.
- To accomplish PA prescription as regular practice within the public health system as primary and secondary prevention for those health conditions related to a sedentary lifestyle.

Developing an exercise-on-prescription programme in primary health-care settings is one of the measures currently in progress.

2.4.4.4 PHYSICAL ACTIVITY PRESCRIPTION RESEARCH

Dissemination of Spanish health promotion practices in general, and in PA prescription in particular, is scarce on a local, regional and national level. Health reports (i.e., the aforementioned regional health policy documents) and intra-regional documents (Servei Català de la Salut, 2011) collect data on promotion activities. However, a lack of standard in data collection or indicators is common.

One pragmatic cluster randomised controlled trial (RCT) developed in several Spanish regions and the design of one randomised controlled trial in Catalonia can be found in literature on the subject (Giné-Garriga et al., 2009; Grandes, Sanchez, Montoya, Ortega Sanchez-Pinilla, & Torcal, 2011; Grandes et al., 2009; Grandes et al., 2003; Grandes et al., 2008). Grandes and colleagues examined the effectiveness of the 'Experimental Program for Physical Activity Promotion' *(Programa Experimental de Promoción de la Actividad Física, PEPAF*) implemented exclusively by GPs in routine practice conducted between 2003 and 2004. Patients aged between 20 and 80 years old considered to be inactive received individual home-based PA prescription. Although the overall clinical effect was small, it was considered efficient in terms of short term increases of PA. Long-term levels of PA were positive for the subgroup of patients receiving repeated PA prescriptions (Grandes, et al., 2011; Grandes, et al., 2008).

This approach seems to adopt one of the first statements published in Spain to promote PA in primary health-care (Vallbona Calbó, 1986). The Catalan physician Vallbona, Professor of Community Medicine in the Baylor College, Houston, has recently co-edited the new Catalan guide for exercise prescription (Departament de Salut. Generalitat de Catalunya, 2007) whose core aim is to encourage interdisciplinary work and knowledge between health professionals (i.e., GPs, nurses, physical therapists, specific medical care specialists) and exercise specialists. Giné-Garriga and colleagues' study design includes community nurses and exercise specialists within the three months home- and supervised-based programme.

2.4.4.5 DISCUSSION ABOUT THE TERM PRESCRIPTION

The English definition of **prescription** is:

> *1 [C] ~ (for sth) an official piece of paper on which a doctor writes the type of medicine you should have, and which enables you to get it from a chemist's shop/drugstore; 2 [C] medicine that your doctor has ordered to you; 3 [U] the act of prescribing medicine; 4 [C] ~ (for sth) a plan or suggestion for making something happen or for improving it." ("Oxford Advanced Learner's Dictionary," 2005).*

The Royal Spanish Language Academy defines ***prescripción*** as *'acción y efecto de prescribir'* and *prescribir* as *'1 tr. Preceptuar, ordenar, determinar algo. 2 tr. Recetar, ordenar remedios'* (Real Academia Española). The Catalan Encyclopaedia defines ***prescripció*** as *'1. Acció de prescriure. (…) 4. Ordre que el metge dóna al malalt'* and *prescriure* as '*1. Ordenar, manar'* (Enciclopèdia Catalana SAU).

The term prescription seems to be in use exclusively among physicians, but some of its definitions in the aforementioned languages do not specify who does the action. Recently published Spanish guidelines on exercise prescription define the term as ACSM stated in 2006 (Abellán Alemán, Sainz de Baranda Andújar, & Ortín Ortín, 2010; Departament de Salut. Generalitat de Catalunya, 2007). This is the definition used in this thesis. However, national regulations and other health legislations may determine that physicians are the only professionals with the right to prescribe for health purposes.

Ortega Sánchez-Pinilla suggests that exercise prescription needs time, and as such, extra time not included in the patient's regular visit at GP surgeries (Ortega Sánchez-Pinilla, 2008). It should be noted that Ortega belongs to the PEPAF group that carried out a GP-only PA promotion programme. Other Spanish physicians advocate for new approaches to prescribe PA and exercise including health professionals and exercise specialists. Terrados considers that prevention and treatment of chronic health conditions should include exercise prescription by specialised professionals including consultant sport physicians and exercise specialists (Terrados Cepeda, 2007).

For this thesis *exercise prescription*, *physical activity prescription* and analogues will be used as previously defined in Chapter 2.3.1 since it is for use in the scientific literature. '*Individualization of the prescription of exercise duration, frequency, intensity and mode'* (Wilmore, et al., 2008, p. 522).

Exercise prescription may be considered as part of some rehabilitation programmes, defined by Wilmore (2008) as *'programs designed to re-establish health or fitness following a disability or illness'*.

2.5 PHYSICAL ACTIVITY REFERRAL SCHEMES

It is possible that physical activity or exercise promotion programmes are being used in clinical practice. However, dissemination of their impact is not always being reported neither through scientific papers nor public or private reports.

There are common barriers to face in both developed and developing countries in terms of implementing PA-related components of recent recommendations: lack of governmental support, the low profile of PA and a poor understanding of its impact, lack of infrastructure, lack of leadership, inexperience in partnerships, competing demands from other health issues (especially in developing countries), lack of resources and funding, and the need for training, guidelines and programme examples (Bull, et al., 2006). Some examples of PA promotion programmes include *Exercise is Medicine* and *Let's Move!* in the US, *ParticipACTION* and *Active Living* in Canada, *Fit for Life Program* in Finland, *Cesena Camina* in Italy, *Life Cycle* in Slovenia and Austria, *Go for Life* in Ireland, *PASEO Project* in several EU countries, *Discovery Healthy Lifestyle Programme* in South Africa, and *VIDA CHILE*; also, campaigns from institutions like the Netherlands Institute for Sport and Physical Activity, or the Physical Activity Network for Wales, (Draper et al., 2010; HEPA Europe, 2009; ISCA, 2011b; Salinas & Vio, 2003).

PA or exercise prescription in primary health-care settings are increasing in different countries but their diffusion is not always optimal, as happens with PA promotion programmes. Aittasalo (2008a) enumerates some prescription-based approaches which are suggested to be effective in the initiation of PA, some are further explained herein. These schemes have common aspects although the professionals involved and the form of prescription or pathway referral varies across and within countries. One study in the US found that subsidised programmes may increase adherence for inactive patients (Shepich, Slowiak, & Keniston, 2007); however, most of pragmatic approaches avoid extra funding by using existing community, healthcare and/or sport resources.

Most programmes are primarily focused on physical activity (e.g., behaviour change, or time performing PA) while a few report cardiorespiratory fitness as an outcome. Regardless of the approach (public health vs. fitness), all schemes coincide in recognising the relationship between health and PA, the importance of the primary health-care setting and the need for a multidisciplinary network.

To encourage people to sustain or improve PA, for both the insufficiently active and the already active, theories and models may help to achieve aims for behaviour change: the Behaviour Learning Theory, the Theory of Planned Behaviour, the Social Cognitive Theory, or the Transtheoretical Model among others, even though, as of yet, no single model has been proved to be sufficient to explain human behaviour (Aittasalo, 2008b; L. V. Kallings, 2008).

The Transtheoretical Model, originally developed for promoting smoking cessation (Prochaska & DiClemente, 1983), is based on six stages which indicate readiness for behavioural change (Prochaska & Velicer, 1997): precontemplation, contemplation, preparation, action, maintenance, and termination (see Table 2.5). However, a systematic review on the effectiveness of the stage-matched interventions applied to PA found no evidence for effect at short-, medium-, or long-term follow-up (van Sluijs, van Poppel, & van Mechelen, 2004).

Table 2.5 The stages of change of the Transtheoretical Model.

STAGE OF CHANGE	DEFINITION
Precontemplation	No intentions to make changes within the next 6 months.
Contemplation	Intention to change behaviour within the next 6 months.
Preparation	Intention to change behaviour within the next months, plus plans for action. Suitable target group for physical activity or exercise promotion.
Action	The change has been adopted but it has lasted less than six months.
Maintenance	The change has been maintained more than six months mostly by avoiding relapses.
Termination	The change has been adopted so well that there is no fear for relapses. Unrealistic for most people in physical activity.
Relapse	The return to an earlier stage (not really a separate stage).

Note. Based on Aittasalo (2008b) and Prochaska & Velicer (1997).

The 5As construct (assess, advise, agree, assist, arrange) has been proposed for clinical counselling to guide brief primary-care interventions as sequential series of steps (Goldstein,

Whitlock, & DePue, 2004; Whitlock, Orleans, Pender, & Allan, 2002). The educational participant-centred components of these models when developed in clinical practice do not differ substantially from some of the principles of exercise training explained previously (see Table 2.6).

Table 2.6 The 5As construct and its relation with principles of exercise training.

THE 5AS		EXERCISE TRAINING PRINCIPLE
Assess	Ask about current behaviour, risk factors, readiness, skills, knowledge, beliefs.	Individuality
Advise	Give specific and personalized advice, including information about personal health harms and benefits.	Awareness
Agree	Collaboratively select appropriate goals and methods based on the participant's interest in.	Feasibility
Assist	Help the participant to achieve goals by acquiring skills, confidence, and social and environmental supports.	Awareness
Arrange	Schedule follow-up for ongoing assistance and to adjust the plan as needed.	Periodization

Note. Based on Aittasalo (2008b) and Goldstein et al. (2004).

Although the effectiveness of PA or exercise referral schemes has been questioned by some researchers, the efficacy has been supported in other reviews (Leijon, Bendtsen, et al., 2010). A recent review by Pavey and colleagues (2011) did not show consistent evidence in outcomes based on fitness or other health issues nor when comparing exercise referral schemes with other alternative PA intervention (i.e., walking programmes). However, they state that *'the referral process of the scheme is, in itself, a key motivator and driver for individuals to take up and adhere to exercise interventions'* (Pavey, et al., 2011, p. 5). The typical referral programme is to a leisure centre lasting 10-12 weeks. Following this pattern, the benefits of these referrals remain potentially valuable for PA promotion and for specific subgroups (i.e., specific health conditions).

No están todos los que son pero sí que son todos los que están.[1]

[1] Not all the important ones are present, but all the present ones are important.

2.5.1 AUSTRALIA. ACTIVE PRACTICE

The *Active Practice* project undertaken in New South Wales aimed to overcome some of the barriers to promote PA in general practice. The study was conducted as a non-randomised controlled trial in which the intervention group received written prescriptions for exercise by their GP (Smith, Bauman, Bull, Booth, & Harris, 2000).

Twenty-seven primary health-care centres volunteered and of those centres fifty-five GPs participated (32% of those invited). GPs received 20-30 minutes of training towards PA promotion and provided PA prescription which they considered appropriate for each patient. Baseline self-reported PA was assessed by researchers and booklets were sent specifically for a random sample of half of the intervention group. The control group included 386 patients, PA prescription-only group 380, and PA prescription-plus-booklet group 376. Follow-up at 6-10 weeks and 7-8 months of self-reported PA levels was carried out showing a decline in activity between the two follow-up measurements. Modest short term improvements were found for the PA prescription supplemented by a stage matched information booklet, meanwhile prescription alone did not lead to significant improvements. However, researchers did not consider the intervention to be an adequate strategy to achieve public health targets for PA.

The *Active Script Programme* assessed its effectiveness on increasing the number of GPs in Victoria who delivered appropriate, consistent and effective advice on PA. This approach worked with Divisions of General Practice (health region management) to train GPs and provide resources (Sims, Huang, Pietsch, & Naccarella, 2004).

The *10,000 Steps Rockhampton Project* was a community-based, PA intervention including primary care PA counselling (Eakin, Brown, Marshall, Mummery, & Larsen, 2004). Currently, the 10,000 Steps programme is ongoing and promotes walking (10000 Steps, 2003).

All these published programmes only targeted GPs. The reason may be because no other health professional group works consistently as part of the primary care team, for example, nurses (Eakin, et al., 2004).

2.5.2 DENMARK. EXERCISE ON PRESCRIPTION

The Danish *Motion på recept* (Exercise on Prescription) scheme encourages GPs to refer inactive patients with medically controlled lifestyle diseases or risk of developing them to an exercise-on-prescription programme. Initiatives are organised and implemented by the local administration, as such, the design of the interventions differs to some extent (Bredahl, 2010). These programmes generally consist of high-intensity, supervised, group-based training and motivational counselling (i.e., aerobic conditioning, light strength conditioning, stretching, and games) (J. B. Sørensen, Kragstrup, Kjær, & Puggaard, 2007).

Groups involved training together with eight to twelve other participants. Patients were requested to pay over 100€ for the intervention comprising of 24 training sessions over four months, mainly for motivational reasons. A comparison between low- and high-intensive intervention found no differences in VO_2max, self-reported PA, health-related quality of life, and other risk factors suggesting focusing on less-intensive interventions aimed at lifestyle activities rather than supervised training for a limited period of time or implementing more than one intervention for high-risk populations (J. B. Sørensen, Kragstrup, Skovgaard, & Puggaard, 2008). A recent qualitative study on the participant view showed that the exercise specialist had a large influence on their behavioural change process as well as being discouraging for others, whereas the GP was described as without significance (Bredahl, 2010; Bredahl & Roessler, 2011).

2.5.3 FINLAND. PHYSICAL ACTIVITY PRESCRIPTION

The *Liikkumisresepti* (Physical Activity Prescription, Prex) works as prescription-based PA counselling by health-care providers, preferably GPs. It was developed and piloted in Finland during 2001 and 2002, and was later found to be feasible and effective in comparison to usual care (Aittasalo, et al., 2006; Finnish Rheumatism Association et al., 2010).

Their intervention started by training GPs and other health-care staff on counselling according to the 5As framework. Regular patients between 20 and 65 years of age who performed less than 30 minutes of moderate-intensity PA less than four days weekly and who had no perceived obstacles for PA were included either in the intervention group or the control group. A subgroup taken from the control group was created and participants received a pedometer

to record their daily walking. Prex could be used as a direct PA prescription or as a referral to physiotherapists, nurses or exercise experts from the community.

Follow-up at 2 and 6 months showed increasing weekly levels of PA for the intervention group. GPs averaged five Prex delivered and a content analysis of a random sample showed that PA had been previously assessed, a PA goal had been set and a control visit had been agreed. However, most of the goals were health-oriented instead of patient-centred, and the average number of weekly PA sessions recommended was high compared to the patients' habitual sessions.

The consensus of a large group of Finnish institutions can be considered a forte of the Prex intervention (i.e., Finnish Rheumatism Association, Fit for Life Programme, Finnish Medical Association, Finnish Heart Association, Research Centre for Health Promotion/University of Jyväskylä, UKK Institute for Health Promotion Research).

2.5.4 NEW ZEALAND. GREEN PRESCRIPTION

One of the first approaches which integrated PA or exercise prescription into a system of regular practice is the New Zealander *Green Prescription* (GRx). Patients with a health condition that may benefit from PA advice are selected by their GP or nurse who then assesses the level of PA. If the PA level is low, a written form of PA prescription is issued to the patient and, if the patient then gives their consent, a copy is sent to GRx collaborative support exercise professionals. See Figure 2.14 (Ministry of Health - Manatū Hauora, 2011).

The effectiveness of GRx has been reported in several studies (C. Raina Elley et al., 2011; C Raina Elley, et al., 2003; Kerse, Elley, Robinson, & Arroll, 2005; Lawton et al., 2009; Swinburn, et al., 1998). Swinburn stated that written goal-oriented GRx was more effective than verbal advice in increasing PA level over a 6-week period (Swinburn, et al., 1998). In the RCT study by Elley and colleagues where patients prompted their GP or nurse, there were reported increases in energy expenditure in total PA and LTPA and some increases in quality-of-life measurements in the *Short Form 36 Health Survey* (SF-36) in the intervention group compared to the control. Lower levels of blood pressure were achieved by the intervention group after the intervention. They concluded that GRx in general practice was effective over 12 months without evidence of adverse events, and that for every ten GRx written one person

achieved and sustained 150 minutes of moderate- to vigorous LTPA per week (C Raina Elley, et al., 2003).

Figure 2.14 The Green Prescription framework.

Reprinted, with permission, from Ministry of Health - Manatū Hauora, 2011.

Similar results were also achieved in an older subgroup compared to the control (Kerse, et al., 2005). A two-year RCT for women showed an increase in PA and a greater proportion of its intervention group achieved 150 minutes of moderate PA per week after twelve months. However, there were no significant improvements in clinical or biochemical variables, and there was an increase in the number of falls and injuries and a reduction in the SF-36 role physical score for the intervention group (Lawton, et al., 2009).

A 2008 survey reported that all GPs were aware of the Green Prescription and 86% had used it, even though 100% gave advice on PA (Sport and Recreation New Zealand, 2008). From a participant point of view, 82% of patients were satisfied with the Green Prescription service in 2010 (Sport and Recreation New Zealand, 2010).

2.5.5 SWEDEN. PHYSICAL ACTIVITY ON PRESCRIPTION

The Swedish national campaign *Sweden on the Move* introduced the *Fysisk aktivitet på Recept* scheme (Physical Activity on Prescription, FaR®) in primary health-care settings based on a

patient-centred approach of the prescription (i.e., individualization). Activities, which are either self-monitored or organised by community PA organisations, are prescribed according to the patient's circumstances (L. Kallings, 2012; Leijon, Bendtsen, Nilsen, Festin, & Ståhle, 2009). A normal fee had to be paid by the patient for this option. Primary health-care centres were responsible for co-ordinating with PA organisations to create a community-based network in the field of physical training. The organisation of each network differs as they are adapted to their local conditions. The PA counselling was patient-oriented and based on the Swedish handbook on PA in the prevention and treatment of diseases (Swedish National Institute of Public Health, 2010). GPs, physiotherapists, nurses and other health-care professionals could prescribe PA (L. V. Kallings, et al., 2008).

Leijon and colleagues studied the effectiveness (i.e., changes in PA) of the Östergötland scheme, where 42 PHC centres took part (Leijon, et al., 2009). Patients had to fulfil criteria in order to be included. They had to either have a sedentary lifestyle or a diagnosis that could be potentially benefit from an increase in PA levels. A written PA prescription was given to the patient; a copy was kept in the medical record, and another copy to the PA coordinator if the activity prescribed was facility based. Activities could be home-based activities such as walking, facility-based activities provided by a local PA organisation, or a combination of both. PA levels were self-reported by the 7-day recall and increased in the short and long term, 3 and 12 months respectively, with the largest increase among those patients who were the least active at baseline. The largest increase in PA was among those participating in lifestyle activities (i.e., walking). Adherence was also higher for patients who were issued home-based activities and were somewhat active at baseline (Leijon, Bendtsen, et al., 2010).

Kallings and colleagues' observational study showed similar results: PA level at six months increased for participants being prescribed PA, with both home- and facility-based activities (L. V. Kallings, et al., 2008). Another study conducted in 2009 showed that the FaR® method had positive effects on physical activity level and cardio metabolic risk factors (L. V. Kallings et al., 2009).

Several economical studies by Romé and colleagues showed interesting results concerning the Swedish scheme too. An RCT during 4 months of the PA prescription showed that exercise twice a week, motivational counselling, and education compared with exercise only once a week did not make any difference in improving levels of PA (Romé, Persson, Ekdahl, &

Gard, 2009). Also, patients with a higher education level, income, and body mass index were the most willing to pay for improved health and weight loss through exercise (Romé, Persson, Ekdahl, & Gard, 2010).

2.5.6 UNITED KINGDOM. EXERCISE REFERRAL

A review by Fox and colleagues on PA promotion through primary care in England identified 157 schemes already in existence by 1994 (Fox, Biddle, Edmunds, Bowler, & Killoran, 1997). This variety still exists today, with an estimated 600 schemes in 2006 in the United Kingdom (UK) (National Institute for Health and Clinical Excellence, 2006). These schemes, involving referral of patients by GPs, are generally called exercise on/by prescription or exercise referral schemes. The British National Institute for Health and Clinical Excellence issued guidance on four common methods to increase the population's PA levels, including exercise referral schemes. However, these were not recommended as regular practice to promote PA due to lack of strong evidence supporting their cost-effectiveness. Instead, they were recommended as part of research studies where effectiveness could be evaluated.

Several reviews showed that exercise referral schemes increase PA levels in certain populations in short term periods and may be suitable for patients targeted as *almost active*. However, recruitment, attendance and adherence should be improved to increase their cost-effectiveness (Morgan, 2005; D. M. Williams, Matthews, Rutt, Napolitano, & Marcus, 2008). N. H. Williams et al. found that seventeen people with a sedentary behaviour needed to be referred for one to become moderately active (N. H. Williams, Hendry, France, Lewis, & Wilkinson, 2007).

An RCT comparing referrals to leisure centres, led walks and advice only for adults with cardiovascular risk factors showed increasing PA levels in all groups and the tailored advice to be the most cost-effective (Isaacs et al., 2007). The authors concluded that assessment and advice from an exercise specialist may be the most appropriate to initiate action at first instance, while subsidised schemes (i.e., group-based activities) may be concentrated on patients with specific health conditions.

The *Let's Get Moving* intervention is one of the last programmes whose central component is based on a brief intervention which is aimed mainly at providing advice to facilitate behaviour

change (Bull & Milton, 2010). It is focused on habit change, and hence differs from exercise referrals where supervised-based exercising or leisure facilities referral are the main form of prescription as has been suggested also by others (Dugdill, et al., 2005). Bull and colleagues suggest that *Let's Get Moving* is either integrated with or replacing exercise referral schemes to reach high risk patients (Bull & Milton, 2010).

2.5.7 UNITED STATES, THE NETHERLANDS. PACE

The *Physician-based Assessment and Counseling for Exercise* (PACE) first developed in San Diego, US, aimed at changing PA behaviour based on the Transtheoretical Model of behaviour change and the Social Cognitive-Theory (Prochaska & DiClemente, 1983). PACE focused on overcoming common barriers encountered by GPs in PA counselling and promotion by recommending moderate-intensity, safe, effective and familiar activities for most patients followed by phone contact (Patrick, et al., 1994). Calfas and colleagues conducted several trials first on PA only and then adding nutritional counselling and the PACE+ program (Calfas, et al., 1996; Calfas et al., 2002). The first trial addressed inactive adults without limitations to exercise. It took from 6 to 9 minutes of counselling plus 10 minutes of the phone call from a health educator and was found effective in increasing weekly walking compared to short term controls (i.e., 8 weeks) measured by a self-reported questionnaire. The PACE+ assessed PA and dietary behavioural changes, comparing different intensity follow-up interventions (mail only, infrequent phone and mail, and frequent phone and mail). There were improvements in PA stage of change although they did not differ relative to the follow-up intervention. The PACE+ framework has been used to assess behavioural changes for specific health conditions, such as hypertension in Japan (Miura et al., 2004).

The PACE was found to be feasible for GPs in the Netherlands, who spent 10-14 minutes on the first visit and less than 10 minutes on further consultations (van Sluijs, van Poppel, Stalman, & van Mechelen, 2004). It was also effective in producing changes in some determinants of PA (i.e., self-efficacy, or behavioural processes of change) in the short and medium term (8 weeks and 6 months, respectively) (van Sluijs, van Poppel, Twisk, Brug, & van Mechelen, 2005). However, the PACE intervention was ineffective in producing additional effects in PA level, stage of change in activity, or body composition relative to standard advice (van Sluijs et al., 2005).

2.5.8 CATALONIA. PAFES

The Catalonian government launched the *Pla d'Activitat Física, Esport i Salut* (Plan for Physical Activity, Sport and Health, PAFES) in 2007 on the basis of a previous, two-year long plan, the *Pla d'Implantació Progressiva per a la prescripció de l'activitat física a l'atenció primària de salut a Catalunya* (Progressive Plan for Physical Activity Prescription in Primary Health-Care Settings in Catalonia, PIP) according to the regional PAAS framework (Government of Catalonia, 2007; Lloret, 2006).

A poster presented by governmental representatives stated the main purpose of PAFES (to increase PA among the adult population with main heart risk factors using an interdisciplinary and intersectional approach) and detailed specific aims (Violan et al., 2010). PAFES matches two settings which, in practice, work separately in Spain: health and sports (Plasència et al., 2008). Throughout the program, patients are encouraged to participate in PA programmes at public sports facilities for at least 6 months (Garcia, Violan, & Cabezas, 2010).

By the end of 2010, 27% of targeted PHC units were included within the framework and 491 professionals were trained. However, there is no information available on the adoption of the programme by these professionals (i.e., number of PA prescriptions being delivered).

Several poster presentations have been presented in relation to PAFES. A three-month trial of participants' adherence to a supervised program after being recruited from their PHC centres showed high rates of attendance: 85.01% (Aranda et al., 2009). In addition, there has been an attempt at designing an evaluation of long-term exercise adherence and dietary behaviour in older adults (Pardo et al., 2009). To date, there are no published results on post-intervention levels of PA in relation to PAFES.

2.6 FROM RESEARCH TO PRACTICE

Physical activity promotion, or more specifically exercise prescription, requires the participation of multiple agents and settings to fulfil its objectives. It is clear that research has its limitations. Thus, conclusions taken from research should be framed within study limitations. Kallings (2008) links controlled conditions with validity:

> *Randomized controlled trials have shown the efficacy of interventions tested under controlled conditions (focus on internal validity), but there is a need for studies that show the effectiveness of promoting physical activity in everyday clinical practice (focus on external validity)* (p. 14).

When research is conducted in pragmatic trials, conditions may not always be the most suitable. Practitioners (GPs, nurses and other), technical and administration staff, management boards, other community settings, and the development of other ongoing programmes play an important role in the final development of pragmatic trials that may enhance or limit its development (Aittasalo, et al., 2006), or may produce biased of final results due to particular motivations. Leijon (2009) suggests that RCT studies are really impossible to recreate in real-life clinical settings. For instance, concerned GPs may give individualised advice and interventions which are separate from the study intervention (Puska, 2002).

Next, some terms are defined in relation to programme evaluation from a public health perspective.

2.6.1 EFFECTIVENESS AND EFFICACY

Effectiveness may be defined as *'producing the result that is wanted or intended; producing a successful result'* ("Oxford Advanced Learner's Dictionary," 2005). Also, as *'the extent to which the intended effect or benefits that could be achieved under optimal conditions are achieved in practice'* (Aittasalo, 2008b). **Efficacy trials** are '*a test of whether a program does more good than harm when delivered under optimum conditions'* (Flay, 1986, as cited in Estabrooks & Gyurcsik, 2003, p. 43).

Estabrooks & Gyurcskik (2003) suggest that research phases should be evaluated for their potential for translation into practice, potential for widespread dissemination, or public health impact. Efficacy trials are characterised by tight controls in the standardised programme and the specific target audience, with the aim of determining if the intervention works. Efficacy

intervention is considered as an antecedent to determining its effectiveness (Estabrooks & Gyurcsik, 2003). In other words, efficacy refers to relative effectiveness (Tones and Tilford (2001) in Aittasalo, 2008b). Leijon (2009) suggests that most exercise on prescription schemes have been studied in terms of efficacy without including aspects on their translation into routine practice, so there is a gap between efficacy and effectiveness. However, recent research has been done to evaluate effectiveness of PA and exercise referral schemes some including economical cost-effectiveness issues (Aittasalo, et al., 2006; Isaacs, et al., 2007; Murphy et al., 2010; J. B. Sørensen, et al., 2008).

A simple question posed by Armstrong et al. (2007) while conducting systematic reviews of health promotion and public health intervention, draws a simple picture of the meaning of effectiveness:

Does the intervention work? (p. 2)

2.6.2 FEASIBILITY

Oxford's definition of **feasibility** is *'That is possible and likely to be achieved. Practicable'* ("Oxford Advanced Learner's Dictionary," 2005). Wang et al. consider feasibility as a synonym of applicability, meaning *'whether the intervention process could be implemented in the local setting, no matter what the outcome is'*. The focus is placed on the process and a question arises which needs to be answered:

Is it possible to run the intervention in this local setting?
(Wang, Moss, & Hiller, 2006, p. 77)

Several other issues should be assessed when determining the feasibility of a project, including the political environment, social norms and local culture, local resources, educational level of the target population, organisation responsibility, and provider skills (Wang, et al., 2006).

The Cochrane Guidelines for Systematic Reviews of Health Promotion and Public Health Interventions define *feasibility* as whether *'the intervention can be replicated in a given setting. This includes cost as well as such non-monetary resources as expertise, training required for intervention staff, interest, and cultural considerations'* (Armstrong, et al., 2007,

p. 38). Another paper from Cochrane suggested the use of the RE-AIM framework to assess the applicability and feasibility of interventions (Jackson, Waters, & The Guidelines for Systematic Reviews, 2005).

The RE-AIM (reach, efficacy/effectiveness, adoption, implementation, and maintenance) framework was first designed to estimate the public health impact of an intervention, thus its dissemination (Glasgow, Vogt, & Boles, 1999) and it has been accepted by many researchers targeting PA promotion in settings such as primary health-care centres, schools or churches (Antikainen & Ellis, 2011; Austin, Bell, Caperchione, & Mummery, 2011; Bopp et al., 2007; Eakin, et al., 2004; Estabrooks & Gyurcsik, 2003; Fortier et al., 2007; Sims, et al., 2004; Smith, 2004; van Acker, de Bourdeaudhuij, de Cocker, Klesges, & Cardon, 2011). RE-AIM dimensions refer to both individual and setting level (see Table 2.7). **Reach** refers to the percentage of potential participants who are exposed to an intervention and how representative they are. **Efficacy** and **Effectiveness** are both the intended or positive impacts and the possible negative consequences of the intervention. **Adoption** concerns the participation rate for both settings (e.g., schools, primary healthcare) and agents (e.g., practitioners) participating in the intervention and their representativeness. **Implementation** refers to the extent to which the intervention has been delivered as intended (in the protocol) in real-world situations. Finally, **Maintenance** refers to the long-term results of the intervention at both individual (e.g., sustained participation in PA) and setting levels (i.e., sustained use of the intervention after the trial) (Estabrooks & Gyurcsik, 2003; Glasgow, 2002; Glasgow, et al., 1999). Reach and efficacy/effectiveness evaluate the individual participation (i.e., patient); adoption and implementation evaluate the context participation (e.g., settings, practitioners); and maintenance evaluates both.

However, even though implementation has been designed for the setting level, it may be extended at the level of the participant as **treatment receipt** (the degree to which the participant understands and is able to use the intervention skills) and **enactment** (the degree to which the participant applies the skills during the programme) (Estabrooks & Gyurcsik, 2003). Receipt and enactment may be strongly related to the concept of **adherence** as defined by WHO: *'the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider'* (World Health Organization, 2003a, p. 3). Leijon (2009) points out that there is no gold standard for assessment of adherence in general (World Health Organization, 2003a)

nor are there validated questions to measure adherence to PA interventions in particular. He also states that only few studies have examined adherence as a primary outcome.

Table 2.7 RE-AIM dimensions and their evaluative questions.

RE-AIM DIMENSION	EVALUATIVE QUESTIONS
Reach (Individual level)	What percentage of potentially eligible participants will take part and how representative are they?
Efficacy or Effectiveness (Individual level)	What impact did the intervention have on all participants who began the programme, on processing intermediate and primary outcomes, and on both positive and negative (unintended) outcomes including quality of life?
Adoption (Setting level)	What percentage of settings and intervention agents will participate and how representative are they?
Implementation (Both setting or agent and individual level)	To what extent are the various intervention components delivered as intended, especially when conducted by regular staff in applied settings? To what extent did the participants receive and enact the intervention components?
Maintenance (Both setting and individual level)	To what extent are different intervention components continued or institutionalized? What are the long-term effects?

Note. Based on Glasgow (2002) and Estabrooks & Gyurcsik (2003).

Internal and external validity of interventions should be considered. Glasgow (2002, p. 530) defines **internal validity** as *'the extent to which outcomes of a study can be attributed to an experimental factor (for example, an intervention) rather than to extraneous or confounding factors'*. Rigorously defined experiments that demonstrate whether a given intervention is efficient or not may show its internal validity (Valente, 2006). **External validity** refers to *'the extent to which we can generalize or apply results of a study to other contexts, settings, and situations outside of the specific situations studied in a given investigation'* (Glasgow, 2002, p. 531). Green & Glasgow (2006) suggest that *'practice-based research would produce evidence that more accurately and representatively reflects the program-context interactions'* (p. 128), Consequently, it may be more useful for practitioners:

If it works but no one can use it, why test it? (Valente, 2006, p. S6)

Efficacy should be assessed for internal validity while reach, adoption, implementation and maintenance may be addressed for external validity.

A recent way to evaluate the application of scientific knowledge in health care and disease prevention should also be mentioned: *Health technology assessment*. It is defined as *'a multidisciplinary process, which in a systematic, transparent, unbiased robust manner summarizes information about the medical, social, economic, and ethical issues related to the use of a health technology'* (Kristensen, 2009, p. 335). Health technology includes disease prevention methods as well as organisational and supportive systems in health care among others, and must be based on research and the scientific method. It has been suggested as useful for policy makers in decision making (García-Altés, 2004). It has also been used as a framework to evaluate training, health benefits, physiological developments, economic issues, or the patient perspective in exercise on prescription programmes (Bredahl, 2010).

2.6.3 ECONOMICAL ANALYSES

Both the RE-AIM and Health Technology Assessment may include economical analysis as primary outcomes related to efficacy, effectiveness or feasibility (Bredahl, 2010; Sims, et al., 2004). According to Walter and colleagues (2006) comparative health economic analyses can be classified according to the type of comparison of the costs and consequences (i.e., non-assessment, assessment in naturalistic units or monetary assessment). The methods of analysis of health economic studies are the following:

Cost-minimisation analysis

Two or more therapeutic alternatives with the same effectiveness or efficacy are compared in terms of net costs in order to establish the cheapest alternative.

Cost-effectiveness analysis

The costs are expressed in monetary units and the results in non-monetary units (e.g., years of life gained, hospital days prevented, or clinical parameters). Otherwise said, comparing the effects in terms of 'cost per unit of effect' (Virgili, Koleva, Garattini, Banzi, & Gensini, 2010).

Cost-utility analysis

Costs are assessed in monetary units and the benefit in non-monetary units with a utility-adjusted outcome, that is, the quality adjusted life year (QALY). This concept combines life expectancy and health-related quality of life. Several methods to measure QALYs exist. For example, generic health-related quality of life questionnaires are commonly used (Virgili, et al., 2010).

Cost-benefit analysis

This method assesses all effects, including health effects in monetary units. It is seldom used as it is, methodologically, difficult to perform.

A recent systematic review on the cost-effectiveness of PA in primary care interventions concluded that most were cost-effective, especially where direct supervision or instruction was not required, such as walking, exercise groups, brief exercise advice on prescription delivered in person. These interventions appeared to be more cost-effective than supervised gym-based exercise classes or instruction-led walking programmes. Also, many interventions had similar cost-utility estimates to funded pharmaceutical interventions (Garrett et al., 2011).

Isaacs and colleagues' drew up the following conclusions on the cost-effectiveness of their trial in which GPs referred patients to leisure centre-based exercise, community-based walking and advice only: assessment and advice from an exercise specialist may be appropriate to initiate action in the first instance, while walking appears to be as effective as leisure centre sessions and is cheaper. They suggest subsidised schemes to focus on higher risk patients or patients with specific conditions (Isaacs, et al., 2007). In New Zealand, the Green Prescription has been found to be highly cost-effective compared to interventions in other countries (C. Raina Elley, et al., 2011). However, a Swedish RCT, where the intervention group participated in supervised exercise sessions twice a week plus motivational counselling, found no differences in cost-effectiveness compared to the control group, although both showed improvements in PA behaviour (Romé, et al., 2009).

Romé and colleagues measured the willingness-to-pay for health improvements to quantify the strength of individuals' preferences for a PA on prescription programme. These improvements were measured using open-ended questions focused on the maximum willingness-to-pay for PA on prescription to obtain a certain health improvement or weight

loss. Results showed that the willingness-to-pay was influenced by a higher education level, income, and body mass index, and that the highest willingness-to-pay for a health outcome of PA was for an immediate health improvement (Romé, et al., 2010).

In Spain, Gusi and colleagues have studied the cost-utility of different exercise programmes (Gusi, Reyes, Gonzalez-Guerrero, Herrera, & Garcia, 2008; Gusi & Tomas-Carus, 2008) such as walking and aquatic training for women with fibromyalgia. Both showed cost-effectiveness if added to usual care.

2.7 THE CITY OF LLEIDA: SOCIAL, DEMOGRAPHICAL AND ENVIRONMENTAL ASPECTS

2.7.1 GEOGRAPHY AND DEMOGRAPHY

Lleida is a city of small-size. It forms part of the Catalonia Autonomous Community, in Spain. It is the provincial capital of Lleida province and the county capital of the *Segrià comarca* (smaller administrative regions), see Figure 2.15.

Figure 2.15 Political maps of Spain and Catalonia.

The Catalonian map is adapted and reprinted, with permission, from Atles Nacional de Catalunya. Institut Cartogràfic de Catalunya (authors: C. Martí & J. Feliu. Universitat de Girona, data from 2005).

Lleida is situated in western Catalonia, in a depression. It is surrounded by mid-size mountains on each side except the western side, where the *Monegros* desert extends out. Generally described as arid continental Mediterranean typical of the *Ebro* Valley, the climate in the city is greatly affected by its location (see Figure 2.16). Average temperatures range from over 25ºC in August to 5ºC in January (see Figure 2.17). Winters are damp with temperatures often falling below -0ºC and fog is common. Summers are hot with temperatures often reaching over 40ºC. Annual precipitation is scarce (Institut Cartogràfic de Catalunya, 2010).

Figure 2.16 Geographical map of Catalonia.

Adapted and reprinted, with permission, from Atles Nacional de Catalunya. Institut Cartogràfic de Catalunya (authors: C. Martí & J. Feliu. Universitat de Girona, data from 2008).

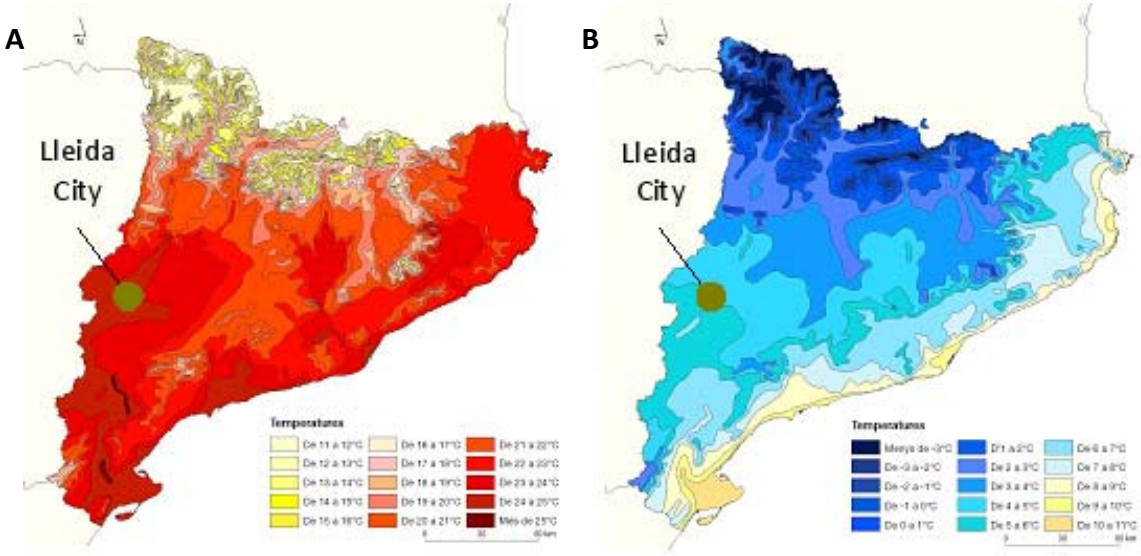

Figure 2.17 Average temperatures in August and January in Catalonia.

Adapted and reprinted, with permission, from Atles Nacional de Catalunya. Institut Cartogràfic de Catalunya (authors: C. Martí & J. Feliu. Universitat de Girona, data from 1996 consulted in 2008 from the *Departament de Medi Ambient i Habitatge* website).

A. Average temperatures in August. From 11ºC (light yellow) to more than 25ºC (dark red). Average of 24 to 25ºC in Lleida.

B. Average temperatures in January. From -3ºC (dark blue) to 11ºC (dark yellow). Average of 4 to 5ºC in Lleida.

By 2010, Lleida had 137,387 inhabitants and was the 7th largest city in Catalonia, with a total of 7,512,381 inhabitants (Institut d'Estadística de Catalunya). Population density in the municipality of Lleida and the surrounding area is low, with 50-150 inhabitants per squared kilometre (see Figure 2.18). The population pyramid follows the typical pattern found in European countries and the population of over 65s lies at around 15% (21,089) in Lleida: a similar percentage to the rest of Catalonia which lies at 16% (see Figure 2.19).

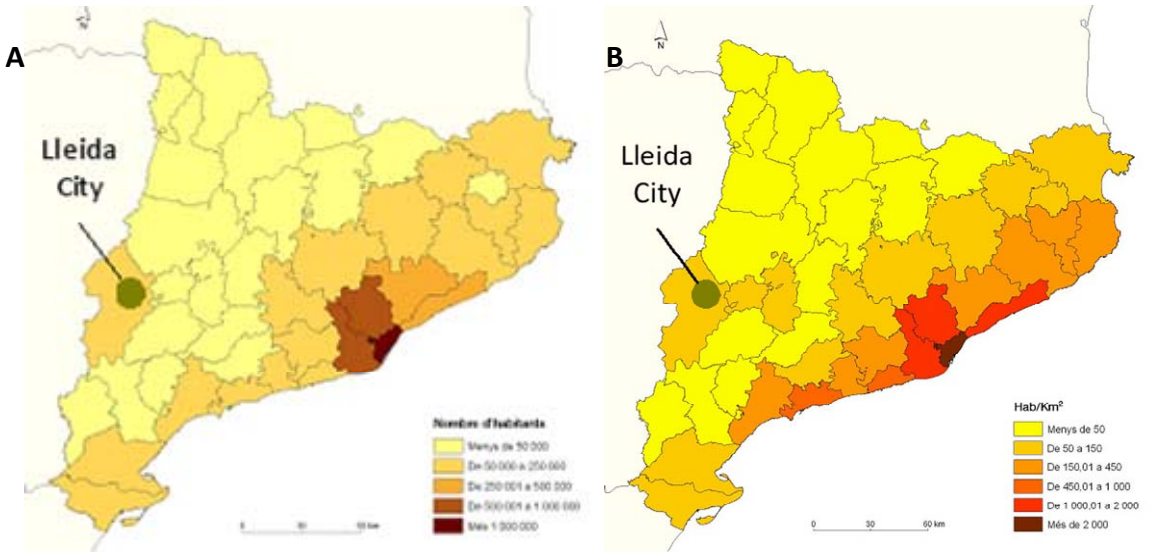

Figure 2.18 Total population and density population in Catalonia.

A. Total population. From less than 50,000 inhabitants (light yellow) to more than 1,000,000. From 50,000 to 200,000 in Lleida. Adapted and reprinted, with permission, from Atles Nacional de Catalunya. Institut Cartogràfic de Catalunya (authors: C. Martí & J. Feliu. Universitat de Girona, data from 2007 consulted in 2008 from the *Institut d'Estadística de Catalunya* website).

B. Density population. From less than 50 inhabitants/squared kilometre (yellow) to more than 2,000 (dark red). From 50 to 150 in Lleida. Adapted and reprinted, with permission, from Atles Nacional de Catalunya. Institut Cartogràfic de Catalunya (authors: C. Martí & J. Feliu. Universitat de Girona, data from 2006 consulted in 2007 from the *Anuari Estadístic de Catalunya* of the *Institut d'Estadística de Catalunya*.

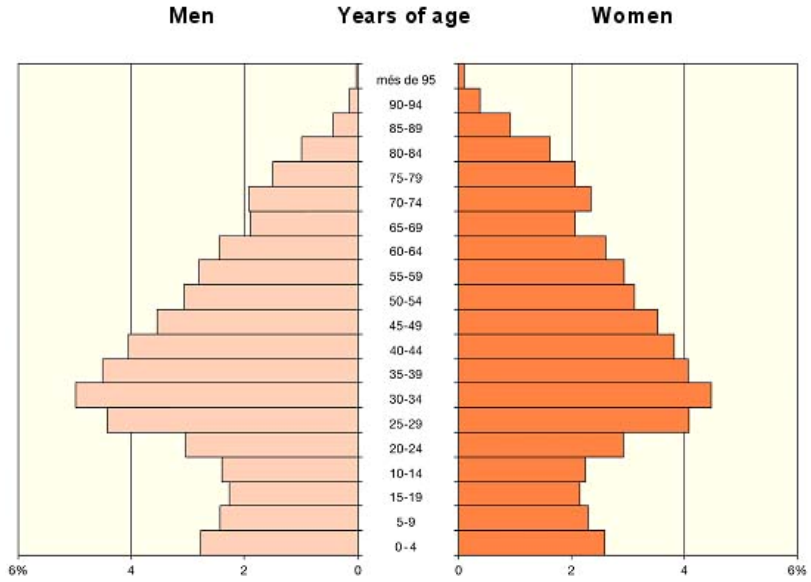

Figure 2.19 Population pyramid of Catalonia in 2007.

Adapted and reprinted, with permission, from Atles Nacional de Catalunya. Institut Cartogràfic de Catalunya (authors: C. Martí & J. Feliu. Universitat de Girona, data from 2007 consulted in 2008 from the *Institut d'Estadística de Catalunya* website).

The service sector is the main industry in Lleida, as in the rest of Catalonia and Spain. However, Lleida Province hosts the highest rate of primary sector industry (i.e., agriculture) in Catalonia, mainly in the area located within the depression where the city is found. Most tourism activities take place in northern areas closer to the Pyrenees Mountains. The gross direct product of the Segrià *comarca* ranges from 20,001 to 25,000€ per year and per inhabitant on average (see Figure 2.20).

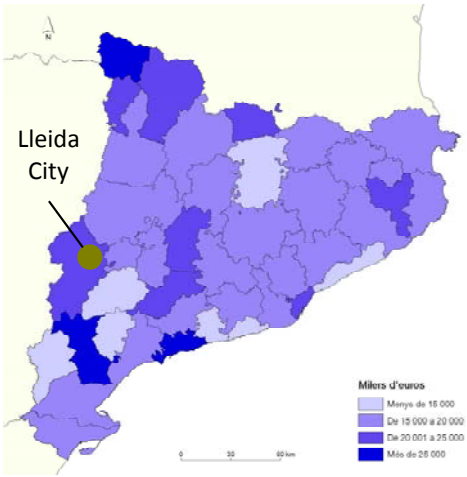

Figure 2.20 Gross Direct Product in Catalonia.

From less than 15,000€ per capita (light blue) to more than 25,000€ (dark blue). From 20,001€ to 25,000€ in Lleida. Adapted and reprinted, with permission, from Atles Nacional de Catalunya. Institut Cartogràfic de Catalunya (authors: C. Martí & J. Feliu. Universitat de Girona, data from 2006 consulted in 2008 from the *Departament de Política Territorial i Obres Públiques* website).

2.7.2 HEALTH AND EXERCISE SERVICES

Two public companies manage seven public PHC centres in Lleida, both commissioned by the Catalan Health Authority (*Servei Català de la Salut,* CatSalut). The Catalan Health Institute (*Institut Català de la Salut,* ICS) is the largest provider in Catalonia employing 80% of total personnel in primary health care. The Catalan Health Institute is in charge of six PHC settings in Lleida and *Gestió de Serveis Sanitaris* is in charge of one. The number of citizens subscribed to each PHC centre varies from 14,948 to 37,842, with an average of 24,235 (as of January 2010) (Servei Català de la Salut, 2011). Other health services such as hospitals, mental health care, private surgeries, and specialist centres are also available in the city.

As regards public exercise and sport equipment, seventy-eight facilities are included in the official list edited by the municipality of Lleida (Ajuntament de Lleida. Regidoria d'Esports). Small sport centres are mainly facilities that are part of public schools and small courts in parks. Other facilities include: an archery field, a climbing wall, pétanque areas and a jogging track by the river *Segre*, among others (see Table 2.8).

Table 2.8 List of public sport facilities in Lleida city.

TYPE OF FACILITY	NUMBER
Small sport centre	32
Football field	12
Sport centre	9
Outdoor swimming-pool	6
Indoor swimming-pool	1
Other	18

Private exercise facilities include five complete fitness centres with a heated swimming-pool, fifteen fitness centres without a pool (usually smaller gymnasiums) and five members-only sports clubs, four of which have a swimming-pool (Javaloyes Sanchis, 2011, unpublished). Community centres which host neighbourhood or elderly associations also organise group-based exercise activities for all.

2.8 PROGRAMA CAMINEM – LET'S WALK PROGRAMME

2.8.1 WALKING

> *Walking is cheap, safe, popular and sociable and can take place in all sorts of environments, urban and rural (Morris & Hardman, 1997).*
>
> *Prescreva caminhada: mais natural dos movimentos humanos, segura, barata, prática, pode ser feita a qualquer hora, em quase qualquer lugar do mundo, não necessita de grandes 'medical screening', pode começar com doses pequenas, aumentadas com a melhora do paciente, chegando a patamares superiores* [1] *(V. R. Matsudo, Araújo, & Matsudo, 2006, p. 123).*

These authors were not the first to advocate for walking as a type of PA. In 1969, Dr. Cooper had already set out a programme consisting of several aerobic exercises for non-active people. The programme was designed to last sixteen weeks, with participants starting the programme by walking a mile in fifteen minutes, five days weekly, and ending the programme by walking four miles in fifty-five minutes, four days weekly. Cooper recommended four basic activities: walking, jogging, cycling and swimming, and emphasised that walking has the great benefit that it can be done by anyone, anytime and anywhere. In addition, most people do not perceive walking as exercise, which is good for those that are shy to start (Cooper, 1979). The Catalan exercise scientist, Rodríguez, advocates walking as the best basic form of exercising when looking for future adherence compared to higher-intensity activities (Rodríguez, 1995). More recently, the ACSM (2006) also suggests that '*Walking may be the activity of choice for many individuals because it is readily accessible, offers tolerable exercise intensity, and is an easily regulated exercise for improving health outcomes and [cardiorespiratory] fitness'* (p. 140). The British National Institute for Health and Clinical Excellence recommends walking for PA promotion and also as a form of exercise referral (National Institute for Health and Clinical Excellence, 2006)

A recent systematic review found that walking can be increased in interventions targeting the most inactive people or at those most motivated to change. It can also be tailored to people's needs, such as the way people receive advice or feedback (e.g., from the GP, the internet,

[1] Prescribe walks: it is the most natural of all human movements, safe, cheap, practical, it can be done at any time at almost everywhere, no medical screening is required, you can start with small doses progressively increased as the patient gets better.

social support of a walking group, from a pedometer, or prompts about reducing car use) (Ogilvie et al., 2007). Also, health benefits from a walking programme may be achieved even when the total amount does not accomplish the general recommendations of 150 minutes of moderate-intensity PA a week (Tully et al., 2007).

Walking is the most common type of leisure-time PA in populations of different countries (Fàbregas Bosch, et al., 2005; Leijon, 2009; US Department of Health and Human Services, 1996). The 2005 Catalonian survey on sports equipment showed that less than 50% of the population used it and as such, performed PA somewhere else, for example, open areas. Walking may be a suitable type of recommended PA to start exercising for health practitioners who regard themselves as having lack of confidence on exercise counselling. Swedish practitioners' most commonly prescribed PA was walking (Leijon, Bendtsen, Nilsen, Ekberg, & Ståhle, 2008).

> *Exercise should be many and of all kinds, running on the double track increased gradually (…) sharp walks after exercises, short walks in the sun after dinner, many walks in the early morning, quiet to begin with, increasing till they are violent and then gently finishing. Hippocrates (c.460-370BC)*

2.8.2 GENERAL PURPOSE OF THE CAMINEM PROGRAMME

Programa CAMINEM. Descobrim Lleida – Camina i fes salut (The Let's Walk Programme. Discover Lleida – Walk and improve your health) is the name of a project to encourage walking for health with the intervention of primary health-care practitioners. The programme was designed in 2004 by the National Institute of Physical Education of Catalonia (*Institut Nacional d'Educació Física de Catalunya,* INEFC), the city council (La Paeria), and the primary-care health provider, the Catalan Health Institute (ICS). It was first tested in February 2005, as reported in the local newspaper *Diari Segre* ("'Senders' al voltant dels CAP per promoure l'exercici físic," 2005).

Advice-only PA was considered to be insufficient for health improvements in patients attending their primary-care providers, so the authors decided to create a tool for GPs and nurses to facilitate tailored and quantified PA prescription (Planas, Peirau, Pujol, & Farreny, 2010). Walking was the recommended PA, following urban routes previously designed in accordance with the following requisites:

- Appropriate length. Distance that requires a minimum of 30 minutes at a walking pace of 4-5 km/h.
- Safe. Bus stops on route, wide pavements, appropriate lightning, no architectonic barriers.
- Familiar. Having a primary health-care centre as a reference.

The result was seven urban routes of a distance between 2,400 and 3,950 meters in length without relevant height differences covering all primary health-care centres in Lleida. These urban routes were validated for PA prescription on a trial with regular PHC centre patients whose GP or nurse determined whether they would benefit from PA for their health condition or as health promotion. 175 participants volunteered to participate (56% women) ranging from 7 to 36 participants for each route. Heart rate was measured as an intensity indicator using heart-rate monitors during the activity. Using a multiple regression analysis it was observed that age and route variables were statistically significant and other outcomes (i.e., body mass index, gender, time) were not determinants as intensity predictors. Differences in speed and walking distance were not intensity predictors within the sample, and the heart rate was found to be within moderate-intensity levels, ranging from 55.1% to 73.5% of theoretical maximum heart rate. Two thresholds were determined for the time needed to walk the urban route at a moderate-intensity pace. These were at 50% of maximum heart rate (below which the intensity is lower) and 80% of maximum heart rate (above which the intensity is higher).

2.8.3 FEATURES OF THE CAMINEM PROGRAMME

The **correlation between time and distance** (urban route) was the most genuine feature of the CAMINEM programme (see Annex C). Another feature was the design of a **written form** that could be used to show the prescription delivered as well as a log for the patient to self-record PA (see Annex D). The third feature was a computer-based questionnaire to **assess current PA levels**, including occupational PA and LTPA. The questionnaire chosen was the ClassAF *(Classificador ràpid de l'activitat física* – Physical Activity quick classifier) which was later included in the Catalan PEFS handbook for PA prescription (Departament de Salut. Generalitat de Catalunya, 2007) because of its simplicity for use in clinical practice, even though it has not been validated for research (see Annex E). Finally, **leaflets and posters** showing the seven urban routes describing the health benefits of regular PA and giving safety tips were issued. The main recommendation was to follow the routes walking at below high-

intensity level which could be judged through the **talk test**, found to correlate with the ventilatory breakpoint *'if you cannot talk comfortably you are exercising too hard'* (Brawner, et al., 2006, p. 75) and suggested as a marker of exercise intensity associated with the ventilatory breakpoint (American College of Sports Medicine, 2010, 2011; Foster et al., 2008).

2.8.4 IMPLEMENTATION OF THE CAMINEM PROGRAMME

In 2007, all GPs and community nurses from the seven PHC settings in the city were invited to include the CAMINEM procedures in their regular intervention, without extra reimbursement. The research staff, which included two GPs, one sports physician and one exercise specialist with degrees in sport sciences and nursing, provided a 1-h training session for the practitioners on the programme counselling procedure. Practitioners were asked to keep all filled prescriptions returned by the patients for further analysis by the research staff. GPs and nurses were contacted regularly to encourage recruitment as well as for professional support to overcome possible barriers for PA prescription.

After two years of training and regular contact no data was available on prescriptions delivered from 2007 onwards.

2.9 SUMMARY

Physical activity and exercise improves fitness, and as a result, health, but the prevalence of both physical activity and exercise is low in industrialised countries. The possibility of reaching people willing to increase physical activity in any of its forms rather than increase exercise training in individuals is perhaps the reason most public health policies focus on behaviour change (i.e., physical activity promotion). However, exercise training increases fitness more than physical activity does. Therefore, if people are able to increase their physical activity level and do it to a high-quality standard, (i.e., planned, structured, repetitive, and fitness-health-purposive) the intervention will be efficient for fitness and health purposes.

Inactive people and/or with health conditions should exercise safely and at a proper training load (i.e., volume and intensity) according to individual needs. The stage-of-change model may be helpful as a starting point when tailoring health-enhancing exercise prescription. However, it has not been proven that stage-matched interventions are an effective way of changing behaviour, so a broader perspective could be taken into account (e.g., exercise training principles), such as the way programmes are tailored for performance athletes. A combination of health education and exercise training abilities are needed for the specific target group and the context: primary, secondary, or tertiary prevention.

Written physical activity prescriptions have been found to be feasible and acceptable for patients and practitioners in health-care settings (Aittasalo, 2008a; Leijon, 2009; J. B. Sørensen, et al., 2006). However, Spanish local or regional interventions of physical activity or exercise prescription, if performed, are seldom reported, and health policies do not include concrete aims and indicators towards physical activity. Despite evidence published by several programmes in other countries, *'the effectiveness, feasibility, and dissemination of the approaches are heavily context-dependent and the results are seldom directly generalizable in countries or arenas different from the original ones'* (Aittasalo, 2008b, p. 48).

A common challenge in bridging the gap between research and practice is to achieve long term activity in inactive people, since 50% of the individuals who begin an exercise programme stop within the first 6 months (Robison & Rogers, 1994). These programmes should be cost-effective and feasible for participants and practitioners in real settings. The CAMINEM programme was innovative at the time it was designed, although neither its

efficacy nor feasibility has ever been assessed. It remains potentially applicable with the support of an interdisciplinary team.

CHAPTER 3 – AIMS OF THE STUDY

The overall aim of this thesis was to conduct a safe exercise-on-prescription pragmatic trial in Lleida using the 'Let's Walk Programme' (*Programa CAMINEM*) as an interdisciplinary approach for 18 months, to facilitate the adoption and maintenance of exercise levels by regular patients, identified in primary health-care settings, with the underlying aim of improving their physical and mental health.

The specific aims were:

1. To assess the effects of CAMINEM within the primary care routine.

2. To describe the feasibility of the intervention in Catalan settings.

Observed effects included participants' clinical health parameters, quality of life, and health-care consultations. The feasibility, that is, external validity, was determined by the reach of potentially selected participants, adoption by health practitioners, participants' adherence and safety participation, and long-term effects.

3.1 Hypotheses

The aforementioned aims were based on the following hypotheses.

A. To assess the effects of the CAMINEM within the primary care routine

HA1) Participants, with a health condition that may benefit from exercising, show improvement in one or more relevant clinical parameters if adhered to the programme.

HA2) Participants with a health condition that may benefit from exercising show improvement in their self-perception of quality of life if adhered to the programme.

HA3) Participants with a health condition that may benefit from exercising demand less health services if adhered to the programme.

B. To describe the feasibility of the intervention in Catalan settings

HB1) The CAMINEM intervention reaches citizens with chronic health conditions that may benefit from exercising.

HB2) The CAMINEM intervention is adopted by health-care personnel.

HB3) The CAMINEM intervention is safe and ensures participants adhere to the exercise prescription from six to twelve months.

HB4) Participants exercise regularly after the CAMINEM intervention, especially those who adhered to the programme.

HB5) Health practitioners prescribe physical activity and/or exercise time after the CAMINEM intervention.

The null hypotheses were:

HA0) Possible clinical effects, and/or self-perception of quality of life and/or health-care attendance have no relation to the CAMINEM intervention.

HB0) Possible feasibility in clinical practice and/or post-intervention exercise participation has no relation to the CAMINEM intervention.

CHAPTER 4 – MATERIAL AND METHODS

4.1 STUDY CONTEXT

The approach would be in line with the current Catalan and Spanish strategies on physical activity promotion, PAAS and Plan A+D, which were previously explained in Chapters 2.4.2 and 2.4.4. More specifically, the intervention follows Plan A+D's two specific aims for HEPA (Consejo Superior de Deportes, 2010b). In addition, it may be included as part of the steps taken to accomplish seven out of the eleven specific aims on PA promotion stated in the Catalan Health Plan (Departament de Salut. Generalitat de Catalunya, 2009b) (see Table 4.1, Annex B).

Table 4.1 Study intervention and its relationship with Catalan and Spanish aims.

AIM	INDICATOR
CATALAN PLAN	
To reduce the impact of inactivity.	Activities developed through the PAAS plan.
To develop actions for detection and treatment of inactivity.	Percentage of health electronic records with information on physical activity advice or prescription.
To promote physical activity in school, health, work, and community settings.	Increasing self-reported levels of physical activity and the percentage of people walking at least 30 minutes a day.
To encourage healthy habits in patients with risk factors.	Activities developed through the PAAS plan.
To encourage healthy habits in patients suffering from diabetes mellitus.	Activities developed through the PAAS plan.
To encourage healthy choices in terms of diet and physical activity for overweight people.	Activities developed through the PAAS plan.
To promote health physical activity and smoke cessation in people suffering from chronic obstructive pulmonary disease.	Activities developed through the PAAS plan.
SPANISH PLAN	
To increase levels of HEPA and sport in the whole population.	NA
To accomplish physical activity prescription as regular practice within the health system as primary and secondary prevention for those health conditions related to a sedentary lifestyle.	NA

Note. PAAS = Catalan regional plan on healthy nutrition and physical activity promotion, HEPA = health-enhancing physical activity, NA = not available.

The CAMINEM framework was seldom used as regular practice in Lleida and in 2009 only one poster presentation was found (poster presented at the AIFICC conference in 2010, Barcelona, reference unavailable). It showed an intervention to increase exercise adherence through the organisation of instructor-led group walks by general nurses. Reports from the Catalan Health Department and the Catalan Health Institute (ICS) did not show any reference concerning the use of the CAMINEM programme by health practitioners.

Despite this, a recent Lleida Province Health Report stated the following objective for the end of 2010:

> *By the end of 2010, the health-care settings situated in the Lleida region will have included the [exercise] prescription tools (CAMINEM), launched by the research group who also participated in the publication of the* PEFS *handbook, within the electronic records of primary-care practitioners in 50% of the settings (Departament de Salut. Generalitat de Catalunya, 2009c, p. 99).*

The evaluation indicator was the percentage of health-care settings which included CAMINEM-related features within the electronic records. As far as the research team knows, all seven primary health-care (PHC) centres have included links to the urban routes maps and the exercise prescription form within the electronic system, but no data concerning their use is available.

The research team was contacted for practical support in October 2009 by two general nurses. Health promotion for patients with specific health conditions is part of their general practice routine, and as a result, they designed an intervention comprised of group-based led-walks following the CAMINEM urban routes. The collaboration between the nurses and the exercise specialist lasted for three months. This partnership fostered a plan to launch the exercise-on-prescription intervention from their health-care setting. Two general practitioners (GPs), who split their work time between general practice and part-time research, dealt with administrative formalities to permit the participation of a health professional that is not officially recognised by the public health service (i.e., exercise specialist, ES) in a pragmatic trial within primary health-care settings. See Figure 4.1 for a complete CAMINEM timeline from its origin.

The outcome of this collaborative effort made it possible for one exercise specialist[1] to be included in two primary health-care settings in Lleida with the aim of furthering the development of this research thesis and providing counselling on health-enhancing exercise for patients previously referred by their health practitioner (i.e., GP or nurse). The steering group coordinating the intervention included the two general nurses from one setting (PHC_A), the two GP-researchers from the other setting (PHC_B), and three researchers from the National Institute of Physical Education of Catalonia (INEFC)[2]; co-ordinated by the author of this thesis. Both settings were situated in socially deprived neighbourhoods in Lleida with high rates of migrant citizens and retired people in PHC_A, and high rates of ethnic minorities and unemployment in PHC_B.

It was decided that the intervention should be pragmatic in order to encourage the participation of time-constrained health practitioners. The steering group designed referral, data collection and communication procedures which would allow a simple and fluid collaboration between practitioners and the ES. It was also decided that no extra reimbursement would be provided for participating practitioners as the proven health benefits of physical activity and regular exercise was thought to be sufficient to encourage patient recommendation. Reimbursement was initially considered as an option to increase participation rates but it was thought there may by some bias in the results when translated into real practice.

In comparison to the PEPAF trial (Grandes, et al., 2009; Grandes, et al., 2003), where the intervention was developed exclusively by GPs, the CAMINEM intervention focused on the collaboration between GPs, as the main actor, and allied health professionals. Tulloch and colleagues (2006) proposed the use of GPs credibility and their existing relationship with patients to recommend PA behaviour change, and offered referrals to other professionals for specialised treatment. Other advantages observed by the Canadian researchers included the fact that PA counsellors may save the valuable time of physicians; it allows more long-term, intensive counselling; and PA counsellors have specialised knowledge of health-related PA that many physicians feel they lack. This kind of collaboration forms the basis of the Catalan

[1] The exercise specialist developing the intervention was the author of this thesis. The author has a similar background to the PA counsellor in Fortier and collaborators (2007): university under-grad and post-grad degrees in sport sciences with knowledge of fitness and health, physical education and outdoor activities. *Llicenciat en Ciències de l'Activitat Física i l'Esport (itinerari específic curricular en "exercici físic i salut"), Certificat d'Aptitud Pedagògica, Màster en Esport Sostenible i Benestar, Màster en Prescripció d'Exercici Físic per a la Salut.*

[2] Adjunct professor of sports medicine, adjunct professor of statistics, and the thesis author.

PEFS handbook, and has been considered for other interventions in Catalonia (Departament de Salut. Generalitat de Catalunya, 2007; Giné-Garriga, et al., 2009).

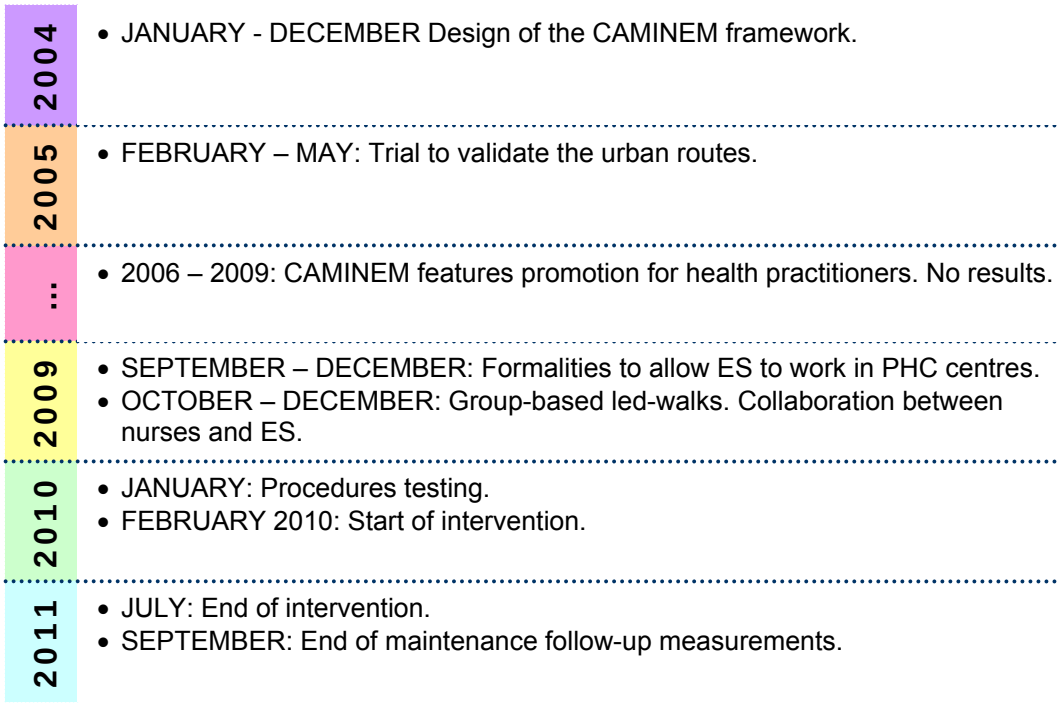

Figure 4.1 CAMINEM timeline – Origins, evolution, and research intervention plan.

Note. ES = exercise specialist, PHC = primary health-care.

4.1.1 STUDY OBJECTS

Two separate study objects provide the focus for this study. When assessing the effects of the CAMINEM intervention, the study objects were composed of regular patients with chronic health conditions attending their PHC centre. When evaluating the feasibility of the intervention, the study objects were composed of both patients and health practitioners (HPs), that is, physicians and nurses.

The number of staff practitioners varies among PHC centres (see Table 4.2). Primary-care units (PCU) are composed of one GP and one community nurse. The PHC settings participating in the intervention included 29 PCU working with a total of 43,036 patients (as of January 2010). Most practitioners work full-time and are employed on a permanent basis,

but some may be part-time or on a temporary contract. All GPs and nurses, independent of employment status, were invited to participate in the intervention, since all of them attend patients over the age of 14 with regular consultations and have the right to diagnose (GP) or promote health interventions (GP and nurse). Other professionals on the staff were not targeted because they do not diagnose or follow-up the targeted group of patients, for example: paediatricians, social workers, clerks, and other administrative staff. None of the PHC units staffed physiotherapists.

Table 4.2 Primary-care units and patients distribution, January 2010.

Primary health-care centre	Number of units	Subscribed population	Ratio patients : primary-care units
PHC_A	13	18,817	1,447
PHC_B	16	24,219	1,514
Both centres	29	43,036	1,484

The intervention recruitment process was similar to other exercise referrals published elsewhere (Isaacs, et al., 2007; L. V. Kallings, 2008; Leijon, 2009). However, behavioural physical activity level was not considered as criterion because it is not tracked in general practice, and the final goal of the intervention is to improve health-related clinical parameters and quality of life. Ordinary PHC patients above the age of eighteen who visited a GP or nurse were considered eligible for opportunistic recruitment during routine consultations. There were no fixed inclusion criteria, other than that the patients should have diagnoses that may be benefit from regular PA or exercise at the moment of the visit, and the acceptance of participation from both the primary-care unit and the exercise specialist. The steering group decided to focus on the following health conditions: overweight/obesity, hypertension, diabetes mellitus, dyslipidemia, musculoskeletal diseases (e.g., osteoporosis), cardiovascular diseases (e.g., heart failure), respiratory diseases (e.g., chronic obstructive pulmonary disease, COPD), and mental health problems (e.g., depression). Practitioners were encouraged to detect potential participants with the selected conditions focusing particularly on: overweight/obesity, hypertension, diabetes mellitus, and depression.

Exclusion criteria were overt cardiovascular disease, uncontrolled hypertension, uncontrolled insulin-dependent diabetes, psychiatric conditions or physical disabilities, or other conditions determined by either the primary-care unit or the ES that would prevent participation in a walking programme and/or exercising at a moderate intensity.

4.2 CAMINEM INTERVENTION

This study assessed the effects and feasibility of a sustainable, clinician-based initiative providing health-enhancing exercise prescription and planning by delivering the intervention during typical consultations in general practice among a diverse population, with the support of an ES. The whole intervention was aimed at encouraging participants to gain long-term (i.e., more than six months) self-efficacy in exercising, understood as participants' beliefs about their capabilities to be physically active in different situations (Bredahl & Roessler, 2011; L. V. Kallings, 2008). Exercise periodization followed the PEFS handbook guidelines; explained earlier in Chapter 2.2.2, and Figure 2.5. The conditioning period goal (short-term, up to two months) was to ensure participants followed the recommendations for adults and older adults with a minimum of 150 minutes of moderate-intensity aerobic physical activity, in bouts of 10 minutes or more (American College of Sports Medicine, 2011; Department of Health, 2011; Department of Health and Ageing, 2010; Nelson, et al., 2007; World Health Organization, 2010). The improvement period of two to six months, was focused on increasing the total amount of exercise volume (first by frequency, then by duration), and on keeping adherence and retention. The maintenance period was set to maintain or increase exercise volume.

Counselling was based on the exercise training principles (Bompa, 1999; García Manso, et al., 1996; Harre, 1987; Skinner, 1993; Wilmore, et al., 2008) and the framework of the 5As construct (Aittasalo, et al., 2006; Estabrooks & Glasgow, 2006; Fortier, et al., 2007; Swedish National Institute of Public Health, 2010). The whole approach was based on encouragement rather than fear and guilt (Patrick, et al., 1994). This collaborative model where an ES works alongside the GPs and nurses, in a designated office next to their surgeries, is perhaps a pioneering model in Spain, however similar collaborations between exercise specialists and health practitioners have been previously reported in and out of PHC settings (M. Aittasalo, et al., 2006; Elley, et al., 2003; Gusi, et al., 2008; Halbert, Silagy, Finucane, Withers, & Hamdorf, 2000; Isaacs, et al., 2007; Jolly et al., 2009). The ES visited participants one day per week in each PHC setting.

Despite the fact that individualisation (i.e., following exercise training principles) and a motivational interview were used to centre the intervention on the participant's needs (Ogilvie, et al., 2007), the type of exercise prescribed was the same: unsupervised,

individually-based, moderate-intensity, continuous, aerobic exercise, namely walking the urban routes especially designed for the programme (Planas, et al., 2010). The aim of the motivational interview was to help participants be compliant with the exercise prescriptions by influencing some elements in cooperation with the participants (Miller & Rollnick (2002), in Bredahl, 2010). The ESs had no prior experience conducting motivational interviews, but they were trained in a Masters Degree in Exercise on Prescription. The interview was used for making a short-term plan of action (i.e., up to the next appointment) and the participants were responsible for following the plan.

Endurance exercising, and walking in particular, was chosen for several reasons:

- Aerobic exercise improves health outcomes related to cardiorespiratory fitness (American College of Sports Medicine, 2006).
- Accessible and easily regulated. No need for supervision to safely achieve health benefits (American College of Sports Medicine, 2006; V. R. Matsudo, et al., 2006; Patrick, et al., 1994).
- Almost everyone can walk. No need for specific skills (Cooper, 1979; Rodríguez, 1995).
- It is cheap, no specific equipment or facilities are needed (Morris & Hardman, 1997; Rodríguez, 1995).
- It is already the most popular leisure-time physical activity in Catalonia (Fàbregas Bosch, et al., 2005).
- It may be suitable for health practitioners who consider having a lack of confidence in exercise counselling and the health effects of exercising (Leijon, et al., 2008; Puig-Ribera, et al., 2005).
- Health benefits of a walking programme may be achieved even when the total amount does not accomplish the general recommendations (Tully, et al., 2007).
- Individual-based exercise may be suitable for those with more time constraints, such as women or young adults, and those with certain referral reasons, like obesity or mental health conditions (James et al., 2008).

Walking specific tracks while controlling the time it takes ensures monitoring control over one of the exercise components: intensity. A constant distance and variable time leads to changes in exercise intensity. The opposite is also possible: intensity can be varied by changing walking distance and keeping time constant. However, given that instruments to measure distance were not affordable for this intervention (e.g., pedometer, GPS) participants were asked to monitor the time variable themselves (e.g., wearing a watch).

Exercise prescriptions were individually tailored, but participants were encouraged to exercise with friends, family, or peers if they wished to, especially participants with mental health problems, high attendance rates or the elderly. Once a month, a group walk was organised and led by the ES to encourage sociability among the participants; to check how the participants exercised; and to give immediate feedback concerning walking pace (i.e., intensity) and clothing. Regular follow-ups were scheduled to adapt new prescriptions to participants' compliance (i.e., the extent to which a prescription is followed as intended) and for data collection. Patient intervention ended if they dropped out of the scheme or after twelve months of regular participation (i.e., adherence).

4.2.1 REFERRAL PROCEDURE

There were two ports of entry into the CAMINEM scheme. Referral by a GP or nurse was the most common entry pathway. After consultation with the patient and after identifying the problem, the GP or nurse could refer the patient if it was thought he or she may benefit from an increase or improvement in PA. Referrals were also accepted in some instances (with approval from the patient's GP) from other professionals, such as midwives, or by self-referral, as with other referral schemes (Isaacs, et al., 2007; Jolly et al., 2009). Once the potential participant had made a verbal participation agreement, the practitioner would then pass the referral form onto the patient for completion and further delivery to the ES and send an email containing the patient's contact information (full name and telephone number, only) to the ES. Following that, the practitioner would register the referral with the health provider database and medical records and, if possible, match it to the ongoing PAFES programme. Finally, the practitioner would check whether baseline data concerning the patient's health parameters (height, weight, waist circumference, heart rate, blood pressure, and outcomes from blood analysis) had been collected within the last six months. If any information was missing, an appointment for its assessment would be scheduled (e.g., blood analysis) or

measurements taken immediately (e.g., blood pressure). These parameters were selected because they are regularly monitored in clinical practice and are related to risk factors for several chronic conditions (Departament de Salut. Generalitat de Catalunya, 2009a).

The same written referral form was used as the one practitioners use for other advance-care physicians, where the reasons for receiving special treatment, patient data, and practitioner data are registered as well as free-text lines to justify the CAMINEM prescription (see Annex F). Several pathways were tested to send the referral form from practitioners to the ES: a) the aforementioned, given to the patient for further delivery; b) placed in a specific file box for further collection; c) simple referral note before sending the referral form. The latter two options were rejected to ensure patient data protection.

The referral timing varied from immediate (patient is referred to the ES office right after the practitioner consultation) to several weeks. Once a week, the ES collected all previously sent emails to make phone contact with patients and schedule the first intervention visit, as soon as possible (the following week). Phone contact was attempted three times, after which patients were considered to have withdrawn. The most common pathway was: practitioner visit – email – phone contact – ES visit, lasting from eight to thirteen days in total. See Figure 4.2 for the ideal schedule. If phone contact could not be made, it would be done the following week, resulting in a delay in the process. The complete referral procedure pathway is shown in Figure 4.3.

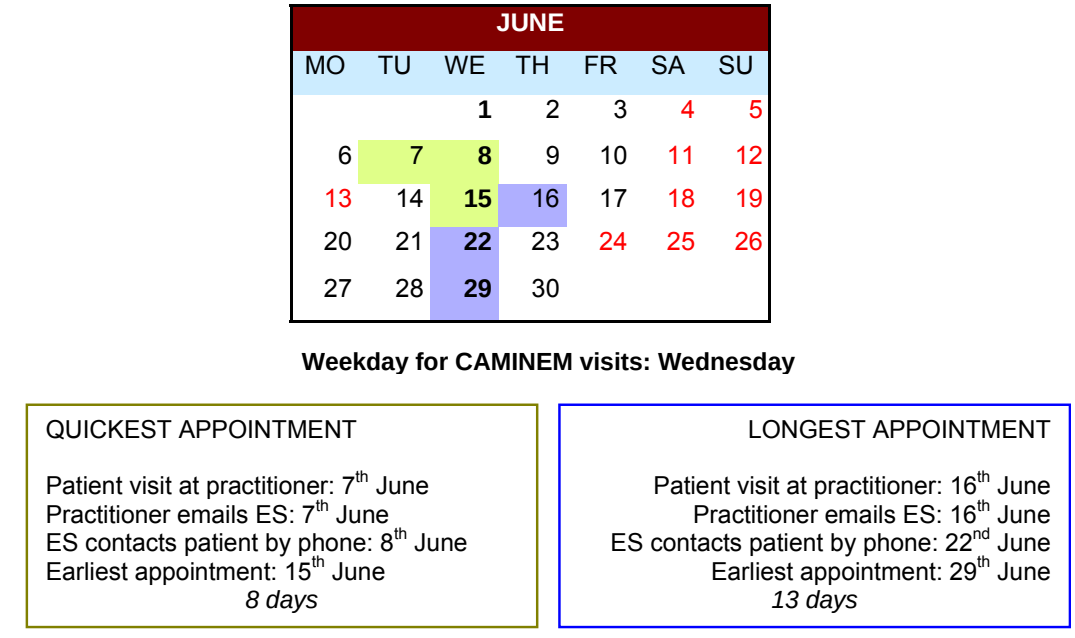

Figure 4.2 Ideal CAMINEM referral scheduling.

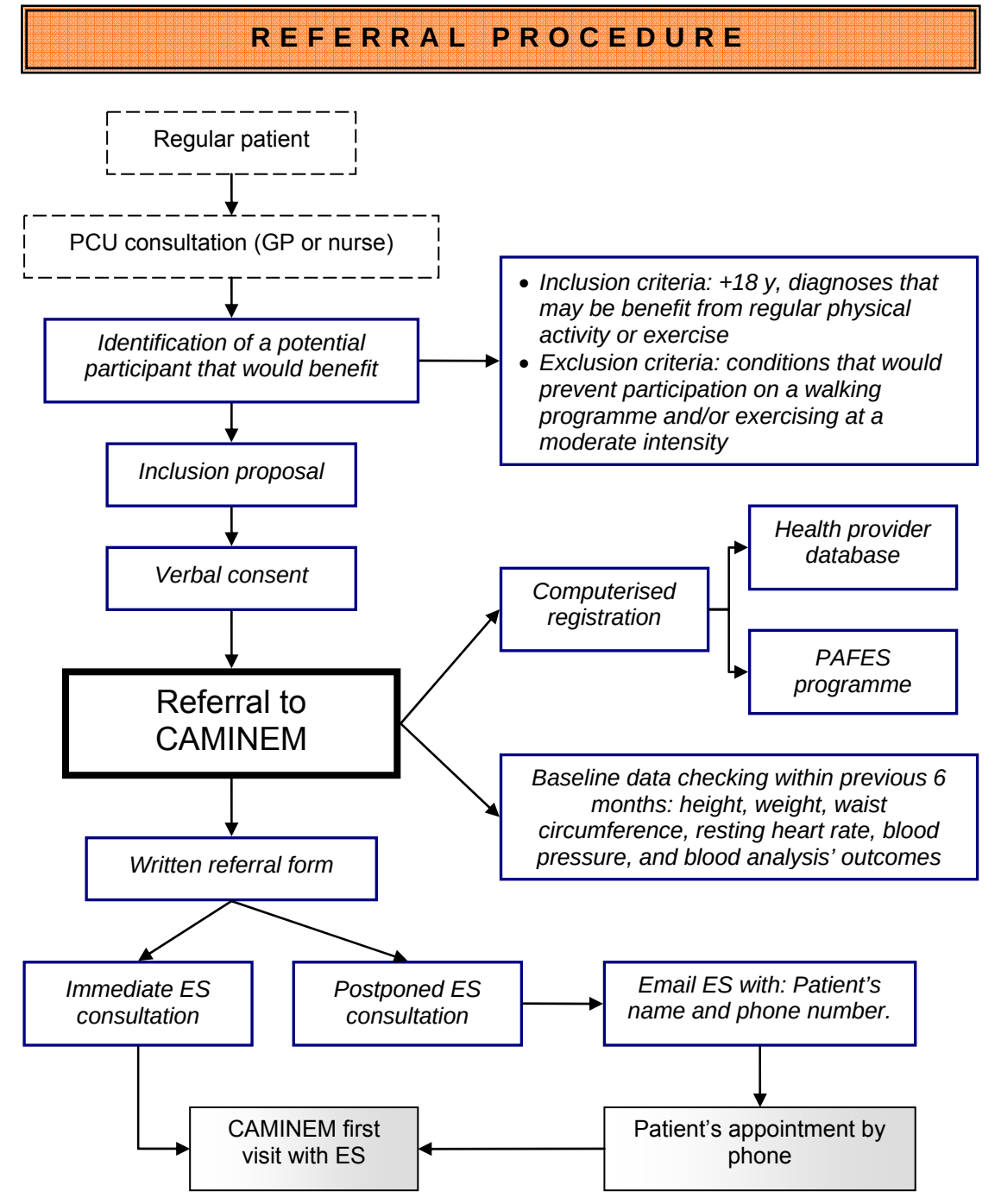

Figure 4.3 CAMINEM referral procedure.

Notes. PCU = primary-care unit, GP = general practitioner, y = years, PAFES = Catalan plan for physical activity, sport and health, ES = exercise specialist. Broken-line box = actions done by participant, italics box = actions done by health practitioner, grey box = actions done by the exercise specialist.

4.2.2 FIRST CONTACT PROCEDURE

The initial consultation consisted of a 30 minute one-to-one person centred interview held at the ES office in either the same PHC centre where the participant was subscribed or the other centre participating in the intervention.

Reception

The ES introduced himself, greeted the participant, and started the motivational interview with the patient by asking the reasons for the referral. The purpose of this was to allow the patient to highlight the practitioner's involvement and recommendation of participant inclusion in the CAMINEM programme citing the potential benefits for his or her medical condition, as opposed to a community-leisure-based intervention. This would draw a clear picture of how much participants knew about the intervention and their views regarding the advantages and disadvantages of PA level and exercise, the general health benefits of exercising, their exercise history, and some indicators about their stage-of-change and preferences. The Transtheoretical Model was used to classify participants for their readiness, to then conduct motivational interviews and to adapt the final prescription to individual needs. Even though this intervention was not stage-based, advice was provided on an individual basis according to the readiness shown by the participant. It was not considered for outcome evaluation because stage-of-change was not a primary outcome.

CAMINEM programme briefing

The ES was then required to verify the participant's eligibility for CAMINEM using the referral form. Following that, the research study could be explained again: a health-enhancing exercise counselling intervention to improve determinant health parameters over a long-term period, with regular follow-ups, and based on walking urban routes and the CAMINEM features. If the participant accepted, the information consent form was signed. If the participation was rejected, more detail about the research and the intervention was explained, emphasising voluntary participation (i.e., participants may drop out at any time) and the possibility of exercising at the time the participant preferred (i.e., home-based exercise). If the participant rejected participation definitively, s/he was invited to further inclusion and was encouraged to keep an active lifestyle.

Inclusion

Afterward, personal and clinical-health data was reviewed and inserted in the research database (Microsoft® Access 2003). If participants reported suffering from health conditions other or in addition to those reported by practitioners, the information was noted down for further consultation with the referring practitioner. The Catalan version SF-12v2 quality-of-life questionnaire was self-administrated, with assistance provided if necessary (e.g., the participant could not read). The SF-12 was chosen by the steering group because it is recommended for clinical practice in PHC in Catalonia (Departament de Salut. Generalitat de Catalunya, 2009a), thus their results may be used by practitioners after the intervention. Physical activity level, including occupational PA and LTPA, was measured with the ClassAF computer-based questionnaire (©Manel Gonzàlez Peris), which is recommended for clinical practice in the PEFS handbook (Departament de Salut. Generalitat de Catalunya, 2007) (see Annex E).

Explanation of the routes and individual exercise prescription

Next, in the goal setting phase, discussion centred on short-term activity and on avoiding focusing feedback on immediate health parameters outcomes (e.g., weight control). Exercise planning was negotiated, rather than ordered (Harre, 1987; Patrick, et al., 1994) and defined by each of the following exercise components:

- **Type**. Participant and ES agreement on one or more urban routes based on the participant's home location and the PHC setting location. Route maps were delivered and highlighted to ensure comprehension. *'Free walking'* was the chosen option in the following cases: a) it was impossible for the participant to walk for 30 minutes due to low fitness or health condition (e.g., obese person suffering from asthma and low levels of habitual PA), b) the participant was out of Lleida most days of the week (e.g., retired participant living elsewhere for long periods of time).

- **Intensity**. Walking briskly was the indication for everyone, close to breakpoint when they begin to experience breathlessness. The talk test was taught to measure individual intensity, which should be neither too low nor too high (American College of Sports Medicine, 2010, 2011; Brawner, et al., 2006; Foster, et al., 2008). However, self-reported low intensities were preferable over high intensities as safety was a top

priority. Exercise intensity was reported as a rating of perceived exertion crossing the analogue visual scale provided with the exercise prescription written form.

- **Volume – duration** (i.e., training session length). Decided by the ES based on following individual baseline information: age, PA regular level, reason for referral. A conservative length of time was preferable to ensure safety as well as positive motivational feedback after self-reporting (i.e., long time for one route lap, or 30 minutes minimum for *free walking* option, or less time due to physical or health condition).

- **Volume – frequency** (i.e., training sessions per week). Agreed by both the participant and the ES, although it tended to be three times a week minimum. The negotiation was based on the participant's age, PA regular level, and perceived stage-of-change and willingness. Complete **resting periods** (one to two days) were recommended for those with low levels of regular PA.

- **Stimuli frequency.** One entire set only (i.e., **no pauses**). Exercise training was continuous, training at a moderate to high intensity without stopping to rest (Wilmore, et al., 2008). As a result, set duration is the same as training session duration. Pauses could be due to a) traffic circumstances, b) dizziness, exhaustion, or other acute response. Both reasons were considered to be sporadic and to have a low relation to the training effects as a whole.

- **Progression** and **routine** would change in follow-up meetings according to the participant's self-reported adherence. The goal for most participants was to perform a **training load** of 150 minutes of moderate-intensity PA weekly.

Exercise prescription form & logbook

Subsequently, the filled written exercise prescription was delivered to the participant and a copy of the exercise planning registered in the research database. The written prescription was also used as a logbook to self-report every exercise session. A record example was filled in to teach how to complete it, and for problem-solving. Participants were told to write down how frequently they exercised (date), for how long (start and end time), and at what intensity (crossing one visual analogue scale of fatigue perception). See Annex D.

Group meetings

Participants were invited to join monthly group walks with other participants and health practitioners, which were led by the ES. Also, they were encouraged to join non-supervised walk meetings organised by other participants who had established peer-contacts during the monthly meetings.

Conclusion

The final step was a follow-up appointment scheduled three weeks later. If possible, it was matched with any previously made regular appointments the participants may have scheduled with their health practitioners. Before finalising the meeting, participants were encouraged to be physically active and to resolve any last-minute doubts.

See Table 4.3 for the relationship between procedure steps, the 5As framework, and exercise training principles. See Figure 4.4 for first contact procedure diagram.

Table 4.3 Relations between first contact procedure, the 5As framework and exercise training principles.

STEPS	5As	EXERCISE TRAINING PRINCIPLES
Reception	Assess	Regression, individuality
CAMINEM programme briefing	Advise, Assist	Specificity, functional unit, awareness, transference
Inclusion	Assess	Regression, individuality
CAMINEM route explanation	Advise	Specificity, hard/easy, awareness
Individual exercise prescription	Advise, Agree, Assist	Individuality, awareness, feasibility
Exercise prescription & logbook	-	Awareness
Group meetings	Assist	Awareness
Conclusion	Arrange	Individuality, transference, periodization, overload

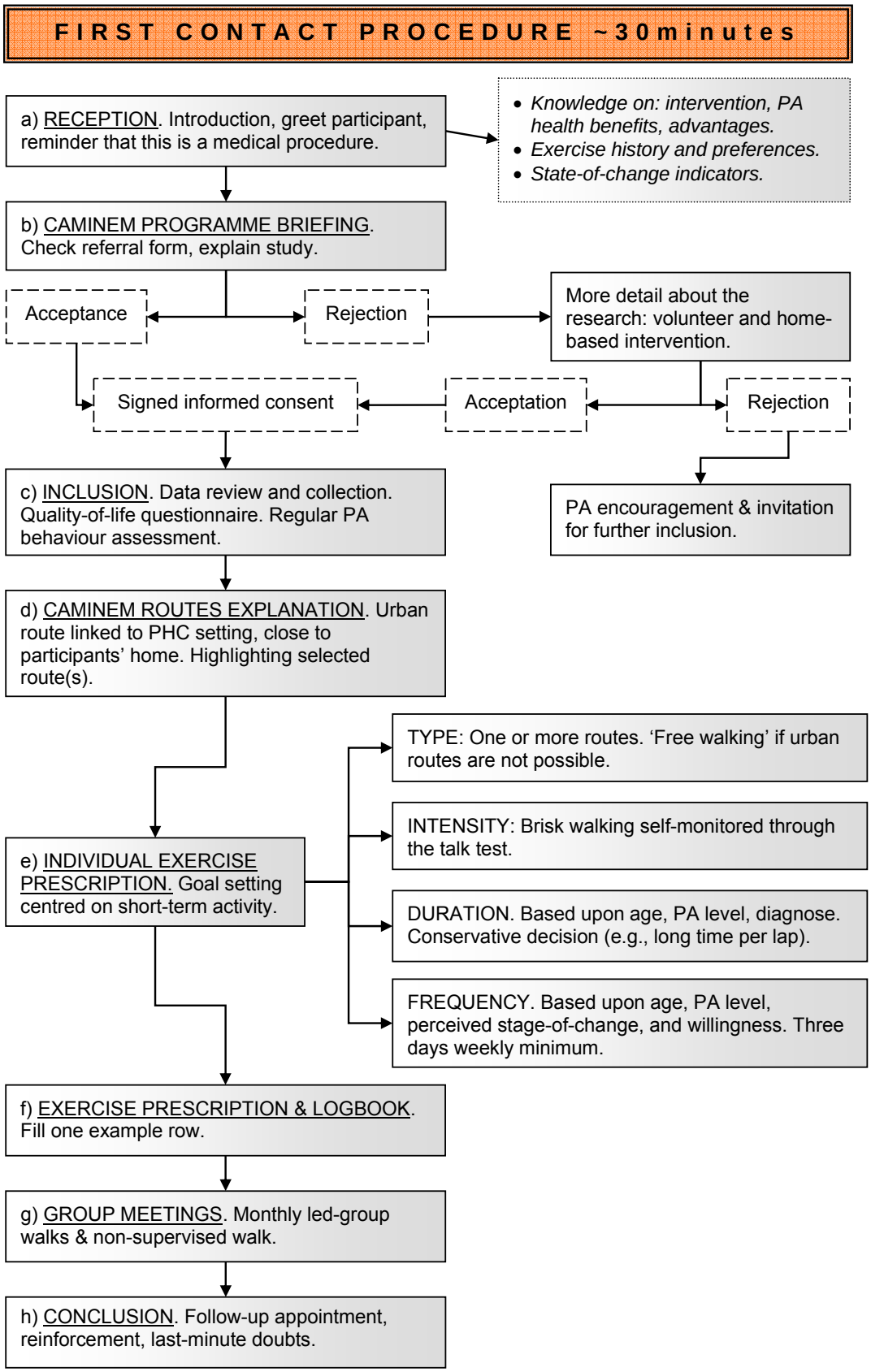

Figure 4.4 CAMINEM first contact procedure.

Note. PA = physical activity, PHC = primary health care. Broken-line box = actions done by participants, grey box = actions done by the exercise specialist.

4.2.3 FOLLOW-UP PROCEDURE

At one week, a brief, 5-minute phone call was made by the ES to offer encouragement regarding any attempts to follow the exercise prescription. The ES offered positive feedback and encouragement to overcome any possible barriers shown by participants. They were also reminded of the next appointment.

The whole exercise intervention for participants who adhered to the programme ideally lasted twelve months. However, it could be delayed if there were gaps in adherence. If a participant was missing for three months without reporting exercise it was considered as a relapse, in which case, the intervention was started again. Follow-up consultations were face-to-face interviews in which previously set exercise prescriptions were discussed and new prescriptions were delivered. Follow-ups up to month 6 lasted 15 minutes, and the ES assessed participants' evolution and set new exercise prescriptions. At month 6 and 9, data collection was added to the regular follow-up procedure.

Reception

Participants were welcomed and greeted. Informal speech was started to briefly evaluate exercise barriers, adverse events, or participants' motivations. Regular follow-up consultations skipped the *data collection* procedure.

Data collection

At month 6 and 9, participants answered questionnaires to assess a) self-perception of quality of life (SF-12v2 and a simple question on well-being: *'what do you think about your overall health, is it better, worse, or the same as the day you started the CAMINEM programme?'*), and b) regular PA behaviour (ClassAF). At the 6-month follow-up, clinical data (i.e., height, weight, waist circumference, resting heart rate, blood pressure, and blood analysis) was collected to referring participants by their nurse. The same data collection procedure was followed as with regular monitoring procedures (see Annex G). Month 6 was considered to be a critical breakpoint since most dropouts occurred within the first six months when starting a PA programme (Robison & Rogers, 1994). Setting an appointment for participants at month 9 was used to keep track of them and provide positive feedback and encouragement.

Logbook collection

Logbooks were collected and filed for further recording in the computer database. However, logbooks were discussed with participants before saving. At the beginning, logbooks were checked to ensure participants' were filling them out correctly. If erroneous, correct fulfilment was explained again as well as stressing the importance of being able to monitor participants' evolution in a situation where exercise is not supervised and the supervisor cannot obtain direct feedback from the participants' exercise session. All remarks were backed up by positive feedback for any good improvement participants may have shown. Table 4.4 shows how feedback was provided.

Table 4.4 Self-reported exercise discussion and feedback.

EXERCISE COMPONENT	FULFILMENT	ACTION
Global report	Correct	Positive feedback
	Erroneous	Solving any doubts, remark on its importance
Type – Urban routes	Yes	Positive feedback
	No	Detection of any barriers, stage of change
Frequency – Days per week	Yes or more	Positive feedback
	No, less	Detection of any barriers, stage of change
Duration – Time per session	Yes	Positive feedback
	No	Reasons
Intensity – Self-perception	Yes	Positive feedback
	No, too low	Positive feedback, encourage to increase speed
	No, too high	Alert, further progression, safe exercise

Following that specific components were discussed focusing particularly on those wrongly fulfilled. If participants reported having taken another route other than the suggested urban routes, or less frequently than was decided, the ES would ask for possible exercise barriers and suggest ways to overcome them. In the case that the participant has previously reported inactivity, it is at this point that they demonstrate their readiness for change. More conservative prescriptions were given to those participants who showed doubt in their ability to change (e.g., lower frequency to ensure future adherence). In cases where the participant walked for more or less time than was previously set, the ES would attempt to find out the underlying reasons and adapt further prescriptions. Finally, self-reported intensity was

discussed with positive feedback when participants had perceived low or moderate fatigue. Nevertheless, participants were alerted when they reported feeling a high level of fatigue after finishing exercising because high-intensity exercise should be avoided. Participants were told to slow down, or to rest more days between one training session and the next.

New exercise prescription

In the following weeks, the participant and the ES decided on a new exercise routine based on the participant's self-reports and the follow-up meeting interview. The goal did not change within each period (i.e., conditioning, improvement, maintenance). Each new prescription made an attempt at increasing the weekly training load compared to the previous one. However, exercising below high intensity levels (i.e., below the aerobic threshold) was the most important aspect to focus on. Changes to the urban routes and exercise volume may have been set, as shown in Table 4.5.

If the participants did not attend the follow-up appointments, they would be contacted by phone to make a new appointment as soon as possible. The phone conversation was used to detect possible barriers and reinforce any good attempt at exercising. After three absences in a row, or three attempts to make phone contact, participants would be considered to have dropped out. Reasons for dropping out were noted in the computerised database and further reported to the PCU. A complete flowchart of the follow-up procedure is shown in Figure 4.5.

Table 4.5 Criteria to determine progressive exercise prescription.

PREVIOUS EXERCISE PRESCRIPTION FULFILMENT	NEW EXERCISE PRESCRIPTION
TYPE – URBAN ROUTES	
Yes	Keep the route(s)
No	Discuss route changes, try other ones
VOLUME – FREQUENCY	
Yes – Equal or one day less	Keep frequency, discuss to increase one more day
No – Less than one day	Discuss route changes, reinforce and motivate
VOLUME – DURATION INTENSITY – SELF-REPORTED	
Yes – Time previously set or ± 10 min	
a. High	a. Increase duration. Encourage to focus on the talk test rather than time.
b. Moderate	b. Keep duration, or discuss decreasing it.
c. Low	c. Discuss decreasing duration.
No – Self-reporting > 10 min	
a. High	a. Increase duration. Encourage to focus on the talk test rather than time.
b. Moderate	b. Increase duration, as participant self-reports.
c. Low	c. Keep duration, encourage speeding up.
No – Self-reporting < 10 min	
a. High	a. Keep duration. Encourage to focus on the talk test rather than time.
b. Moderate	b. Decrease duration, as participant self-reports.
c. Low	c. Decrease duration or double lap, adapting total duration.
PROGRESSION AND ROUTINE	**GOAL**
Adherence to previous prescriptions	
Conditioning period (0 to 2 months)	To achieve 150 min/wk of moderate-intensity exercise. Three-weeks periodically follow-ups.
Improvement period (2 to 6 months)	To increase volume, first frequency then duration. Discuss more routes inclusion. Two-months periodically follow-ups.
Maintenance period (6 to 12 months)	To maintain or increase volume. Discuss double laps and more routes inclusion. Three-months periodically follow-ups.
Non adherence (empty logbooks)	To increase adherence. Three-weeks periodically follow-ups.
Non retention (regular absences)	To increase retention. Three-weeks periodically follow-ups.

Note. min = minutes, wk = week.

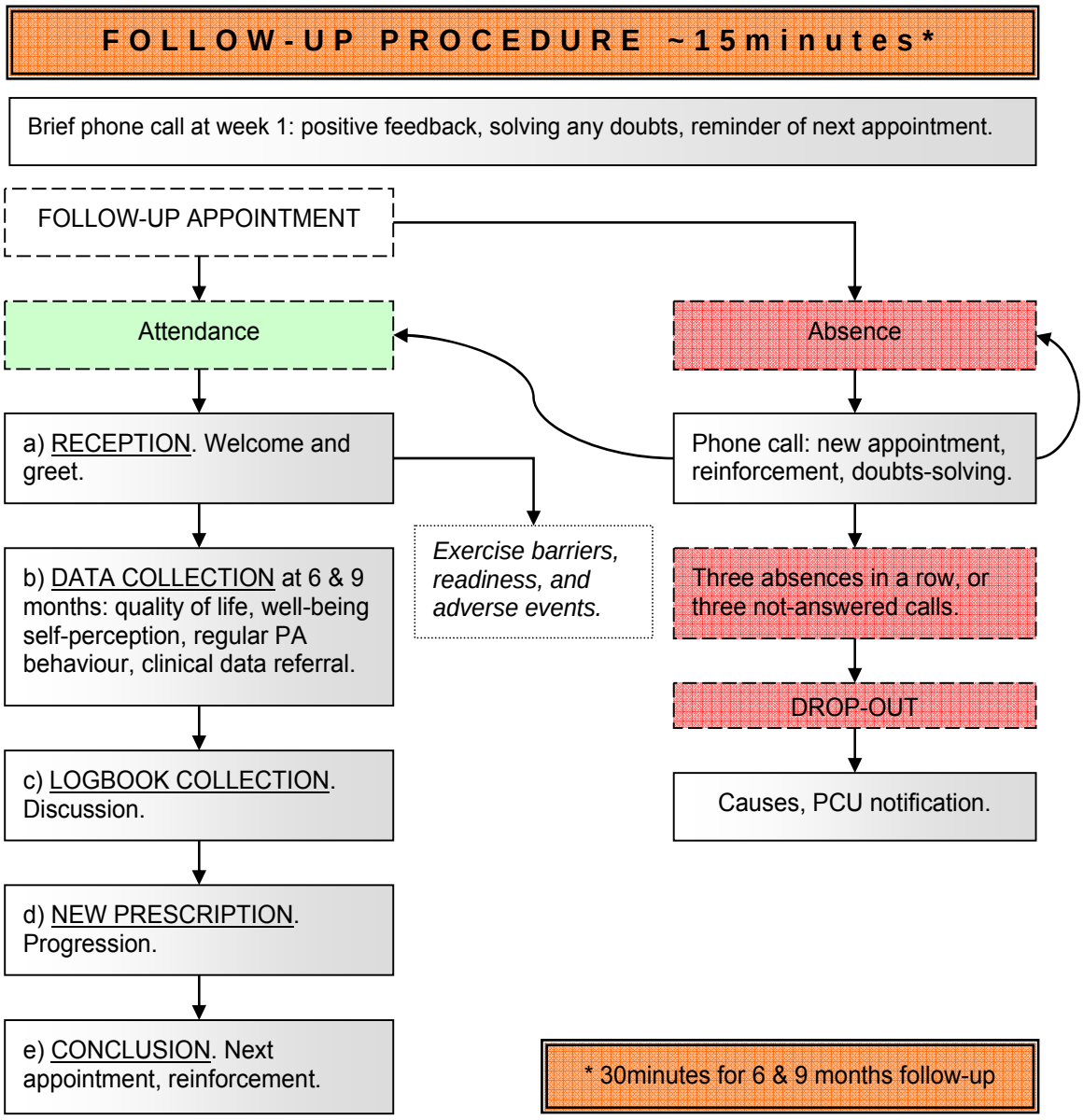

Figure 4.5 CAMINEM follow-up procedure.

Note. PA = physical activity, PCU = primary- care unit. Broken-line box = actions done by participants, grey box = actions done by the exercise specialist, green box = positive outcome, red box = negative outcome.

4.2.4 DISCHARGE PROCEDURE

Participants were included in the CAMINEM intervention for twelve months, unless participants dropped out of the programme or were dropped after a three month gap, as explained earlier. The twelve-month follow-up meeting, lasting thirty minutes, began as with

other regular follow-up appointments and ended with the participant being discharged and a subsequent report to their PCU.

Reception and logbook collection

The procedure was similar to regular follow-ups, welcoming and congratulating them for their adherence. Then, logbooks were checked and discussed with participants. In this final meeting, logbook discussion was given a higher priority than data collection in order to finalise the regular monitoring process.

Data collection

As in month 6 & 9, assessment procedures were as follows: a) quality of life (SF-12v2), b) regular PA behaviour (ClassAF), and c) self-perception of well-being. This was followed with a referral to nurses for clinical data collection (i.e., height, weight, waist circumference, resting heart rate, blood pressure, and blood analysis petition).

Self-confidence

Participants and the ES discussed the whole CAMINEM intervention and concluded by stressing the importance of regular PA planning for health purposes (i.e., exercise) and PA behaviour (LTPA, occupational PA, active lifestyle). The ES informed participants of relevant community-based activities and any information previously collected directly from institutions (e.g., public administration, private fitness centres) that may be suitable for the CAMINEM participant profile. Participants would then decide on suitable pleasant and varied activities which could be continued after the intervention. They were reminded of the minimum amount of exercise desirable to prevent disease with focus placed on moderate-intensity activities unless participating in activities supervised by an ES or under medical control/referral. Comparison between the first and last day of intervention would lead to discussion on overcoming exercise barriers or adverse events.

Farewell

The ES thanked participants for the one-year participation and encouraged them to keep physically active and to monitor their HEPA. Finally, reports were sent to the PCU which referred the participants. See Figure 4.6 for the discharge procedure flowchart.

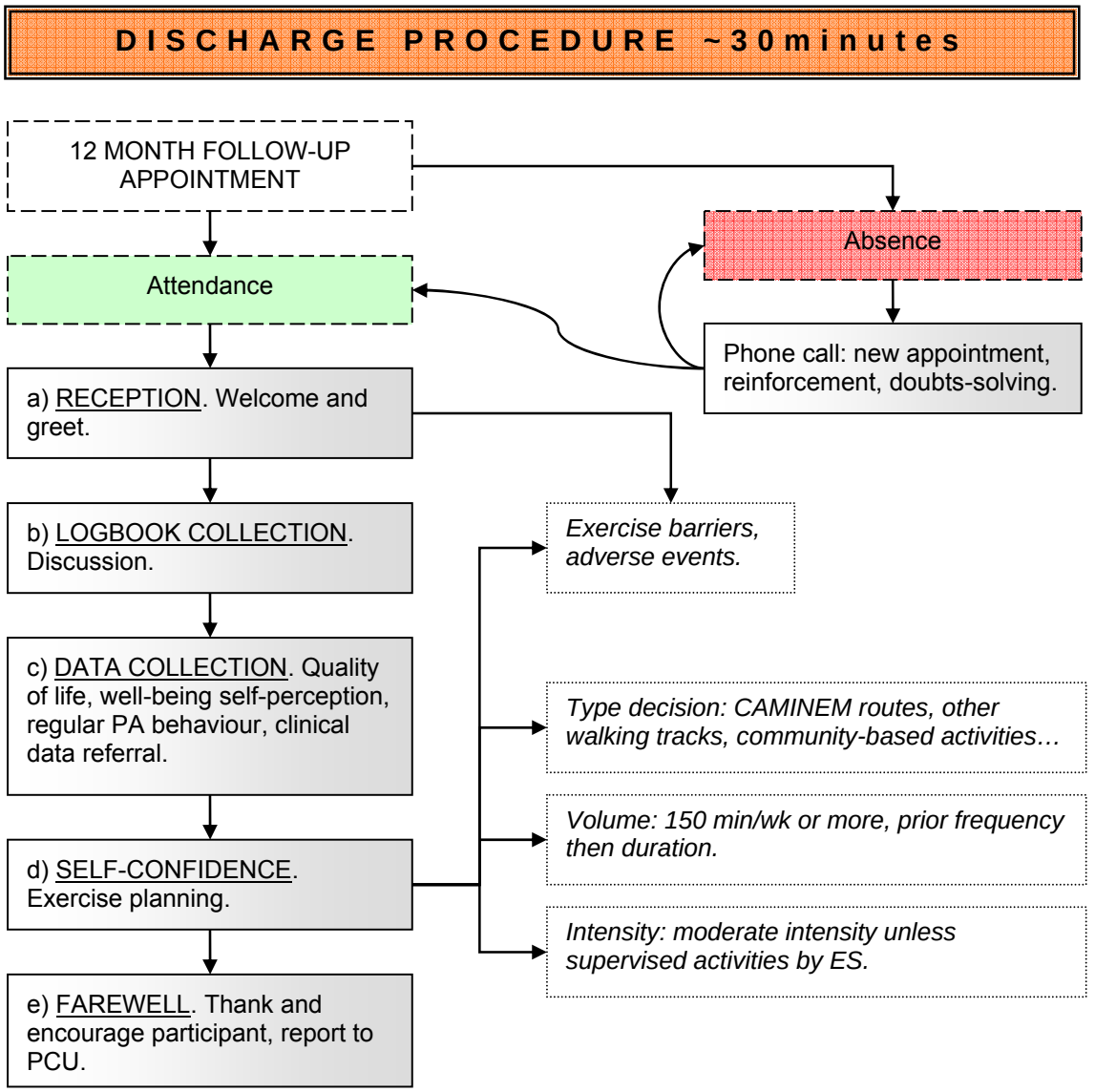

Figure 4.6 CAMINEM discharge procedure.

Note. min = minutes, wk = week, ES = exercise specialist, PCU = primary-care unit. Broken-line box = actions done by participants, grey box = actions done by the exercise specialist, green box = positive outcome, red box = negative outcome.

4.2.5 MAINTENANCE

Participants were contacted by phone to assess the residual effects after having finished their participation in the CAMINEM programme. Phone contact was made a minimum of six months after last contact between the ES and participants (i.e., last visit at the ES office), whether they dropped out of the programme or were discharged. During the phone call, participants were invited to answer questionnaires related to their PA behaviour (ClassAF),

and self-perception of well-being by a simple question similar to that used in the 6 and 9 month follow up: *What do you think about your overall health, is it better, worse, or the same as the last day we met in the framework of the CAMINEM programme?* Clinical data was collected in line with the regular practice procedure followed by practitioners for chronic patients. Data obtained at least three months after last contact was used for further analysis.

Two group meetings were held with invited participants whose last intervention appointment had occurred at least six months previously. The meeting was carried out with the support of practitioners and ES volunteers and used for collection of the following data: a) quality-of-life (SF-12v2) and b) other data that could had not been collected through a phone call. Participants were also told about the overall purpose of the CAMINEM intervention from February 2010 to July 2011, the period of time when participants may have been included. Finally, they were informed of local settings where they could participate in community-based exercise activities. It was thought that the meetings did not 'leave participants to their own devices' once the research intervention was completed, as Dubbert suggested (as cited in Cyarto, Brown, & Marshall, 2006), but rather provided the participants with the tools to continue with their PA routine. The intervention schedule is shown in Figure 4.7.

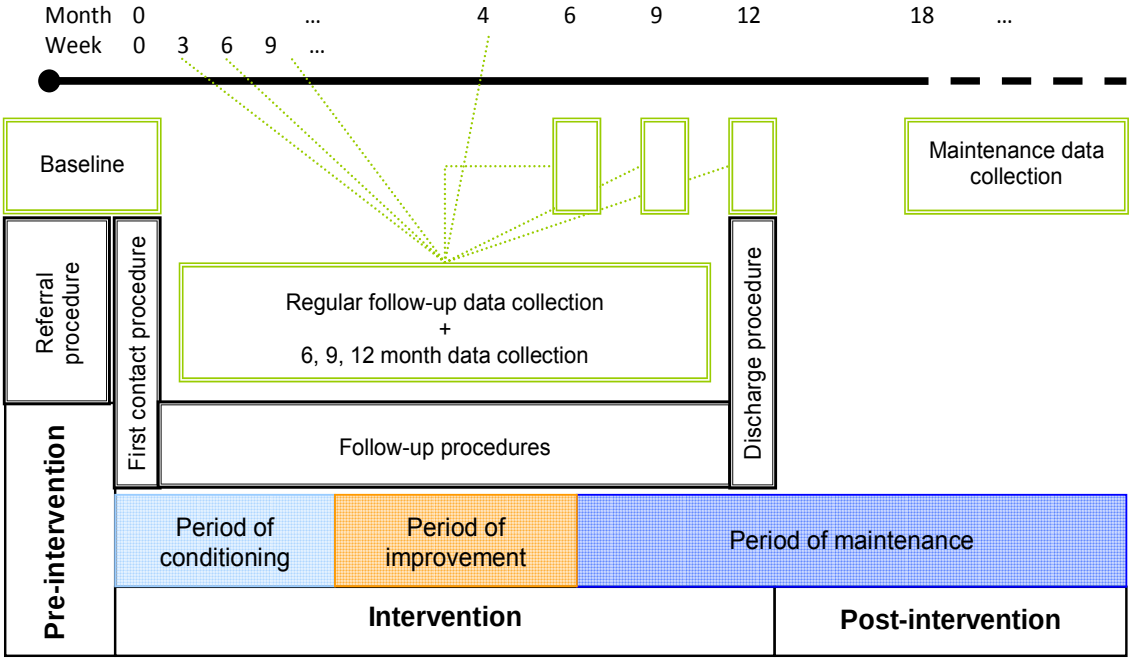

Figure 4.7 CAMINEM intervention schedule and exercise periods.

4.2.6 INTERDISCIPLINARY COMMUNICATION

This PHC setting pragmatic intervention included an exercise specialist not recognised as a health professional by Spanish regulations but located in an office alongside health practitioners. Thus, communication among the agents participating in the intervention was considered to be a key aspect.

Interdisciplinary work was considered from the very beginning of the intervention design process with the steering group composed of physicians (general practitioners and a consultant sports physician), community nurses and exercise specialists. CAMINEM features have been designed for use with the adult population as primary, secondary, or tertiary prevention of non-communicable diseases and as such, paediatricians and dental surgeons were not invited to participate. However, other staffed professionals were told about the programme and invited to collaborate in the intervention (e.g., administration staff) or in further interventions (e.g., clinical psychologist). Figure 4.8 shows all professionals involved in the programme. The exercise specialist, general practitioners, and community nurses had the main roles. Administrative staff and clerks were also made aware of the programme to inform users. The primary health-care centres' direction boards supported the programme institutionally, and the sports physician acted as counsellor. Specialised care physicians could be contacted and informed of their patients' participation, after his or her approval. A clinical psychologist and various midwives who requested programme information were invited to participate by recommending potential participants to visit their PCU for further referral. Some practitioners, who co-ordinate specific programmes such as primary care research or community activities, were also encouraged to collaborate alongside the CAMINEM intervention.

All PCU (general practitioners and nurses) received 1 hour training for the intervention procedure, focused on referral and follow-up, before the intervention started. The role of the ES as part of the working team and research framework was explained in detail as well as the methods for data protection (herein detailed in Chapter 4.5). These training sessions were periodically repeated in both PHC centres during the intervention period.

Figure 4.8 Professionals involved in the CAMINEM Programme.

Health practitioner were contacted regularly in the course of the study to inform them of the monthly group walks, where practitioners were invited to participate, and to encourage recruitment. Regular reminders were provided due to a tendency for health practitioners to have a low adherence to external interventions (e.g., requests from other institutions than the healthcare provider). The steering group was aware that external requests for participation were not commonly followed by evolution and results feedback. Thus, practitioners' willingness to collaborate on external interventions varied widely.

Periodically, once every two months, follow-up reports on referred participants (in and out the programme) were delivered to PCUs with selected information collected through motivational

interviewing and phone calls (e.g., adverse events, family barriers, reasons for dropping) and participant self-reported logbooks (e.g., exercise progression).

The ES and practitioners members of the steering group met frequently (every other week), usually during the same day the ES worked for the intervention, to discuss intervention development (e.g., agents' and participants' adherence). Non-scheduled brief meetings with other collaborating health practitioners were held to discuss specific participants' circumstances.

4.2.7 MATERIAL AND PERSONAL RESOURCES

One-to-one exercise counselling had to be provided in a location that would ensure privacy. Regular offices were available at the ES's disposal where medical records were strictly blocked, so the ES could have use of a computer (research database, PA behaviour questionnaire), telephone, and printer. This intervention did not include fitness testing or objective monitoring, thus the material needed was mostly paper-based: printed urban routes, exercise prescription forms & logbook, quality-of-life questionnaires, and written consents. The ES wore an identification card as *personal trainer* and could access the personnel room and other departments.

The ES scheduled appointments in each PHC centre 3.5 h weekly. That time was used for participants' counselling, phone contact and reporting feedback to PCU. Extra time was used as a result of a delay in participant arrival or brief meetings with practitioners *in situ*. Monthly group-based walks led by the ES lasted 1 h plus an extra hour for their organisation. The two GPs of the steering group were already using part of their time for research activities, and the CAMINEM intervention was intended to be part of community-based health promotion practitioners regularly do. To sum up, approximately 10 h weekly of extra work from an ES and no extra work for regular practitioners during their clinical practice was needed to develop the intervention.

4.3 DATA COLLECTION

The data-collection methods used to gather information were intended to be the less demanding for health practitioners during their routine. Personal data (date of birth, gender), referral reason (diagnosed medical condition), and referring practitioner was registered once participants gave their consent to be included in the research. Relevant medication was used for exercise counselling but not for research purposes, as well as other information practitioners may state on their referral (e.g., weight control, motivation to exercise with peers). Information hosted in the health provider database (ICS) was accessed by members of the steering group (i.e., general practitioners or nurses), one researcher from the primary-care research group *IDIAP Jordi Gol*, and the thesis author who obtained previous permission to consult data.

4.3.1 EFFECTS

Biochemical- and body composition-related clinical parameters, self-perception of quality of life, and primary health-care services demand were collected to assess the CAMINEM intervention effects. Physical activity as a behaviour was not included as an outcome because adhered participants would already record their achievement of the exercise prescriptions set by the exercise specialist. It was evaluated in terms of *implementation*. Any changes to occupational or leisure-time physical activity would have less association with fitness capacities than the exercise prescribed.

4.3.1.1 CLINICAL HEALTH DATA

Clinical parameters were collected by PCUs during their regular routine unless no data had been recorded within 6 months prior to the referral (in this case, missing data was collected on the day of referral), or specific collection was scheduled at month 6 and 12 of the intervention.

Weight was measured to the nearest 0.1 kg using a mechanical column scale, then height was measured to the nearest 0.5 cm in an upright position without shoes, and body mass index (BMI) calculated as body weight (kg) divided by the square height (m). Waist circumference was measured in a standing position midway between the lower rib margin and the iliac crest with a tape measure to the nearest 0.5 cm. Blood pressure was measured with the participant

in a sitting position after five minutes of rest, using an electronic sphygmomanometer (OMRON Intellisense™ HEM-907). Both systolic and diastolic blood pressures were calculated as the mean of two determinations (mmHg). Resting heart rate (beat/min) was measured at the same time as blood pressure, if arrhythmias were detected a second measurement would be taken manually from an ulnar artery for 1 min. These methods are similar to those used in other interventions (L. V. Kallings, Johnson, et al., 2009).

Blood samples were drawn from an antecubital vain after overnight fasting. The samples were analysed by accredited methods in the clinical chemistry laboratory at the University Hospital *Arnau de Vilanova*, Lleida. The outcomes levels were calculated for: glucose (mg/dl), total cholesterol (mg/dl), high-density lipoprotein cholesterol (HDL) (mg/dl), low-density lipoprotein cholesterol (LDL) (mg/dl), and triglycerides (mg/dl). Glycated haemoglobin (HbA_{1c}) was also measured as a percentage of total haemoglobin for those diagnosed with diabetes mellitus.

A comparison was drawn between clinical data collected at four different times: M1 – baseline, M2 – during intervention, M3 – post-intervention, M4 – maintenance. The CAMINEM intervention took place from February 2010 to July 2011 and medical records were accessed on September 2011 for data analyses. Ideal participants would be evaluated before, during and after (short- and long-term) their intervention. However, participants with low retention (i.e., dropout) were evaluated as intention-to-treat.

M1 data was taken from pre-intervention data collection at a maximum of six months. Data collected one month after inclusion was taken as baseline data because the PCU may have realised at referral that some data was missing and a new referral for blood analysis had to be scheduled. If more than one measure was available, the nearest to the inclusion date was chosen, preferably pre- rather than post-inclusion.

M2 data was aimed at assessing possible chronic effects during the intervention and was collected for participants who had adhered to the programme for more than 6 months. Chronic effects are adaptations to training acquired over weeks or months: cumulative, delayed, partial, and residual effects (Hardman, 2007; Zatsiorsky & Kraemer, 2006). The CAMINEM intervention included low- to moderate-intensity exercises without supervision, so changes may occur after several months even though acute effects of very inactive participants may lead to quick changes in clinical parameters. M2 was collected after one month of inclusion

and up to two months prior to discharge or dropout. If more than one measure was collected, the nearest to six months of adherence was chosen, preference given to measurements taken later rather than sooner.

M3 data was used to assess clinical parameters after finishing the intervention (either due to full completion or intention-to-treat for abandonment). This data was obtained for those participants having finished before the end of the whole CAMINEM intervention (i.e., July 2011). The timeframe for this measure was from two months before ending up to three months after finishing. If more than one measure was obtained, the nearest to the last day was chosen, with preference given to measurements taken later rather than sooner.

M4 data was taken to assess the long-term effects (maintenance, further explained in Chapter 4.3.2.4). This data was obtained for those participants who had finished at least six months before the day data was collected (i.e., before March 2011). The M4 data timeframe was placed at three months after final intervention contact (discharge or dropout). If more than one measure was collected, the closest to six months post-intervention was chosen, with preference given to measurements taken later rather than sooner.

Figure 4.9 shows five different profiles of included participants to give the full picture of the possible differences in data collection.

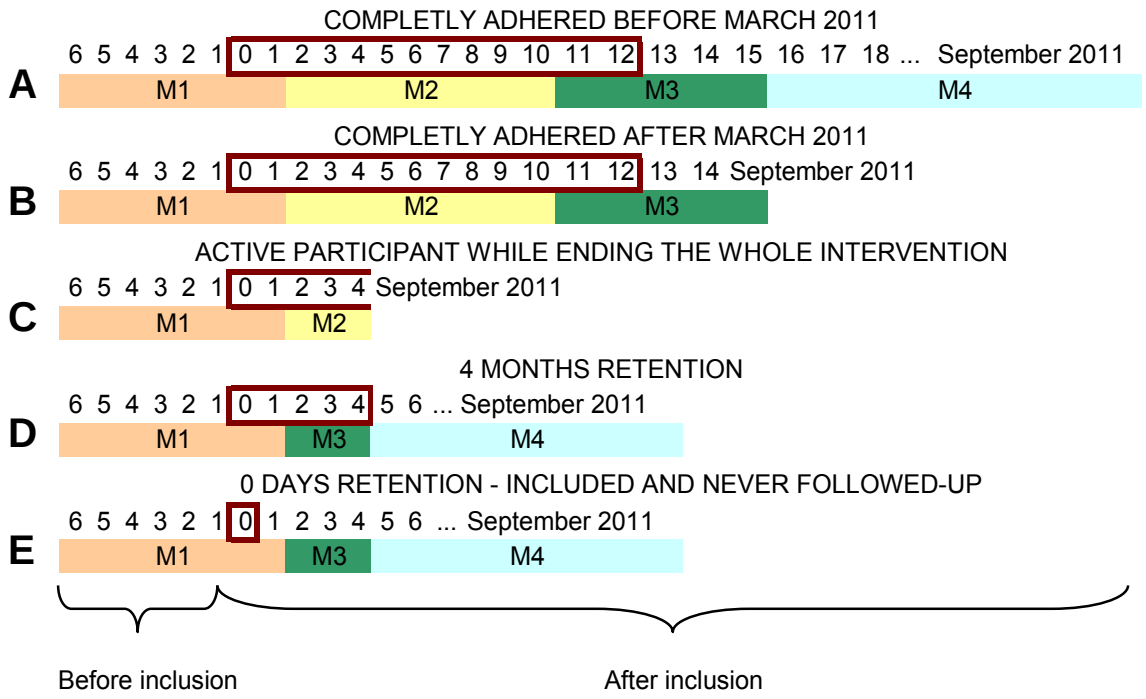

Figure 4.9 Five participant profiles for data collection.

Note. M1 = baseline, M2 = during intervention, M3 = post-intervention, M4 = maintenance.

A and B both completed 12-months of intervention. However, A finished before March 2011, so maintenance data (after 6 months of discharge) could be collected.

B finished later, so maintenance data could not be collected.

C was receiving exercise counselling by the time the CAMINEM intervention ended (July 2011).

D received counselling for four months before dropping out.

E was included (accepted participation) but never attended follow-up meetings, and so withdrew from the first day.

4.3.1.2 QUALITY OF LIFE

Quality of life was measured by the exercise specialist during follow-up consultations using the Short Form 12 Health Survey version 2 (SF-12v2) in Catalan (Ware, Kosinski, & Keller, 1996), and a simple question comparing self-perceived well-being in two separate moments: '*What do you think about your overall health, is it better, worse, or the same as the day you started the CAMINEM programme?'* SF-12v2 includes 12 questions and generates a health profile of eight sub-scale scores: physical functioning, role limitations due to physical problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health. Two sub scores are generated from four scales each regarding physical and mental aspects of health. All scores are applied to a scale ranging from 0 (worst score) to 100 (best score). SF-12v2 was delivered at M1 – baseline (Day 0), M2a – during intervention (Month 6), M2b – during intervention (Month 9), M3 – post-intervention (Month 12), M4 – maintenance (Month 18 onwards).

SF-12v2 has been found to correlate with the original form SF-36 and the Spanish version was found to be reliable and valid with normal population values (Gandek et al., 1998; Vilagut et al., 2008). However, the 12-item version is recommended for use with a larger population survey than the 36-item version. Even though the sample prevision was not high, the SF-12 was chosen by the steering group because it is recommended for clinical practice in PHC in Catalonia (Departament de Salut. Generalitat de Catalunya, 2009a), thus their results may be used by practitioners after the intervention.

4.3.1.3 HEALTH SERVICES DEMAND

Health services demand data was obtained from the health provider database. The number of monthly visits with either the general practitioner or community nurse was collected for the following periods of time: a) from 12 months before the inclusion date, b) during participant inclusion, c) from the end of the participant's programme to the end of the whole intervention (July 2011), d) during the number of previous months resulting from the sum of during and post intervention. The ratio of monthly visits was calculated for consultations with the GP, nurse and both.

4.3.2 FEASIBILITY

The RE-AIM framework (Estabrooks & Gyurcsik, 2003; Glasgow, 2002; Glasgow, et al., 1999) was used to evaluate the feasibility, understood as the extent to which the intervention process could be implemented in the local setting (Wang, et al., 2006). Effects were measured as opposed to effectiveness because a comparative prior trial under optimal conditions (i.e., efficacy trial) had not been undertaken. Economical analyses have not been included in this intervention design due to a lack of human resources.

4.3.2.1 REACH

The total number of potential participants was calculated using the health provider database according to the following inclusion criteria: a) patients subscribed at PHC_A and PHC_B, b) patients above the age of 18 and diagnosed with hypertension and/or ischemic heart disease and/or diabetes mellitus and/or dyslipidemia and/or registered with a BMI higher than or equal to 25, and c) patients complying with the above criteria who had attended their PHC

centre in 2010. Other health conditions were excluded due to the broad variety of coding in the database. Selected nurses who adopted the intervention programme were then encouraged to record total referral invitations and the number of patients who declined, in a regular week. The number of patients who agreed to participate was recorded through the number of referrals from PCU to the ES. The number of patients who actually participated was calculated according to the number of information consent forms signed in the first intervention visit. See Figure 4.10 for the participant's target.

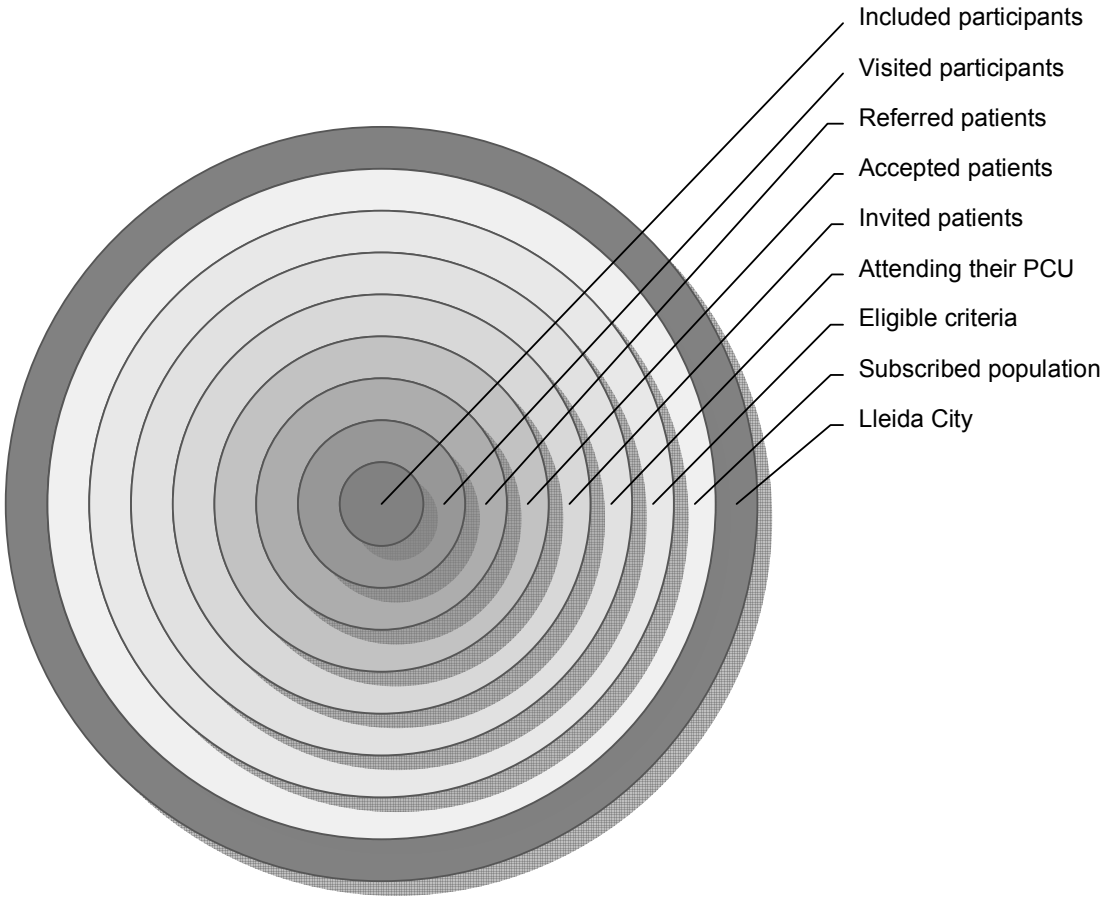

Figure 4.10 From total population sample to included participants.

Note. PCU = primary-care unit.

Reasons for exclusion and further dropout (i.e., not retained) were recorded from ES and participant contact (e.g., phone contact, face-to-face visit). This design was intended to answer the recommended evaluative questions suggested by Estabrooks & Gyurcsik (2003).

4.3.2.2 ADOPTION

Settings where the steering group practitioners worked were selected for the CAMINEM intervention. This non-randomised selection was due to the accessibility of the ES to provide counselling in these PHC centres. However, patients referred by practitioners from other PHC centres could be included after their GP's permission, and the visit would take place in either of the two approved centres.

All general practitioners and community nurses were invited to participate. A one-hour training session was repeated to encourage recruitment and to update procedures for new practitioners. The total number of agents (GPs and nurses) was obtained from the PHC list of workers. Practitioners who were working as temporary staff for less than 3 months were not selected for the intervention.

4.3.2.3 IMPLEMENTATION

Implementation was measured mainly at individual level by assessing participants' adherence and enactment, that is, the extent to which participants followed the exercise prescriptions using learned skills and CAMINEM features. Regular physical activity behaviour was assessed at baseline (M1), at 6 Months (M2a), 9 Months (M2b), 12 Months (M3), and 18 Months onwards (M4, for maintenance purposes) using a quick classifier questionnaire thought to be useful for clinical practice, ClassAF, see Annex E (Departament de Salut. Generalitat de Catalunya, 2007). The ClassAF, however, has not yet been validated for research as a tool for physical activity behaviour outcome assessment. Exercise prescription adherence assessment was measured as:

- Retention days. The amount of time participants were included.
- Attendance at follow-up meetings. The ratio of attendance to total number of appointments. More than 50% attendance was considered positive.
- Exercise compliance. It was measured as: a) the number exercise sessions completed divided by the number of prescribed sessions (how much exercise), and b) percentage of exercise sessions completed as prescribed (what exercise). For participants to be compliant they should complete more than 50% of the number of prescribed exercise sessions. Also, their self-reported duration (time), type (urban routes) and intensity (self-reported) should be completed at more than 50% of the original prescription.

Participants included for more than 180 days (six months) were considered to have been retained but not necessarily adhered to the intervention. Participants may attend follow-up meetings but may not exercise as intended (e.g., less frequently). Participants may also exercise and not report it to the exercise specialist who, as a result, could not assess the training load. Safety was measured as the number of adverse events reported by either participants or practitioners as a result of exercise prescriptions. Reasons for dropping out were also collected.

4.3.2.4 MAINTENANCE

The main outcome for individual maintenance was PA behaviour of all included participants (whatever their retention was) after at least six months after final contact. PA behaviour of those participants who adhered for more than six months was used to determine maintenance, relapse or decrease of LTPA and occupational PA compared to the first and the last measure before ending. Participants' clinical post-intervention parameters were obtained during PCU regular consultations, already explained in Chapter 4.3.1.1.

Self-perception of quality of life was measured with the SF-12v2 and a simple question comparing self-perception of well-being at two moments: '*What do you think about your overall health, is it better, worse, or the same as the last day we met in the framework of the CAMINEM programme?'* Questionnaires were reported by phone or personally at a group meeting.

Maintenance at a setting level was not measured objectively but as step taken by health practitioners and/or health-care setting Direction Boards which would lead to continuation with the intervention. Table 4.6 summarises all data collection, by PCU and ES, to assess intervention effects and feasibility.

Table 4.6 Data collection summary.

	EFFECTS		FEASIBILITY	
	PCU	**ES**	**PCU**	**ES**
PRE-INTERVENTION				
Regular consultation	Diagnose, clinical parameters* (M1)		R: Inclusion criteria	
Day 0		Personal data†, quality of life§, *Stage of change, observations* (M1)		I: PA behaviour‡
FOLLOW-UP				
All		*Stage of change, observations*		I: Adherence, adverse events
Month 6	Clinical parameters* (M2)	Quality of life**, *Stage of change, observations* (M2a)		I: PA behaviour‡, adherence, adverse events
Month 9		Quality of life**, *Stage of change, observations* (M2b)		I: PA behaviour‡, adherence, adverse events
Month 12	Clinical parameters* (M3)	Quality of life**, *Stage of change, observations* (M3)		I: PA behaviour‡, adherence, adverse events
MAINTENANCE				
Regular consultation	Clinical parameters* (M4)		M: Clinical parameters* (M4)	
Month 18				M: PA behaviour‡, quality of life** (M4)
OVERALL POST-INTERVENTION		**ES**		**ES**
		Health services demand	R: Included patients A: Referring practitioners M: Setting interventions	

Note. PCU = primary-care unit, ES = exercise specialist, PA = physical activity, R = reach, I = implementation, A = adoption, M = maintenance. M1 = baseline data, M2 = during intervention data, M3 = post-intervention data, M4 = maintenance data. Italic = data for counselling purposes only.

* Weight (kg), height (cm), waist circumference (cm), resting heart rate (beat/min), blood pressure (mmHg), plasma glucose (mg/dl), blood total cholesterol (mg/dl), blood LDL (mg/dl), blood HDL (mg/dl), blood triglycerides (mg/dl), glycated haemoglobin (%). † = genre, date of birth. ‡ = ClassAF score. § = Outcomes from SF-12v2 questionnaire. ** = Outcomes from questionnaires (SF-12v2, short question).

4.4 DATA ANALYSIS

Possible effects of the intervention (clinical parameters, quality of life, and health services demand) were evaluated for all participants. Participants were distributed into four groups according to two determinants:

- PA behaviour at baseline, after recoding ClassAF scores as insufficiently active (0 to 5) and sufficiently active (6 and above). Recoding into categorical variables is necessary because ClassAF outcomes do not include quantitative information such as energy expenditure or time exercising.

- Intervention adherence for 6 months. Adherence was understood as participants who had regularly attended follow-up meetings and had compliance.

Microsoft® Office Excel 2003 was used for data treatment. Statistical significance was set at $p < .05$ and the confidence intervals were 95%. The statistical software PASW statistics (release 18.0.0) was used for all analyses.

Categorical variables are presented as percentages. Pearson's chi-squared (χ^2) tests were used to determine differences between groups.

Continuous variables are presented as the mean value and standard deviation (SD) at different measures. Statistical differences were assessed by analyses of variance (ANOVA) by time in relation to the four groups using the Schefée test, a contrast coefficient test, when comparing two subgroups out of all four, and the *t*-test when comparing two groups only (i.e., effects for the adhered groups only). Normally distribution of variables was tested using the Shapiro-Wilk test for samples lower than 30, and the Kolmogorov-Smirnov test for samples higher than 30.

Analyses pre- and post-intervention were carried out if the sample was higher than five in each measurement. Continuous variables which statistically differed between groups at baseline (i.e., confounding factors) were used as covariates. Analyses of variance were used for variables following normal distribution. Non-parametric tests were applied for variables that were not normally distributed: the Mann-Whitney *U* test between groups, the Wilcoxon Signed-Rank test (Wilcoxon's *Z*) for two measurements within groups, and the Kendall's

coefficient of concordance (Kendall's *W*) for three measurements within groups. Mean differences between moments were shown as total difference and the percentage of difference.

Health-care attendance was measured as a ratio of number of the visits to the GP or nurse per month. Results are presented as the mean, median, minimum and maximum values.

For reach, the proportion was shown as the percentage of patients included in relation to diagnoses and primary health-care setting. Distribution of referrals by the health practitioner over the 18 month intervention is shown according to adoption.

To assess changes in physical activity behaviour, ClassAF scores were recoded as originally set (see Annex E): *inactive* (0-1), *minimum physical activity* (2-3), *slight physical activity* (4-5), *moderate physical activity* (6-11), and *very active* (12-33). Outcomes are presented as percentages within each group. Participant attendance at meetings with the exercise specialist was calculated as the rate of attended meetings in relation to all scheduled. Compliance to the prescription was calculated as the rate of times following exercise components indications (frequency, type, duration, intensity) in relation to all prescribed. More than 50% either for attendance or compliance was considered positive.

Programme retention days started from the first consultation up to last contact between participant and the exercise specialist. Reasons for dropping out were recorded directly from participants unless there was no possibility of asking for it (e.g., no phone contact possible).

Post-intervention long-term effects on clinical parameters were evaluated by distributing participants in four different groups according to: a) PA behaviour six months after the intervention, and b) intervention adherence for 6 months.

4.5 OTHER CONSIDERATIONS

This study was approved by the Clinical Investigation Ethics Committee of the IDIAP Jordi Gol, located in Barcelona. All procedures and interventions have followed the ethical principles set by the World Medical Association in the Declaration of Helsinki.

The participation of the participants was strictly voluntary and withdrawal would not have had any consequence on the management of their illness which would be carried out by their health practitioner strictly following the accepted international norms. Patients gave their verbal consent for referral as well as signed an informed consent, where the research aims and use of information was explained, before inclusion into the intervention (see Annex H). Participants refusing their formal inclusion or announcing abandonment were encouraged to maintain a healthy lifestyle and return to their PCU if they wished to participate at a later date.

The data has been treated with the utmost confidentiality according to Spanish regulations, and has been used exclusively for the purposes of this doctoral thesis. Clinical data collection was part of the ordinary health-care routine data gathering and written permission to use these data was obtained from the regional administration. Health data requested exclusively for the purpose of this study was extracted by members of the healthcare administration. Documents with medical information (e.g., practitioner referral) were filed and kept in the PHC centre. Non-medical research data (e.g., exercise logbooks) was filed in the INEFC-Lleida.

The lack of clarity regarding medico-legal responsibility has been shown as a barrier for UK practitioners (Graham, Dugdill, & Cable, 2005). Liability for any harm caused after the prescription of exercise is unclear in Spain. Although in other countries, such as Sweden (Swedish National Institute of Public Health, 2010, p. 59), the owner of a gym could not be held liable for injuries that a participant may potentially suffer if it is not matter of deficient safety procedures at the gym. Sport law specialists and fitness professionals were consulted regarding the CAMINEM programme and all considered the intervention to promote safe exercise counselling under the current regulations (Mas Alòs, 2011, unpublished). The exercise specialist was a member of the exercise professional association COPLEFC (*Col·legi de Llicenciats en Educació física i Ciències de l'activitat Física i l'esport de Catalunya* – Association of physical education and exercise professionals of Catalonia) and a holder of civil responsibility insurance in accordance with Catalan regulations on practicing exercise professionals.

CHAPTER 5 – RESULTS

Both primary health-care centres selected for the intervention participated and no practitioners refused to collaborate on referring patients. As a result, 63 practitioners (29 GPs, 34 nurses) were included. During the intervention process three practitioners from other PHC settings were contacted for inclusion approval of three participants who self-requested inclusion. Several practitioners, both GPs and nurses, were working on a temporary basis during the intervention and were included as able to refer patients if they were working at the PHC centre for at least three months. The total number of practitioners that could refer patients was 82 (36 GPs and 46 nurses).

Practitioners referred 229 patients of which 178 were finally included. There were 35 participants available for the 6-month follow-up, and 33 for the 9-month follow-up. 22 participants adhered completely to the intervention. It should be noted that some participants were retained for 6, 9 or 12 months without keeping adherence (i.e., completing exercise prescriptions and/or assisting regularly at follow-up meetings). Also, 44 participants were active by the time the intervention finished, ranging from 1 to 180 days (n = 30), and more than 270 days (n = 14).

Maintenance data was collected from 92 participants who had finished their participation at least three months before clinical data collection (July 2011), and 89 at least six months before quality-of-life data collection (September 2011). Figure 5.1 shows the complete flow chart of members participating in the study.

Those participants finally included were mostly women (64.6%) and referred by nurses (83.1%). Reasons for referral, which could include more than one, were primarily cardiovascular risk factors: being overweight or obese (50.6%), high blood pressure (44.9%), and abnormal cholesterol levels (36%). Diabetes mellitus was the next common health condition (32%). Musculoskeletal diseases (e.g., osteoporosis, osteoarthritis, sciatica, fibromyalgia, and/or low back pain) were cited as reasons in 21.9% of cases, cardiovascular diseases (e.g., heart failure) in 16.9%, respiratory disorders (e.g., asthma, COPD, emphysema, and/or tobacco control) in 13.5%, mental health-illnesses (e.g., depression, anxiety, schizophrenia, loneliness, and/or dysthymia) in 10.7%, and other health conditions (e.g., cancer at low stages, cancer survivors, transplant, hypothyroidism, alcohol addiction) in 7.3% of cases. The percentage of participants who reported being sufficiently physically active was

almost the same as those who reported being insufficiently active. Practitioners from both settings had similar levels of participation, referring 77 and 101 patients. See Table 5.1.

Table 5.1 Participants profile.

	Frequency	
	N = 178	(%)
Gender		
Male	63	(35.4)
Female	115	(64.6)
Health condition [a]		
Overweight	90	(50.6)
Hypertension	80	(44.9)
Dyslipidemia	64	(36.0)
Diabetes Mellitus	57	(32.0)
Musculoskeletal	39	(21.9)
Cardiovascular	30	(16.9)
Respiratory	24	(13.5)
Mental illness	19	(10.7)
Other	13	(7.3)
Number of health conditions		
One	53	(29.8)
More	51	(28.7)
Three	46	(25.8)
Four or more	28	(15.7)
Basal physical activity level [b]		
Insufficiently active	91	(51.1)
Sufficiently active	86	(48.3)
Primary health-care centre		
PHC_A	77	(43.3)
PHC_B	101	(56.7)
Practitioner		
Physician	30	(16.9)
Nurse	148	(83.1)

[a] The total sums exceed 100%.
[b] 1 missing.

According to the correlation between reasons for referral and gender, hypertension in men (49.2%) and overweight in women (58.3%) were the most common diagnoses. When taking into consideration the total number of reasons, dyslipidemia and diabetes mellitus were more common in men, whilst musculoskeletal diseases and mental health conditions were much more common in women than men. Patients with high blood pressure were referred almost exclusively by nurses: 48% of patients suffering from it were referred by nurses, compared to 3% by GPs. Practitioners from the PHC_A mostly referred patients with one (45.5%) or two

(31.2%) conditions, while PHC_B tended to refer patients with more than one condition (82.2%). In reference to age, the youngest age group (18 to 44 years old) was mostly referred due to overweight (84%) and was diagnosed with one or two conditions only (88%). Patients from 45 to 64 years of age were referred due to respiratory diseases, mental ill-health and other reasons in a greater proportion than other age groups. Almost one-third of older adults (31.1%) were diagnosed with a cardiovascular condition, while the percentage in other age groups was below 10%. Participants reporting lower levels of PA were generally referred with more than one health condition, and the sufficiently active were referred with a lower number of conditions (see Table 5.3).

Four groups were categorised for analyses according to two determinants: a) PA behaviour at baseline, after recoding ClassAF outcomes as insufficiently active (0 to 5) and sufficiently active (6 and above), and b) intervention adherence for 6 months (see Table 5.2).

Table 5.2 Intervention groups distribution.

GROUP	Adherence ≥ 180days	Basal physical activity level	Number of participants (*N* = 178) [a]
AD-IN	Yes	Inactive	15
AD-AC	Yes	Active	20
NA-AC	No	Active	66
NA-IN	No	Inactive	76

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive.
[a] 1 missing.

For participant maintenance purposes, four different groups were categorised as with the previous groups, according to: a) PA level at the time of assessment (after six months of finishing the intervention), and b) previous intervention adherence. Table 5.4 shows participants distribution for maintenance analyses.

Table 5.3 Reasons for prescription and its characteristics.

	GENDER				PRACTITIONER				SETTING				AGE GROUP						BASAL PA LEVEL				TOTAL	
	Male		Female		Physician		Nurse		A		B		18-44		45-64		65+		Insufficient		Sufficient			
	n = 63	(%)	*n* = 115	(%)	*n* = 30	(%)	*n* = 148	(%)	*n* = 77	(%)	*n* = 101	(%)	*n* = 25	(%)	*n* = 92	(%)	*n* = 61	(%)	*n* = 91	(%)	*n* = 86	(%)	*N* = 178	(%)
Reasons for prescriptions [a]																								
Overweight	23	(36.5)	**67**	(58.3)	**17**	(56.7)	**73**	(49.9)	**37**	(48.1)	53	(52.5)	**21**	(84.0)	41	(44.6)	28	(45.9)	**54**	(59.3)	36	(41.9)	**90**	(50.6)
Hypertension	**31**	(49.2)	49	(42.6)	9	(3.0)	71	(48.0)	26	(33.8)	**54**	(53.5)	3	(12.0)	**43**	(46.7)	**34**	(55.7)	39	(42.9)	**40**	(46.5)	80	(44.9)
Dyslipidemia	27	(42.9)	37	(32.2)	10	(33.3)	54	(36.5)	22	(28.6)	42	(41.6)	8	(32.0)	35	(38.0)	21	(34.4)	33	(36.3)	31	(36.0)	64	(36.0)
Diabetes Mellitus	29	(46.0)	28	(24.3)	3	(10.0)	54	(36.5)	17	(22.1)	40	(39.6)	2	(8.0)	33	(35.9)	22	(36.1)	30	(33.0)	27	(31.4)	57	(32.0)
Musculoskeletal	5	(7.9)	34	(29.6)	10	(33.3)	29	(19.6)	14	(18.2)	25	(24.8)	3	(12.0)	19	(20.7)	17	(27.9)	22	(24.2)	17	(19.8)	39	(21.9)
Cardiovascular	17	(27.0)	13	(11.3)	5	(16.7)	25	(16.9)	9	(11.7)	21	(20.8)	2	(8.0)	9	(9.8)	19	(31.1)	16	(17.6)	14	(16.3)	30	(16.9)
Respiratory	15	(23.8)	9	(7.8)	5	(16.7)	19	(12.8)	6	(7.8)	18	(17.8)	1	(4.0)	17	(18.5)	6	(9.8)	11	(12.1)	13	(15.1)	24	(13.5)
Mental illness	2	(3.2)	17	(14.8)	5	(16.7)	14	(9.5)	7	(9.1)	12	(11.9)	1	(4.0)	12	(13.0)	6	(9.8)	11	(12.1)	8	(9.3)	19	(10.7)
Other	5	(7.9)	8	(7.0)	2	(6.7)	11	(7.4)	4	(5.2)	9	(8.9)	1	(4.0)	10	(10.9)	2	(3.3)	8	(8.8)	5	(5.8)	13	(7.3)
Number of health conditions																								
One	16	(25.4)	**37**	(32.2)	9	(30.0)	**44**	(29.7)	**35**	(45.4)	18	(17.8)	**11**	(44.0)	**27**	(29.3)	15	(24.6)	24	(26.3)	**28**	(32.5)	**53**	(29.8)
Two	17	(27.0)	34	(29.6)	**11**	(36.7)	40	(27.0)	24	(31.2)	27	(26.7)	**11**	(44.0)	25	(27.2)	**51**	(28.7)	25	(27.5)	26	(30.2)	51	(28.7)
Three	**18**	(28.6)	28	(24.3)	7	(23.3)	39	(26.4)	13	(16.9)	**33**	(32.7)	3	(12.0)	26	(28.3)	46	(25.8)	**26**	(28.6)	20	(23.3)	46	(25.8)
Four or more	12	(19.0)	16	(13.9)	3	(10.0)	25	(16.9)	5	(6.5)	23	(22.8)	0	(0.0)	14	(15.2)	28	(15.7)	16	(17.6)	12	(14.0)	28	(15.7)

Note. PA = physical activity. Bold: the most common condition.
[a] The total sums exceed 100%.

Table 5.4 Maintenance groups distribution.

GROUP	Adherence ≥ 180days	Maintenance physical activity level	Number of participants (*n* = 98) [a]
AD-MAC	Yes	Active	7
NA-MAC	No	Active	34
AD-MIN	Yes	Inactive	0
NA-MIN	No	Inactive	35

Note. AD-MAC = adhered and active at long term, NA-MAC = non adhered and active at long term, AD-MIN = adhered and inactive at long term, NA-MIN = non adhered and inactive at long term.
[a] 22 missing.

The low number of participants in any of the subgroups including adhered participants is due to the short period of time between intervention discharge and data collection. However, of the 9 participants who adhered to the CAMINEM intervention that should have been assessed for maintenance purposes, 2 were missing and 7 were reported as being physically active. Non-adhering participants who were assessed for maintenance had withdrawn from the intervention from 176 to 558 days.

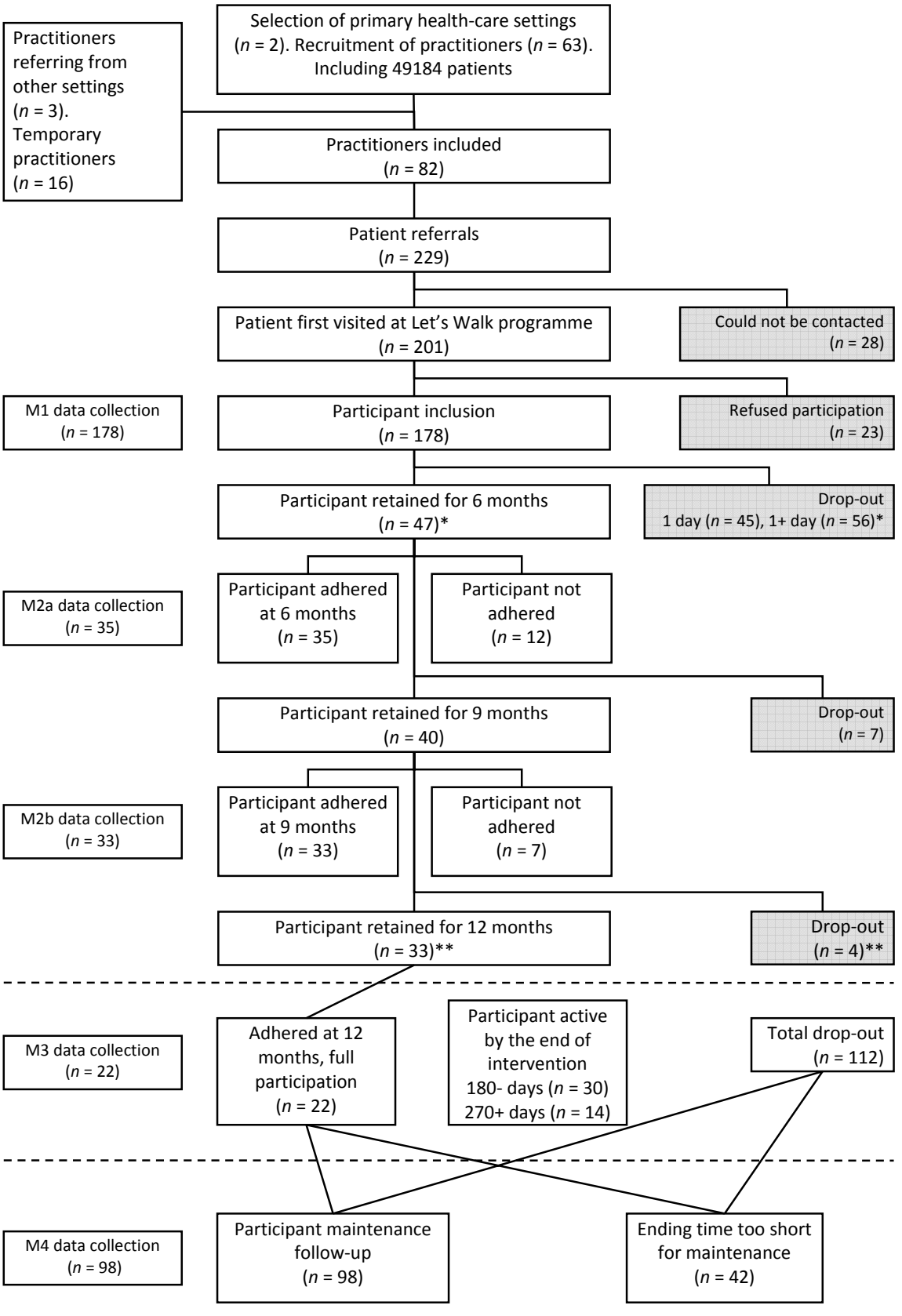

Figure 5.1 Data collection flow chart including participant dropout.

Note. M1 = baseline, M2 = during intervention, M3 = post-intervention, M4 = maintenance. * The sum is less than 178 due to active participants by the time of the intervention end. ** The sum is less than 40 due to active participants.

5.1 EFFECTS

Overall data includes high rates of missing values due to a lack of rigorous procedure in data collection. However, baseline data was collected for most participants except waist circumference (46%) and resting heart rate (60%). Data for all clinical parameters was collected from 43 participants only (24%), and 29 (16%) including quality of life. Table 5.5 shows descriptive statistics for baseline clinical parameters, quality of life and healthcare attendance.

Table 5.5 Descriptive statistics at baseline (M1).

	n	Minimum	Maximum	Mean	SD
Age (years)	178	18.0	84.0	58.1	12.2
Clinical parameters					
BMI (kg/m^2)	155	21.5	46.5	22.0	4.8
Waist circumference (cm)	82	86.0	142.0	106.1	10.8
Systolic blood pressure (mmHg)	162	100.0	181.0	134.7	15.8
Diastolic blood pressure (mmHg)	162	53.0	112.0	78.6	10.3
Resting heart rate (beats/min)	106	50.0	107.0	75.0	12.7
Total blood cholesterol (mg/dl)	139	115.0	336.0	204.8	38.8
LDL blood cholesterol (mg/dl)	118	46.2	198.4	121.7	33.1
Triglyceride (mg/dl)	134	31.0	526.0	153.4	81.7
HDL blood cholesterol (mg/dl)	118	31.0	100.0	53.4	14.0
Plasma glucose (mg/dl)	141	72.0	283.0	117.2	38.0
Glycated haemoglobin (%) [a]	50	5.7	10.8	7.5	1.2
SF-12v2 questionnaire outcomes					
Physical functioning	108	27.3	58.4	45.8	8.4
Role physical	108	21.9	59.7	45.6	11.3
Bodily pain	108	23.0	59.9	34.5	11.9
General health	108	24.9	66.4	40.9	7.7
Vitality	108	26.8	70.6	51.9	13.1
Social functioning	108	14.7	57.1	45.6	12.4
Mental health	108	25.8	68.6	49.8	12.2
Role emotional	108	13.3	58.1	44.5	12.0
PCS: Summary scale Physical	108	26.6	55.2	39.8	6.0
MCS: Summary scale Mental	108	15.8	75.5	50.4	14.2
Health-care attendance					
In the year prior to inclusion (visits per month)	178	0.0	7.3	1.5	1.1

Note. BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetres of mercury, min = minute, mg = milligram, dl = decilitre.
[a] Sample size for participants diagnosed with diabetes mellitus: *n* = 57.

Statistical differences were calculated by analyses of variance (ANOVA) for quantitative measures in relation to groups (see Table 5.6). Participant characteristics did not differ

significantly between groups in most parameters, except with age and body mass index. The same results when comparing two subgroups in relation to their PA behaviour (AD-IN & NA-IN vs. AD-AC & NA-AC): contrast coefficient test was done not assuming equal variances for age (t = 2.563, p = .001) and assuming them for BMI (t = 2.313, p = .022). Participants reporting being sufficiently active were older and had a lower BMI than insufficiently active participants. All groups averaged more than 1 monthly visit to their practitioner in the year prior to the inclusion date.

Table 5.6 Homogeneity at baseline (M1) among groups for continuous variables.

	AD-IN (n = 15)		AD-AC (n = 20)		NA-AC (n = 66)		NA-IN (n = 76)		p-value
GROUP	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Age*	56.0	9.2	64.5	6.5	59.1	13.1	55.8	12.6	0.029
Clinical parameters									
BMI (kg/m^2)*	32.5	4.2	30.2	4.3	30.9	4.3	33.2	5.2	0.021
Waist circumference (cm)	111.4	15.3	102.3	8.0	105.7	11.4	106.0	9.8	0.487
Systolic blood pressure (mmHg)	131.1	11.2	140.3	15.3	134.3	17.0	134.2	15.7	0.385
Diastolic blood pressure (mmHg)	79.2	8.6	77.1	7.4	77.6	11.0	79.8	10.8	0.575
Resting heart rate (beats/min)	74.0	14.1	75.2	15.8	73.0	12.5	77.0	11.5	0.552
Total blood cholesterol (mg/dl)	201.9	26.8	203.8	40.5	202.7	41.5	207.5	38.9	0.923
LDL blood cholesterol (mg/dl)	125.5	23.1	121.5	34.4	120.2	35.8	122.2	32.6	0.974
Triglyceride (mg/dl)	144.2	69.8	155.4	88.5	155.5	94.3	153.9	70.6	0.979
HDL blood cholesterol (mg/dl)	60.4	19.7	51.3	13.2	52.4	14.2	53.5	13.0	0.423
Plasma glucose (mg/dl)	115.2	33.5	114.5	25.5	116.9	42.8	118.9	38.9	0.970
Glycated haemoglobin (%) [a]	7.5	1.5	7.1	0.9	7.7	1.4	7.4	1.2	0.693
SF-12v2 questionnaire outcomes									
Physical functioning	44.7	8.0	54.5	4.5	45.6	7.5	45.1	9.0	0.184
Role physical	46.1	5.3	57.4	4.7	46.0	10.4	44.2	12.8	0.161
Bodily pain	33.4	5.9	25.3	4.6	33.7	11.6	36.4	12.9	0.272
General health	40.4	5.5	48.2	9.9	40.9	6.9	40.1	8.1	0.237
Vitality	46.0	11.3	54.2	21.0	52.9	11.6	51.3	13.8	0.547
Social functioning	41.2	9.8	51.8	10.6	46.8	12.4	44.6	12.9	0.448
Mental health	45.5	10.7	53.9	8.4	45.4	11.8	42.5	12.4	0.251
Role emotional	50.3	13.5	47.2	10.6	49.2	11.8	50.1	12.7	0.954
PCS: Summary scale Physical	39.3	5.5	45.1	2.2	39.5	6.1	39.7	6.2	0.353
MCS: Summary scale Mental	48.4	14.0	53.5	9.3	51.2	13.3	49.4	15.3	0.871
Health-care attendance									
In the year prior to inclusion (visits per month)	1.1	0.6	1.5	0.9	1.6	1.2	1.5	1.2	0.574

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive, BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetres of mercury, min = minute, mg = milligram, dl = decilitre.
[a] Sample size for participants diagnosed with diabetes mellitus: Total (n = 57), AD-IN (n = 6), AD-AC (n = 9), NA-AC (n = 18), NA-IN (n = 24).
* p < .05

To determine categorical differences between groups, Pearson's chi-squared (χ^2) tests were used. A *p*-value below 0.05 was regarded as significant. Absence of association was found among qualitative variables and groups, except age grouping (as it has been shown previously without grouping age). In relation to categorical variables, difference was found for overweight diagnose. Although overweight participants were the majority in most groups, the adhered participants who were previously active (AD-AC) statistically showed a lower proportion ($\chi^2 = 16.3$, $p = .001$) than the others. The most common profile for participants in all the groups was an adult woman referred by their nurse from the PHC_B. Only the profile for AD-AC was slightly different with an older woman as most common participant (see Table 5.7).

Table 5.7 Homogeneity at baseline (M1) among groups for qualitative variables.

GROUP	AD-IN		AD-AC		NA-AC		NA-IN		
N = 178 [a]	*n* = 15	(%)	*n* = 20	(%)	*n* = 66	(%)	*n* = 76	(%)	*p*-value
Gender									0.252
Man	7	(46.7)	9	(45.0)	26	(39.4)	21	(27.6)	
Woman	**8**	(53.3)	**11**	(55.0)	**40**	(60.6)	**55**	(72.4)	
Primary Health-care Centre									0.358
A	4	(26.7)	10	(5.0)	32	(48.5)	30	(39.5)	
B	**11**	(73.3)	10	(5.0)	**34**	(51.5)	**46**	(60.5)	
Health practitioner									0.713
Physician	1	(6.7)	3	(15.0)	12	(18.2)	14	(18.4)	
Nurse	**14**	(93.3)	**17**	(85.0)	**54**	(81.8)	**62**	(81.6)	
Age group									0.015
18-44	1	(6.7)	0	(0.0)	8	(12.1)	16	(21.1)	
45-64	**12**	(80.0)	9	(45.0)	**31**	(47.0)	**40**	(52.6)	
65+	2	(13.3)	**11**	(55.0)	27	(40.9)	20	(26.3)	
Diagnosed overweight									
No	5	(33.3)	**18**	(90.0)	32	(48.5)	32	(42.1)	0.001

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive, BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetres of mercury, min = minute, mg = milligram, dl = decilitre. Bold = the most common within groups.
[a] 1 missing.

5.1.1 CLINICAL HEALTH OUTCOMES

M1 – baseline, M2 – during, M3 – post-intervention, and M4 – maintenance were recorded with the intention of tracking the evolution of clinical health parameters throughout participants' participation in the exercise counselling intervention. However, many participants (n = 143, 80.3%) did not adhere for six months, so the possible effects of exercise could not be assessed. Thus, these measures were used as intention-to-treat over three different periods. As shown in Figure 4.9 the period of time between M1 and M3 varies according to participants' adherence. To measure clinical effects over time, measurements are recoded as follows: M1 – baseline, MOT2, MOT3 and MOT4. Figure 5.2 shows two parallel timelines. One side displays normal follow-up for participation adherence. The other side displays intention-to-treat follow-up, where both adhering and non-adhering participants are included. The number of participants in adhered subgroups (AD-IN, AD-AC) differs in M3 compared to MOT3, and M4 to MOT4 because of drop-outs before completing 12 months of participation. However, there was enough time for post-intervention measurements (up to 3 months) or maintenance measurements (at least 3 months after abandonment) to be taken.

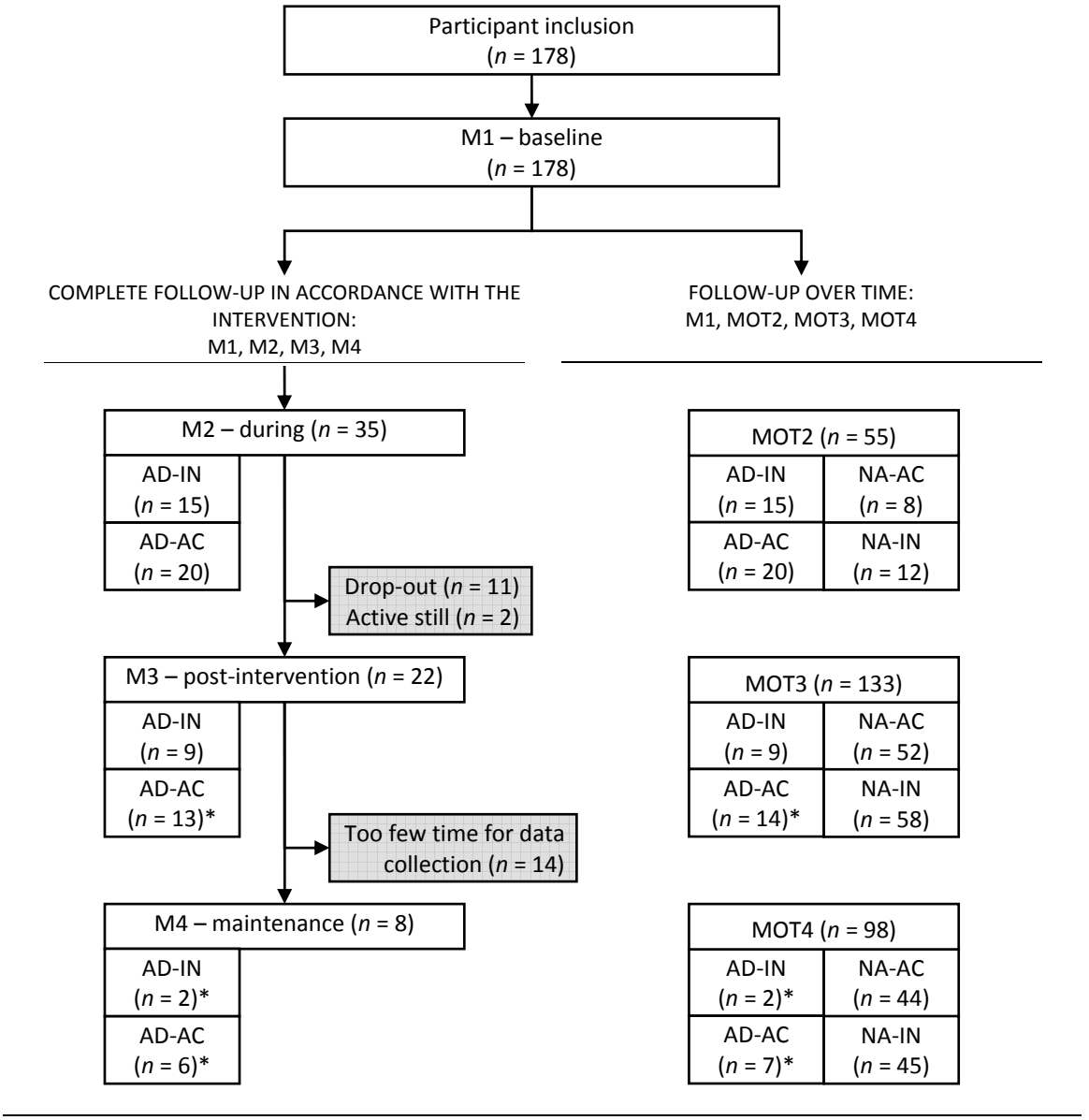

Figure 5.2 Follow-up assessment flow chart.

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive. * Participants were adhered for at least 6 months and dropped before completing the programme.

5.1.1.1 FOLLOW-UP IN ACCORDANCE WITH THE INTERVENTION

Two out of four groups were analysed according to intervention timing: AD-IN and AD-AC (see Table 5.8). Statistical differences between these two groups were calculated by contrast coefficient tests assuming equal variances for age ($t = 3.020$, $p = .041$) and assuming them for BMI ($t = 1.276$, $p = .204$). Previously active participants were significantly older than those previously insufficiently active (see Figure 5.3). Participant characteristics did not differ

significantly between groups in any other variables. This contrasts with differences found in BMI when comparing all four subgroups, as shown in Table 5.6.

Table 5.8 Homogeneity at baseline (M1) for adhered groups only.

	AD-IN (*n* = 15)		AD-AC (*n* = 20)		
GROUPS	Mean	SD	Mean	SD	*p*-value
Age*	56.0	9.2	64.5	6.5	0.041
Clinical parameters					
BMI (kg/m^{2-})	32.5	4.2	30.2	4.3	0.204

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, BMI = body mass index, kg = kilogram, m = metre.
* $p < .05$

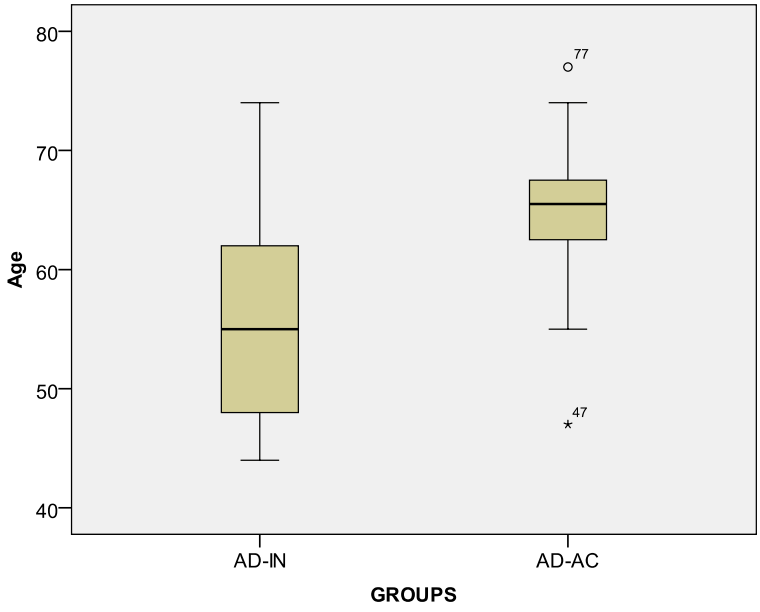

Figure 5.3 Box plot of participant adhered subgroups distribution by age.

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active.

Normally distribution by age was tested using the Shapiro-Wilk test (samples were lower than 30), with *p*-value greater than 0.05, so null hypothesis was accepted.

M2 was collected for a range of time from one month after inclusion up to one month before ending participation. The broad timeframe was due mostly to varying discharge. However, adherence was considered when participants kept to the programme and were compliant with prescriptions for six months (n = 35, 19.7%). Thirteen participants either dropped out between six and 12 months or did not finish by the time the intervention ended. As a result, 22 participants completed the whole CAMINEM programme intervention (M3), what means that one out of eight participants included (N = 178) fulfilled the programme (12.4%).

Results on clinical parameters for adhered subgroups during and post-intervention are shown in Table 5.9 and Table 5.10, respectively. Maintenance data was collected from 3 participants only and results are not relevant due to the low sample number.

Table 5.9 Clinical parameters during (M2) the intervention for adhered participants.

	AD-IN (n = 15)			AD-AC (n = 20)			Total		
GROUPS	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
BMI (kg/m^2)	14	31.8	4.9	15	29.6	4.5	29	30.7	4.7
Waist circumference (cm)	8	106.9	15.5	14	99.8	11.4	22	102.4	13.1
Systolic blood pressure (mmHg)	14	129.1	15.6	20	139.7	17.6	34	135.3	17.4
Diastolic blood pressure (mmHg)	14	78.0	11.5	20	77.7	9.9	34	77.8	10.5
Resting heart rate (beats/min)	11	72.2	13.4	16	69.1	11.8	27	70.3	12.3
Total blood cholesterol (mg/dl)	14	186.7	30.8	18	186.4	36.7	32	186.6	33.7
LDL blood cholesterol (mg/dl)	10	109.5	32.3	17	111.7	29.1	27	110.9	29.7
Triglyceride (mg/dl)	14	124.8	48.5	18	156.2	124.2	32	142.4	98.4
HDL blood cholesterol (mg/dl)	10	49.2	13.4	17	54.7	17.4	27	52.7	16.0
Plasma glucose (mg/dl)	14	122.1	39.4	17	113.6	27.4	31	117.4	33.0
Glycated haemoglobin (%) [a]	5	7.9	2.4	8	7.6	1.0	13	7.8	1.6

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetres of mercury, min = minute, mg = milligram, dl = decilitre.
[a] Sample size for participants diagnosed with diabetes mellitus: AD-IN (n = 6), AD-AC (n = 9), total (n = 15).

Table 5.10 Clinical parameters post-intervention (M3) for adhered participants.

GROUPS	AD-IN (*n* = 9)			AD-AC (*n* = 13)			Total		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
BMI (kg/m^2)	6	30.9	4.2	12	29.4	4.0	18	29.9	4.0
Waist circumference (cm)	4	107.3	9.7	12	98.1	7.7	16	100.4	8.9
Systolic blood pressure (mmHg)	5	131.6	6.8	13	138.9	20.6	18	136.9	18.0
Diastolic blood pressure (mmHg)	5	77.8	10.2	13	75.0	8.8	18	75.8	9.0
Resting heart rate (beats/min)	5	70.4	18.6	10	75.4	14.8	15	73.7	15.7
Total blood cholesterol (mg/dl)	5	178.6	46.4	11	205.7	33.1	16	197.3	38.4
LDL blood cholesterol (mg/dl)	2	110.1	86.1	9	133.3	30.4	11	129.1	39.6
Triglyceride (mg/dl)	5	119.0	62.7	11	103.4	28.3	16	108.3	40.5
HDL blood cholesterol (mg/dl)	2	53.5	14.8	9	53.8	8.1	11	53.7	8.6
Plasma glucose (mg/dl)	6	117.0	24.8	11	100.8	17.9	17	106.5	21.4
Glycated haemoglobin (%) [a]	4	6.9	1.5	4	7.0	0.9	8	7.0	1.2

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetres of mercury, min = minute, mg = milligram, dl = decilitre.
[a] Sample size for participants diagnosed with diabetes mellitus: AD-IN (*n* = 4), AD-AC (*n* = 5), total (*n* = 9).

Table 5.11 shows the *n* sample per group for pre-post analyses for all clinical parameters. Evolution between baseline (M1) and post-intervention (M3) were considered preferable over evolution between baseline (M1) and during intervention (M2) for assessing long-term effects. BMI was the unique clinical parameter measured in the three different moments by a minimum of five participants, the minimum threshold selected. All other clinical parameters were measured in two different moments (basal and during- or post-intervention) but waist circumference and HbA_{1c} because of low sample. Age was used as a covariate for ANOVA measurements (see Table 5.12).

Table 5.11 Sample for multivariate analyses of variance for adhered subgroups.

Measurements	M1 & M2 & M3		M1 & M3		M1 & M2		M2 & M3	
	AD-IN	AD-AC	AD-IN	AD-AC	AD-IN	AD-AC	AD-IN	AD-AC
Groups*	*n*	*n*	*n*	*n*	*n*	*n*	*n*	*n*
BMI	**5**	**9**	6	12	11	13	5	9
Waist circumference [a]	2	2	4	3	5	4	2	6
Systolic blood pressure	4	12	**5**	**12**	12	18	4	13
Diastolic blood pressure	4	12	**5**	**12**	12	18	4	13
Resting heart rate	4	9	4	10	**7**	**14**	4	9
Total blood cholesterol	3	8	3	10	**11**	**17**	5	9
LDL blood cholesterol	1	5	1	8	**7**	**13**	2	6
Triglyceride	3	8	3	10	**12**	**16**	5	9
HDL blood cholesterol	1	5	1	8	**7**	**13**	2	6
Plasma glucose	4	7	4	10	**12**	**16**	6	8
Glycated haemoglobin [a]	3	3	3	4	4	8	4	3

Note. M1 = basal, M2 = during, M3 = post-intervention, AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, BMI = body mass index. Grey = selected measurements for analyses.
[a] No analysed.
* Sample size for: AD-IN (*n* = 15), AD-AC (*n* = 20).

Comparative analyses within and between groups were done by ANOVA for variables following normal distribution (diastolic blood pressure, rest heart rate, total blood cholesterol, LDL-cholesterol, and HDL-cholesterol). Non-parametric tests were applied for variables that were not normally distributed: Mann-Whitney *U* test between groups (body mass index, systolic blood pressure, triglycerides, and glucose), Wilcoxon's *Z* for two measures within groups (systolic blood pressure, triglycerides, and glucose), and Kendall's *W* for three measures within groups (BMI).

Table 5.12 Multivariate analyses of variance for adhered groups.

Measure		M1		M2		M3		Signification effects		Evolution	
Group		AD-IN (*n* = 15)	AD-AC (*n* = 20)	AD-IN (*n* = 15)	AD-AC (*n* = 20)	AD-IN (*n* = 9)	AD-AC (*n* = 13)	Group	Time	AD-IN	AD-AC
DBP [a] (mmHg)	mean	78.4	76.1			77.8	75.5			0.77%	0.77%
	SD	8.8	6.3			10.2	9.0	*p* = .631	*p* = .584	*p* = .533	*p* = .999
	n	5	12			5	12	Mdif = 1.7	Mdif = 1.0	Mdif = 2.0	Mdif = 0.0
HR [a] (beats·min^{-1})	mean	76.0	73.4	70.9	69.5					7.19%	5.61%
	SD	14.0	14.8	14.9	10.7			*p* = .154	*p* = .082	*p* = .555	*p* = .043*
	n	7	14	7	14			Mdif = 8.1	Mdif = 3.8	Mdif = 2.2	Mdif = 5.4 95% CI [0.2, 10.6]
CHO [a] (mg/dl)	mean	202.5	203.8	187.7	185.6					7.88%	9.81%
	SD	28.0	42.5	33.5	37.6			*p* = .606	*p* = .029*	*p* = .235	*p* = .051
	n	11	17	11	17			Mdif = 7.0	Mdif = 16.4 95% CI [1.9, 31.0]	Mdif = 14.1	Mdif = 18.7
LDL [a] (mg/dl)	mean	129.4	121.5	114.0	110.2					13.51%	10.25%
	SD	24.5	38.1	32.2	30.0			*p* = .522	*p* = .205	*p* = .891	*p* = .089
	n	7	13	7	13			Mdif = 12.1	Mdif = 10.4	Mdif = 2.1	Mdif = 18.6
HDL [a] (mg/dl)	mean	57.0	50.6	52.7	49.2					8.14%	2.82%
	SD	21.1	13.2	14.9	11.8			*p* = .353	*p* = .344	*p* = .754	*p* = .327
	n	7	13	7	13			Mdif = 8.8	Mdif = 2.2	Mdif = 1.4	Mdif = 2.9
BMI [b] (kg/m^2)	mean	32.2	30.2	31.9	29.4	31.5	29.3	M1	M3	2.45%	2.92%
	SD	3.4	5.2	5.3	5.3	4.4	4.7	*U* = 59.0	*U* = 28.0	*W* = 0.284	*W* = 0.326
	n	5	9	5	9	5	9	*p* = .570	*p* = .454	*p* = .241	*p* = .053
SBP [c] (mmHg)	mean	133.0	139.4			131.6	141.5	M1	M3	1.06%	-1.48%
	SD	10.5	17.4			6.8	19.2	*U* = 78.0	*U* = 21.5	*Z* = 0.405	*Z* = 0.356
	n	5	12			5	12	*p* = .118	*p* = .278	*p* = .686	*p* = .722
TG [c] (mg/dl)	mean	144.2	163.2	131.9	165.5			M1	M2	9.33%	-1.39%
	SD	69.8	91.1	48.6	128.9			*U* = 99.5	*U* = 118.0	*Z* = 0.628	*Z* = 0.398
	n	12	16	12	16			*p* = .719	*p* = .761	*p* = .531	*p* = .691
GLY [c] (mg/dl)	mean	117.8	116.5	124.0	113.8			M1	M2	-4.98%	2.36%
	SD	33.5	27.3	41.7	28.3			*U* = 106.0	*U* = 113.0	*Z* = 1.260	*Z* = 1.501
	n	12	16	12	16			*p* = .502	*p* = .812	*p* = .207	*p* = .133

Note. M1 = basal, M2 = during, M3 = post-intervention, AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, BMI = body mass index, kg = kilogram, m = metre, SBP = systolic blood pressure, DBP = diastolic blood pressure, Mdif = mean difference, mmHg = millimetres of mercury, HR = heart rate, min = minute, CI = confidence interval, CHO = total cholesterol, mg = milligram, dl = decilitre, TG = triglyceride, GLY = fasting glucose.

[a] 2x2 multivariate analysis. Age-adjusted comparison.

[b] Mann-Whitney *U* (pre- and post-intervention) and Kendall's *W* (pre-, during, and post-intervention within group).

[c] Mann-Whitney *U* (pre- and post-intervention) and Wilcoxon's *Z* (pre- and post-intervention within group).

* $p < .05$

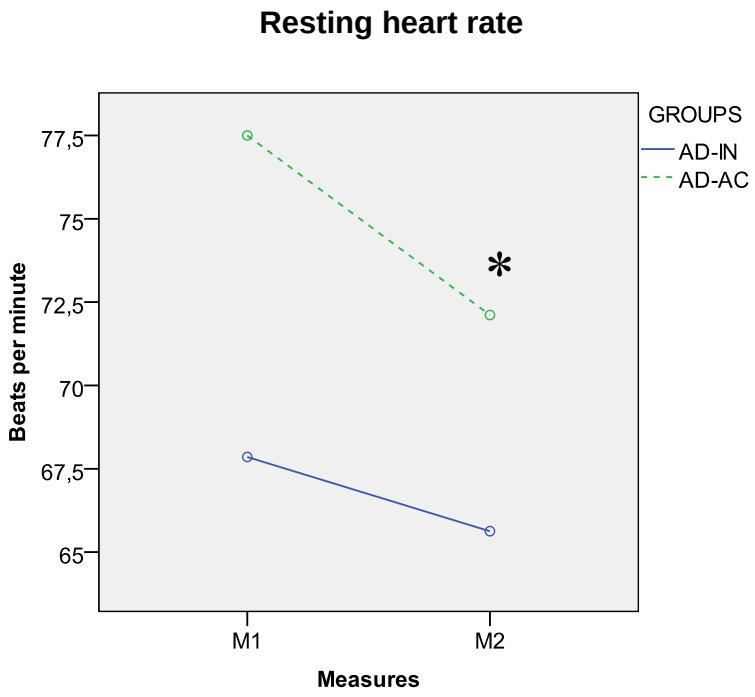

Figure 5.4 Resting heart rate evolution for adhered groups.

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active.

* Decrease for adhered and previously active participants: p = .043, 95% Confidence interval [0.2, 10.6].

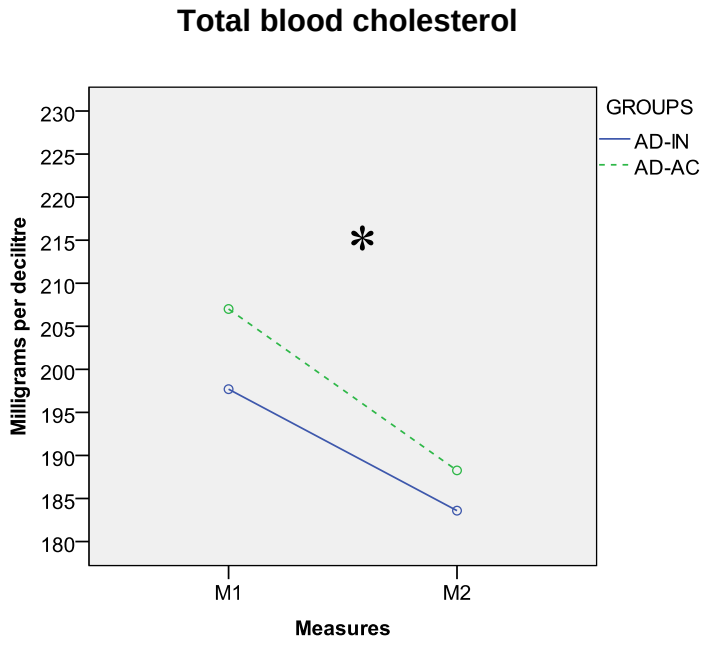

Figure 5.5 Total blood cholesterol evolution for adhered groups.

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active.

* Decrease within groups from M1 to M2: p = .029, 95% Confidence interval [1.9, 31.0].

Statistical differences were found in rest heart rate for the AD-AC group and blood total cholesterol before-after the intervention for AD-IN and AD-AC groups, see Figure 5.4 and Figure 5.5. Heart Rate decreased by 5.61% beats per minute (p = .043) with 95% CI [0.2, 10.6] and cholesterol decreased significantly (p = .029), with 95% CI [1.9, 31.0].

5.1.1.2 INTENTION-TO-TREAT FOLLOW-UP

MOT2 was collected for participants who were included in the intervention from 64 to 508 days, with a median of 349 days. MOT2 was taken for active participants after the first month of inclusion up to nine. Active participants with less than 180 days of inclusion by the time the intervention ended could have been assessed. MOT3 was collected for all participants who had concluded their participation by the time the intervention ended. Thus, time ranged from 0 to 477 days with a median of 42. This low number was due to the high rate of participants dropping out after the first consultation (n = 45), see Figure 5.1 (p. 133). Results on clinical parameters during (MOT2), post-intervention (MOT3) and maintenance (MOT4) are shown in Table 5.13, Table 5.14, and Table 5.15, respectively.

Table 5.13 Clinical parameters during intention-to-treat follow-up (MOT2).

	AD-IN (n = 15)			AD-AC (n = 20)			NA-AC (n = 8)			NA-IN (n = 12)			Total (N = 55)		
GROUPS	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
BMI (kg/m^2)	14	31.8	4.9	15	29.6	4.5	6	29.9	3.3	9	31.5	3.5	44	30.7	4.3
Waist circumference (cm)	8	106.9	15.5	14	99.8	11.4	3	96.3	7.0	1	91.5		26	101.3	12.5
Systolic blood pressure (mmHg)	14	129.1	15.6	20	139.7	17.6	8	135.6	13.7	10	131.3	13.2	52	134.6	16.0
Diastolic blood pressure (mmHg)	14	78.0	11.5	20	77.7	9.9	8	80.8	8.4	10	82.0	8.1	52	79.1	9.8
Resting heart rate (beats/min)	11	72.2	13.4	16	69.1	11.8	4	71.3	11.8	8	82.4	9.3	39	72.9	12.4
Total blood cholesterol (mg/dl)	14	186.7	30.8	18	186.4	36.7	6	206.0	33.9	10	193.5	22.6	48	190.4	31.8
LDL blood cholesterol (mg/dl)	10	109.5	32.3	17	111.7	29.1	5	132.5	29.3	10	119.6	21.1	42	115.5	28.2
Triglyceride (mg/dl)	14	124.8	48.5	18	156.2	124.2	5	122.2	38.5	10	105.0	26.1	47	132.3	83.9
HDL blood cholesterol (mg/dl)	10	49.2	13.4	17	54.7	17.4	5	53.2	23.5	10	52.9	6.0	42	52.8	15.0
Plasma glucose (mg/dl)	14	122.1	39.4	17	113.6	27.4	6	100.0	13.3	10	117.7	38.9	47	115.3	32.6
Glycated haemoglobin (%) [a]	5	7.9	2.4	8	7.6	1.0	1	6.5		3	7.7	1.4	17	7.7	1.5

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive, BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetre of mercury, min = minute, mg = milligram, dl = decilitre.
[a] Sample size for participants diagnosed with diabetes mellitus: AD-IN (n = 6), AD-AC (n = 6), NA-AC (n = 1), NA-IN (n = 4), total (n = 17).

Table 5.14 Clinical parameters post-intervention intention-to-treat follow-up (MOT3).

GROUPS	AD-IN (*n* = 9)			AD-AC (*n* = 14)			NA-AC (*n* = 52)			NA-IN (*n* = 58)			Total (*N* = 133)		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
BMI (kg/m^2)	6	30.9	4.2	12	29.4	4.0	23	31.4	3.8	22	34.8	4.9	63	32.1	4.7
Waist circumference (cm)	4	107.3	9.7	12	98.1	7.7	3	104.7	12.7	8	103.8	11.7	27	101.9	9.9
Systolic blood pressure (mmHg)	5	131.6	6.8	13	138.9	20.6	27	133.1	14.5	28	127.1	14.5	73	131.8	15.7
Diastolic blood pressure (mmHg)	5	77.8	10.2	13	75.0	8.8	27	79.6	11.4	28	79.9	10.3	73	78.8	10.4
Resting heart rate (beats/min)	5	70.4	18.6	10	75.4	14.8	20	78.0	12.6	16	73.8	13.1	51	75.4	13.6
Total blood cholesterol (mg/dl)	5	178.6	46.4	11	205.7	33.1	16	205.8	40.2	18	198.3	43.7	50	200.3	40.3
LDL blood cholesterol (mg/dl)	2	110.1	86.1	9	133.3	30.4	14	125.2	32.9	11	106.5	38.0	36	120.7	36.8
Triglyceride (mg/dl)	5	119.0	62.7	11	103.4	28.3	16	125.4	65.5	17	169.2	108.4	49	135.0	80.3
HDL blood cholesterol (mg/dl)	2	53.5	14.8	9	53.8	8.1	14	56.6	14.5	11	52.5	17.4	36	54.4	13.7
Plasma glucose (mg/dl)	6	117.0	24.8	11	100.8	17.9	15	107.1	21.8	18	123.7	40.2	50	112.9	30.2
Glycated haemoglobin (%) [a]	4	6.9	1.5	4	7.0	0.9	3	6.9	1.0	7	7.7	1.2	18	7.2	1.2

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive, BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetre of mercury, min = minute, mg = milligram, dl = decilitre.
[a] Sample size for participants diagnosed with diabetes mellitus AD-IN (*n* = 4), AD-AC (*n* = 6), NA-AC (*n* = 15), NA-IN (*n* = 8), total (*n* = 33).

Table 5.15 Clinical parameters at maintenance intention-to-treat follow-up (MOT4).

GROUP	AD-IN (*n* = 2)			AD-AC (*n* = 7)			NA-AC (*n* = 44)			NA-IN (*n* = 45)			Total (*N* = 98)		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
BMI (kg/m^2)				1	25.7	.	21	31.3	3.8	28	34.8	6.0	50	33.1	5.5
Waist circumference (cm)							9	101.6	12.1	10	109.2	12.1	19	105.6	12.4
Systolic blood pressure (mmHg)	1	147.0	.	2	146.0	28.3	26	134.4	19.2	33	134.4	15.6	62	135.0	17.3
Diastolic blood pressure (mmHg)	1	101.0	.	2	85.0	4.2	26	76.8	10.0	33	82.0	12.1	62	80.2	11.5
Resting heart rate (beats/min)				1	81.0	.	20	73.8	11.1	23	78.0	11.4	44	76.1	11.2
Total blood cholesterol (mg/dl)	1	183.0	.	1	171.0	.	25	198.3	43.6	24	195.0	39.3	51	195.9	40.5
LDL blood cholesterol (mg/dl)				1	98.2	.	16	120.1	37.0	19	125.2	41.0	36	122.2	38.4
Triglyceride (mg/dl)	1	275.0	.	1	214.0	.	25	176.8	117.3	24	155.6	75.0	51	169.5	97.9
HDL blood cholesterol (mg/dl)				1	30.0	.	16	59.5	32.2	18	50.4	14.5	35	54.0	24.5
Plasma glucose (mg/dl)	1	140.0	.	1	115.0	.	26	109.2	28.8	23	124.7	45.5	51	116.9	37.4
Glycated haemoglobin (%) [a]	1	6.1	.	1	7.0	.	5	7.0	0.6	9	7.3	1.2	16	7.1	0.9

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive, BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetre of mercury, min = minute, mg = milligram, dl = decilitre.
[a] Sample size for participants diagnosed with diabetes mellitus AD-IN (*n* = 1), AD-AC (*n* = 5), NA-AC (*n* = 12), NA-IN (*n* = 15), total (*n* = 33).

Comparative analyses within and between groups were done. Due to a low sample for four measurements, basal (M1) and post-intervention (MOT3) were chosen for pre-post analyses, grouping adhered participants and non-adhered participants. Thus, the adhered group (AD-Group) comprised of AD-IN and AD-AC and the non-adhered group (NA-Group) comprised of NA-AC and NA-IN. Homogeneity between these two groups was calculated by contrast coefficient tests not assuming equal variances for age (t = 1.552, p = .126) and assuming them for BMI (t = 0.731, p = .466). As a result, adhered and non-adhered groups were homogeneous at baseline for all clinical parameters, as well as for categorical variables except those diagnosed with dyslipidemia and overweight (see Table 5.16).

There were no statistical differences between the two groups on baseline data neither for continuous variables nor for qualitative data (gender, practitioner referring, PHC centre) except those diagnosed with dyslipidemia or overweight.

Table 5.16 Homogeneity at baseline (M1) between groups by adherence.

	AD-Group (n = 35)		NA-Group (n = 142)		
GROUPS	Mean	SD	Mean	SD	p-value
Age	60.8	8.8	57.4	12.9	0.126
Clinical parameters					
BMI (kg·m$^{2-1}$)	31.2	4.3	32.2	4.9	0.466
	AD-Group		NA-Group		
GROUPS	n = 35	(%)	n = 142	(%)	p-value
Diagnosed dyslipidemia	19	(29.7)	45	(70.3)	0.022*[a]
Diagnosed overweight	12	(13.3)	78	(86.7)	0.046*[b]

Note. AD-Group = adhered, NA-Group = non-adhered, BMI = body mass index, kg = kilogram, m = metre.
[a] Continuity correction = 5.270
[b] Continuity correction = 3.998
* p < .05

Comparative analyses within and between groups were done using ANOVA for variables following normal distribution (rest heart rate, total blood cholesterol, LDL-cholesterol). Non-parametric tests were applied for variables that were not normally distributed: body mass index, waist circumference, systolic and diastolic blood pressure, triglycerides, HDL-cholesterol, glucose, and glycated haemoglobin.

Table 5.17 Intention-to-treat multivariate analyses of variance.

Measure		M1		MOT3		Signification effects		Evolution	
Group		AD (*n* = 35)	NA (*n* = 142)	AD (*n* = 23)	NA (*n* = 110)	Group	Time	AD	NA
HR [a] (beats/min)	mean	72.9	73.6	72.7	76.2			0.21%	-3.50%
	SD	15.8	12.1	15.7	13.4	*p* = .583	*p* = .564	*p* = .969	*p* = .271
	n	14	32	14	32	Mdif = 2.1	Mdif = 1.3	Mdif = 0.1	Mdif = 2.7
CHO [a] (mg/dl)	mean	201.2	222.3	193.4	199.0			4.06%	11.71%
	SD	25.4	43.3	36.4	41.8	*p* = .287	*p* = .008**	*p* = .383	*p* = .001**
	n	13	23	13	23	Mdif = 13.3	Mdif = 15.6 95% CI [4.3, 26.9]	Mdif = 7.8	Mdif = 23.3 95% CI [9.7, 36.9]
LDL [a] (mg/dl)	mean	125.8	127.7	127.7	115.1			-1.48%	10.95%
	SD	22.2	35.0	40.4	38.4	*p* = .698	*p* = .413	*p* = .852	*p* = .131
	n	9	14	9	14	Mdif = 5.4	Mdif = 5.4	Mdif = 1.9	Mdif = 12.6
BMI [b] (kg/m^{2-})	mean	30.5	33.4	29.9	32.8	M1	MOT3	1.99%	1.91%
	SD	4.1	4.6	4.0	4.4	*U* = 1553.0	*U* = 242.0	*Z* = 1.862	*Z* = 3.314
	n	18	44	18	44	*p* = .230	*p* = .013*	*p* = .063	*p* = .002**
WC [b] (cm)	mean	102.6	108.7	100.6	106.75	M1	MOT3	1.99%	1.87%
	SD	9.09	12.3	7.2	11.3	*U* = 441.5	*U* = 75.0	*Z* = 0.847	*Z* = 1.791
	n	7	8	7	8	*p* = .995	*p* = .521	*p* = .397	*p* = .073
SBP [b] (mmHg)	mean	137.5	135.3	138.6	130.8	M1	MOT3	-0.76%	3.50%
	SD	15.6	15.9	16.9	14.6	*U* = 1775.0	*U* = 375.0	*Z* = 0.207	*Z* = 2.349
	n	17	51	17	51	*p* = .303	*p* = .124	*p* = .836	*p* = .019*
DBP [b] (mmHg)	mean	76.8	80.4	76.2	79.4	M1	MOT3	0.76%	1.31%
	SD	6.9	11.1	9.1	10.3	*U* = 1943.0	*U* = 385.5	*Z* = 0.649	*Z* = 0.791
	n	17	51	17	51	*p* = .757	*p* = .161	*p* = .516	*p* = .429
TG [b] (mg/dl)	mean	144.9	171.2	112.5	145.9	M1	MOT3	28.77%	17.37%
	SD	70.9	90.4	43.4	87.8	*U* = 1482.5	*U* = 206.5	*Z* = 2.621	*Z* = 1.773
	n	13	21	13	21	*p* = .736	*p* = .220	*p* = .009**	*p* = .076
HDL [b] (mg/dl)	mean	51.9	51.2	52.0	50.0	M1	MOT3	-0.21%	2.42%
	SD	13.0	12.1	8.5	11.1	*U* = 1113.5	*U* = 132.5	*Z* = 0.178	*Z* = 0.624
	n	9	14	9	14	*p* = .808	*p* = .864	*p* = .859	*p* = .533
GLY [b] (mg/dl)	mean	114.4	119.1	107.2	113.0	M1	MOT3	6.67%	5.43%
	SD	28.9	41.7	23.5	25.3	*U* = 1701.0	*U* = 243.5	*Z* = 0.754	*Z* = 0.505
	n	14	21	14	21	*p* = .983	*p* = .448	*p* = .451	*p* = .614
HbA_{1c} [b c] (%)	mean	7.4	7.4	7.2	7.2	M1	MOT3	2.58%	1.77%
	SD	1.4	0.9	1.0	1.1	*U* = 214.5	*U* = 33.5	*Z* = 0.406	*Z* = 0.254
	n	7	7	7	7	*p* = .565	*p* = .565	*p* = .684	*p* = .799

Note. M1 = basal, MOT3 = over time post-intervention, AD = adhered to the intervention, NA = non adhered to the intervention, HR = heart rate, min = minute, Mdif = mean difference, CHO = total cholesterol, mg = milligram, dl = decilitre, CI = confidence interval, BMI = body mass index, kg = kilogram, m = metre, WC = waist circumference, cm = centimetre, SBP = systolic blood pressure, mmHg = millimetres of mercury, DBP = diastolic blood pressure, TG = triglyceride, GLY = fasting glucose.

[a] 2x2 multivariate analysis. Age-adjusted comparison.

[b] Mann-Whitney *U* (pre- and post-intervention) and Wilcoxon's *Z* (pre- and post-intervention within group).

[c] Percentage varies due to decimals.

* $p < .05$ ** $p < .01$

As shown in Table 5.17, most clinical parameters improved over time for both groups: participants who adhered and who did not adhere. Improvements in total blood cholesterol (p = .008, 85% CI [4.3, 26.9]) and BMI (p = .013) were found over time regardless of grouping. Adhered participants saw a significant decrease in their triglycerides level (28.77%, p = .009) when comparing means range. The NA-Group showed significant improvements in total blood cholesterol (11.71%, p = .001, 95% CI [9.7, 36.9]), see Figure 5.6. The range mean for BMI also improved significantly for the NA-Group (1.91%, p = .002); although it did not for the AD-Group, most likely due to a larger sample. Differences in range mean for SBP was also significant for the NA-Group (3.50%, p = .019) while it did not improve for the AD-Group.

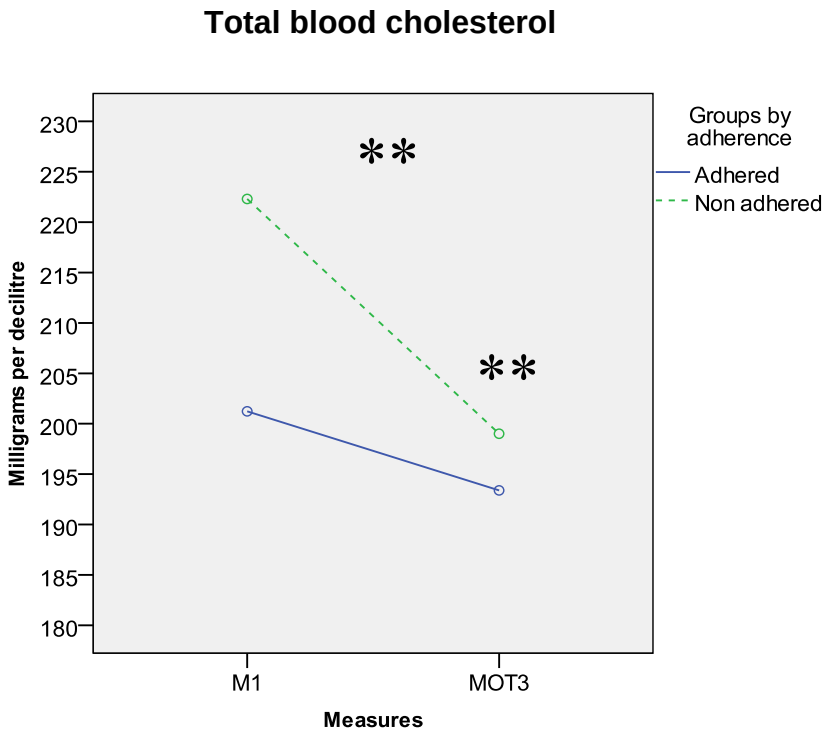

Figure 5.6 Total blood cholesterol evolution for groups according to their adherence.

** Decrease within groups from M1 to MOT3: p = .008, 95% Confidence interval [4.3, 26.9]; and for the non-adhered group: p = .001, 95% Confidence interval [9.7, 36.9].

5.1.2 QUALITY OF LIFE

Data collection for quality-of-life data was more regular than clinical parameters, since the exact dates for collection were the first contact visit, six-, nine-, and twelve-month consultation. In relation to SF-12v2 outcomes, PCS and MCS scores include overall physical and mental health respectively from the 12 questionnaire items. The AD-IN group saw an increase in all scores over time. It should be noted that the score for "bodily pain" is better if it is lower. On the other hand, the previously active participants (AD-AC) saw a decrease in all scores in relation to physical health from baseline (M1) to post-intervention (M3), although overall mental health did increase by 16.67%.

Multivariate analyses were not used because any combination of measurements included a minimum of $n = 5$ for each group, except M2a and M3 (six- and twelve-month follow-up) which is not relevant for pre-post analyses. Table 5.18 shows a sample for grouping. See Table 5.19 for complete results during the intervention.

Table 5.18 Sample for analyses of variance for quality-of-life outcomes.

Groups	AD-IN Adhered, previously inactive (*n* = 15)	AD-AC Adhered, previously active (*n* = 20)
Combination		
M1 & M2a & M2b & M3	2	0
M1 & M2a & M3	2	0
M1 & M2b & M3	3	0
M1 & M2a & M2b	6	4
M2a & M2b & M3	3	7
M1 & M3	3	0
M1 & M2b	7	4
M1 & M2a	6	4
M2a & M3	6	10

Note. M1 = baseline, M2a = 6-month follow-up, M2b = 9-month follow-up, M3 = 12-month follow-up.

Table 5.19 SF-12v2 data for adhered participants.

		AD-IN (*n* = 15)		AD-AC (*n* = 20)		TOTAL (*n* = 35)	
GROUP		Mean	SD	Mean	SD	Mean	SD
SF-12v2 questionnaire outcomes							
Physical functioning	M1	44.7	8.0	54.5	4.5	48.0	8.3
	M2a	46.3	9.4	52.9	5.3	50.3	7.8
	M2b	49.8	5.7	51.8	7.7	50.9	6.8
	M3	50.6	3.9	54.2	4.0	52.7	4.3
Role physical	M1	46.1	5.3	57.4	4.7	49.9	7.4
	M2a	48.1	7.4	55.8	5.6	52.8	7.3
	M2b	49.8	5.7	52.4	7.6	51.3	6.8
	M3	51.8	5.3	53.5	8.3	52.9	7.1
Bodily pain	M1	33.4	5.9	25.3	4.6	30.7	6.6
	M2a	33.1	7.7	31.1	9.7	31.9	8.9
	M2b	30.4	7.3	27.3	6.1	28.6	6.7
	M3	29.1	4.6	25.8	5.8	27.2	5.5
General health	M1	40.4	5.5	48.2	9.9	43.0	7.8
	M2a	44.7	7.3	45.0	6.8	44.9	6.9
	M2b	43.5	6.6	48.8	6.5	46.5	6.9
	M3	45.6	5.2	47.2	5.8	46.6	5.5
Vitality	M1	46.0	11.3	54.2	21.0	48.7	14.8
	M2a	51.7	13.0	62.2	8.2	58.1	11.4
	M2b	55.3	9.2	64.7	7.2	60.6	9.3
	M3	53.6	9.7	63.0	8.2	59.2	9.8
Social functioning	M1	41.2	9.8	51.8	10.6	44.7	10.9
	M2a	47.5	8.8	52.1	8.5	50.3	8.8
	M2b	47.6	10.5	57.1	0.0	53.0	8.3
	M3	52.4	5.6	52.2	12.7	52.3	10.2
Mental health	M1	45.5	10.7	53.9	8.4	48.3	10.4
	M2a	44.9	8.8	52.5	6.6	49.5	8.3
	M2b	49.1	8.0	54.2	5.8	52.0	7.1
	M3	49.4	6.3	55.5	6.3	53.0	6.9
Role emotional	M1	50.3	13.5	47.2	10.6	49.2	12.2
	M2a	56.4	6.7	60.0	9.4	58.6	8.5
	M2b	50.9	8.4	60.1	7.3	56.1	8.9
	M3	55.7	9.9	62.5	9.0	59.7	9.7
PCS: Summary scale Physical	M1	39.3	5.5	45.1	2.2	41.2	5.4
	M2a	39.7	4.5	41.6	4.3	40.8	4.4
	M2b	41.1	5.5	39.5	6.1	40.2	5.8
	M3	40.8	5.1	39.5	5.9	40.0	5.5
MCS: Summary scale Mental	M1	48.4	14.0	53.5	9.3	50.1	12.5
	M2a	53.9	7.8	61.5	10.0	58.5	9.8
	M2b	53.4	10.5	64.8	4.7	59.9	9.5
	M3	56.8	7.3	64.2	10.3	61.1	9.7

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, M1 = baseline, M2a = 6-month follow-up, M2b = 9-month follow-up, M3 = 12-month follow-up.

According to self-perception of well-being by the simple question '*What do you think about your overall health, is it better, worse, or the same as the day you started the CAMINEM programme?'* all participants reported feeling equal or better than the inclusion day at both the six- and nine-month measurement periods during the intervention. The greatest difference was found for previously inactive participants who reported feeling better after nine months of participation (91.7%). However, nearly half of the participants did not answer the question at the six- (15 of 35) or nine-month (16 of 33) follow-up. By the end of the intervention, none of the respondents reported feeling worse compared to their first day and 100% of previously inactive participants reported feeling better than their first day. Chi-squared tests were used to measure the relationship between self-perception of health and groups. The results suggested that the rate of previously inactive participants feeling better was higher than those previously active. See Table 5.20 for all data concerning post-intervention measurements.

Table 5.20 Self-reported perception of health for adhered participants.

		AD-IN		AD-AC		TOTAL	
GROUP		*n*	(%)	*n*	(%)	*n*	(%)
Self-perception of health [a]	M2a						
Worst		0	(0.0)	0	(0.0)	0	(0.0)
Equal		1	(9.1)	5	(55.6)	6	(30.0)
Better		10	(90.9)	4	(44.4)	14	(70.0)
Self-perception of health [b]	M2b						
Worst		0	(0.0)	0	(0.0)	0	(0.0)
Equal		1	(8.3)	1	(20.0)	2	(11.8)
Better		11	(91.7)	4	(80.0)	15	(88.2)
Self-perception of health [c]	M3						
Worst		0	(0.0)	0	(0.0)	0	(0.0)
Equal		0	(0.0)	5	(38.5)	5	(23.8)
Better		8	(100.0)	8	(61.5)	16	(76.2)

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, M2a = 6-month follow-up, M2b = 9-month follow-up, M3 = 12-month follow-up.
[a] AD-IN (*n* = 15), AD-AC (*n* = 20), total (*n* = 35). Missing data *n* = 15.
[b] AD-IN (*n* = 15), AD-AC (*n* = 18), total (*n* = 33). Missing data *n* = 16.
[c] AD-IN (*n* = 9), AD-AC (*n* = 13), total (*n* = 22). Missing data *n* = 1.

5.1.3 HEALTH SERVICES DEMAND

Participant health-care attendance was similar before, during and after the CAMINEM intervention. Globally, included participants averaged 1.5 visits per month in the year before their inclusion. Participants who finally adhered to the intervention attended their GP or nurse less than those who did not adhere, although these differences were not statistically significant ($p > .05$) after the values had been measured using ANOVA test. During and after their inclusion participants averaged 1.3 visits. Table 5.21 shows participants' attendance rate to their primary-care unit (PCU), GP and nurse. Adhered participants globally attended few times their PCU in the duration of the study, although no differences between groups were found after completing ANOVA tests on all measures. Samples for adhered participants are small compared to non-adhered participants, so ranges within groups vary greatly (see Figure 5.7). When the same number of months before and after the inclusion date are compared, the attendance rate of all groups decreases to a total of 1.69 visits per month before the inclusion date and 1.3 after the inclusion date (during and after the intervention).

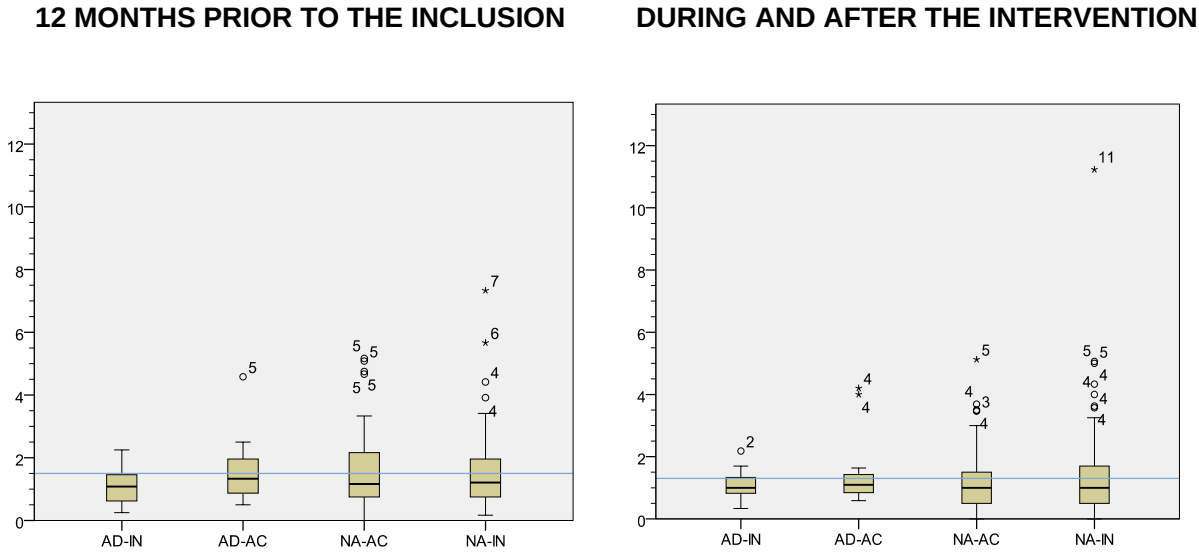

Figure 5.7 Health-care provider visits per month by intervention groups.

Note. Blue lines = mean. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive.

Table 5.21 Participant health-care attendance.

VISITS PER MONTH	*n*	Mean	Median	Minimum	Maximum
In the year prior to the inclusion					
AD-IN	15	1.11	1.08	0.25	2.25
AD-AC	20	1.50	1.33	0.50	4.58
Subtotal adhered		1.34	1.17		
NA-AC	66	1.55	1.17	0.00	5.17
NA-IN	76	1.54	1.21	0.17	7.33
Subtotal non-adhered		1.54	1.17		
Total	177	1.50	1.17	0.00	7.33
During the intervention					
AD-IN	15	1.09	1.00	0.33	2.18
AD-AC	20	1.50	1.13	0.59	5.00
Subtotal adhered		1.33	1.08		
NA-AC	45	1.42	1.00	0.00	9.50
NA-IN	45	1.62	1.00	0.00	7.00
Subtotal non-adhered		1.52	1.00		
Total	125	1.47	1.00	0.00	9.50
After the intervention					
AD-IN	8	1.03	1.00	0.00	2.00
AD-AC	14	0.77	0.67	0.00	3.25
Subtotal adhered		0.86	0.78		
NA-AC	51	1.06	1.00	0.00	5.13
NA-IN	58	1.44	1.00	0.00	12.00
Subtotal non-adhered		1.27	1.00		
Total	131	1.39	1.00	0.00	12.00
Previous months from inclusion					
AD-IN	15	1.13	1.14	0.25	2.07
AD-AC	20	1.49	1.36	0.47	4.40
Subtotal adhered		1.34	1.20		
NA-AC	66	1.76	1.32	0.00	6.50
NA-IN	76	1.80	1.40	0.40	7.62
Subtotal non-adhered		1.78	1.39		
Total	177	1.69	1.33	0.00	7.62
During and after intervention					
AD-IN	15	1.08	1.00	0.33	2.18
AD-AC	20	1.37	1.10	0.59	4.20
Subtotal adhered		1.25	1.06		
NA-AC	66	1.14	1.00	0.00	5.13
NA-IN	76	1.46	1.00	0.00	11.23
Subtotal non-adhered		1.32	1.00		
Total	177	1.30	1.00	0.00	11.23

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive.

5.2 FEASIBILITY

5.2.1 REACH

The total number of citizens registered at the two primary health-care settings included in the study was 49,184 at the end of 2010. 16,744 (34.04%) patients fulfilled the inclusion criteria, that is, patients over the age of 18 and diagnosed with diabetes mellitus and/or hypertension and/or dyslipidemia and/or ischemic heart disease and/or registered with BMI $\geq$ 25. Most of these patients (15,374; 91.82%) had visited their PHC provider at least once in 2010.

Records of referral invitations were not available. Consequently, the number of patients refusing to participate after their GP or nurse suggested inclusion is unknown.

Practitioners referred 229 patients to the exercise-on-prescription programme, with 1.49% of patients having visited their PHC provider. 201 (87.77%) finally attended the first consultation for the CAMINEM inclusion. The most commonly cited reasons for not attending were that phone contact could not be made (n = 10) or absence three times in a row (n = 8). Other reasons were reported by phone. The most common reason for exclusion was that they did not sign the informed consent (n = 14). Figure 5.8 shows the flow chart of participant's reach and reasons for exclusion.

With regard to proportion rates, Table 5.22 lists the participants and general population by diagnoses and primary health-care setting, making a comparison between the two. It shows that ranking by diagnoses is similar for both lists and overweight patients were proportionately higher, followed by hypertension and dyslipidemia.

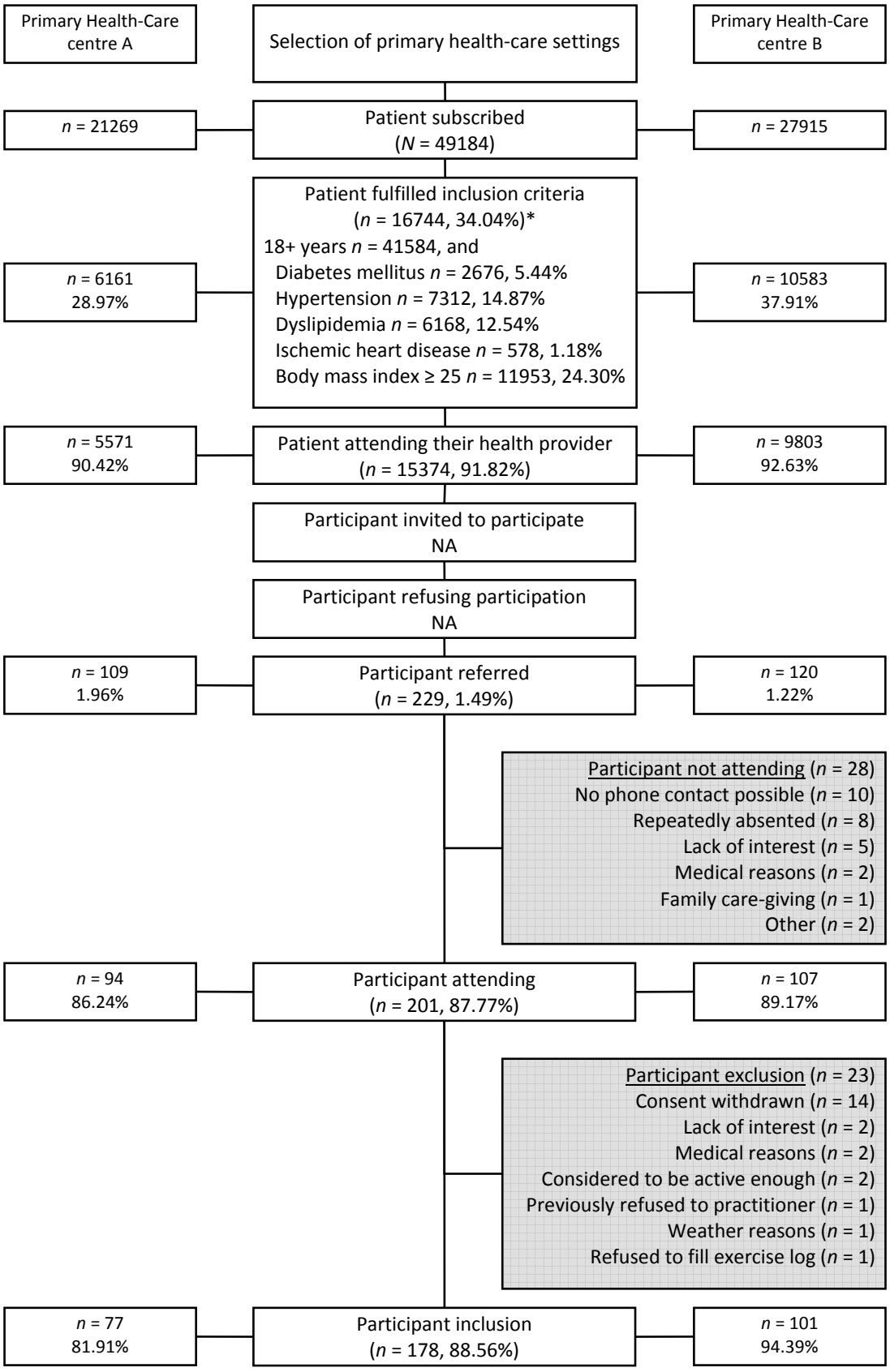

Figure 5.8 Participant's reach flow chart and reasons for exclusion.

Note. NA = not available. * More than one condition could be satisfied.

Table 5.22 Participants proportion rate.

	CAMINEM Programme		Inclusion criteria attending their health provider		Proportion	
					Ratio	(%)
	n = 178	(%) [a]	*N* = 15374	(%)	1:86	(1.16)
Health condition						
Overweight	90	(50.6)	11953	(24.3)	1:133	(0.75)
Hypertension	80	(44.9)	7312	(14.9)	1:91	(1.09)
Dyslipidemia	64	(36.0)	6168	(12.5)	1:96	(1.04)
Diabetes Mellitus	57	(32.0)	2676	(5.4)	1:47	(2.13)
Musculoskeletal	39	(21.9)				
Cardiovascular	30	(16.9)	578	(1.2)	1:19	(5.19)
Respiratory	24	(13.5)				
Mental illness	19	(10.7)				
Other	13	(7.3)				
Primary health-care centre						
A	77	(43.3)	21269	(43.2)	1:276	(1.38)
B	101	(56.7)	27915	(56.8)	1:276	(1.03)

[a] The sum exceeds 100%. More than one health condition could be satisfied.

5.2.2 ADOPTION

Seven public primary health-care settings can be found in Lleida, of which two of them were accessible for the purpose of the intervention. A total of 82 health practitioners were invited to refer patients to the CAMINEM programme (see Figure 5.9). None of them formally refused to participate although some did not refer any patients. For the 18 months that the intervention was in operation, 33 health practitioners from these two PHC centres (40.24%) referred at least one patient. Three patients registered at other PHC centres prompted their GPs to be referred.

Patient referral was, generally, the responsibility of the health practitioner signing the referral form. Although, each primary care unit self-organises some of their procedures, especially concerning health promotion, so the patient may have been referred by the nurse even though the form was signed by the GP. It should be noted that the majority of participants were referred by nurses (see Figure 5.10). Ten practitioners referred more than ten patients in total while other ten referred just one. No locum tenentes referred patients. On the other hand, nurses referred patients regardless of their employment situation: eight out of 12 substitute nurses referred (66.67%) and 19 out of 34 regular nurses (55.88%) made referrals. Table 5.23 shows the referrals ranking by PHC centre, practitioner and position.

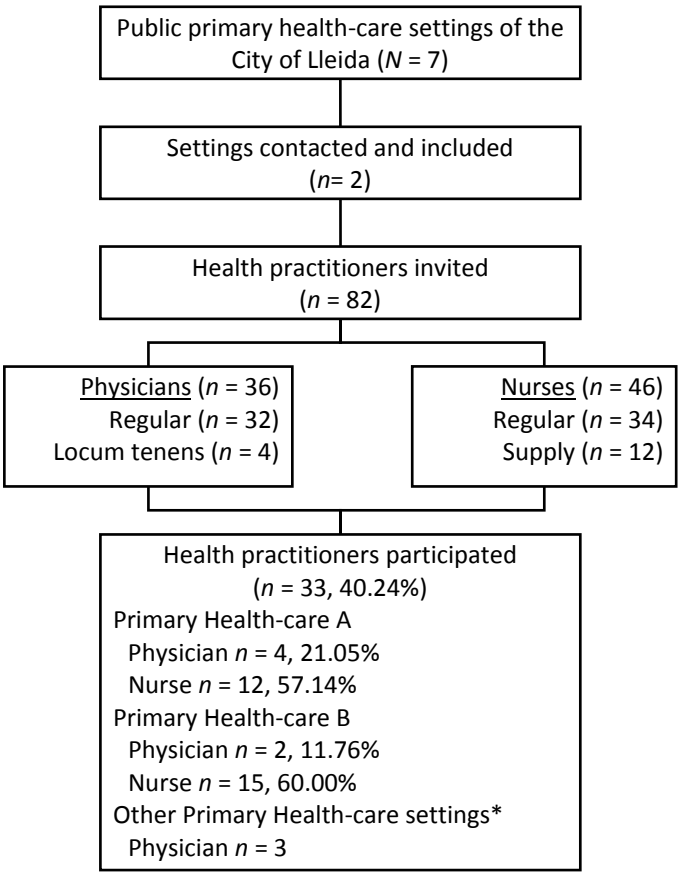

Figure 5.9 Settings and agents flow chart.

* Practitioners prompted by their patients.

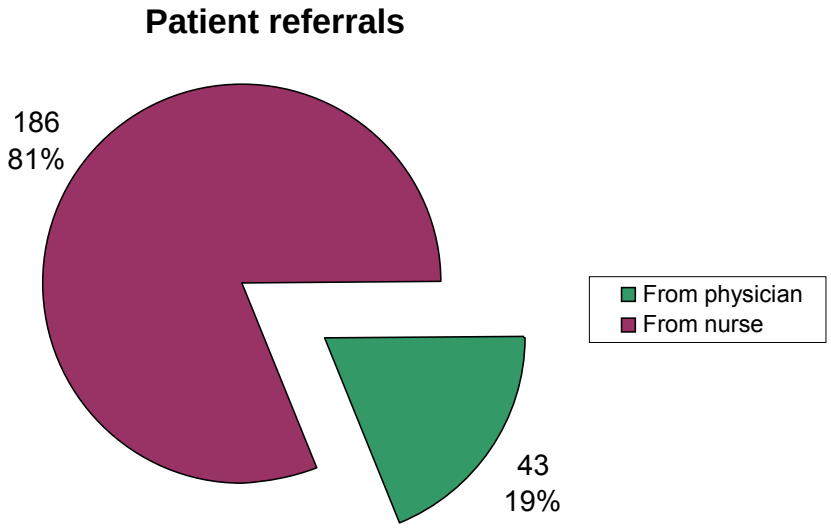

Figure 5.10 Distribution of referrals by health practitioner.

The distribution of participant inclusion in the programme was irregular during the intervention period. Participant inclusion peaked in the spring of the first year, that is, at the beginning of the intervention. Participant inclusions fell in the winter and increased again from March onwards (see Figure 5.11).

Table 5.23 Ranking of referrals by practitioner.

HP_ID	PHC Centre	Position	Referrals	HP_ID	PHC Centre	Position	Referrals
GP03	A	Regular	24	N13	A	Substitute [a]	4
N22	A	Regular	22	N09	B	Regular	3
N02	B	Regular	20	N19	A	Substitute [a]	3
N06	B	Regular	14	GP02	A	Regular	2
N10	B	Regular	13	N14	A	Substitute [a]	2
N12	A	Regular	12	N16	A	Substitute [a]	2
N24	B	Regular	12	N25	A	Regular	2
GP01	B	Regular	11	N27	A	Regular	2
N01	B	Regular	10	GP04	C[b]	Regular	1
N05	B	Regular	10	GP05	D[b]	Regular	1
N15	A	Regular	9	GP06	A	Regular	1
N17	A	Substitute [a]	9	GP07	C[b]	Regular	1
N03	B	Regular	6	GP08	A	Regular	1
N04	B	Substitute [a]	6	GP09	B	Regular	1
N11	A	Regular	6	N07	B	Regular	1
N08	B	Regular	5	N21	B	Substitute [a]	1
N18	A	Regular	5	N23	B	Regular	1
N20	B	Regular	5	N26	B	Substitute [a]	1

Note. HP_ID = health practitioner identification code, PHC = primary health care, GP = general practitioner, N = nurse.
[a] Working temporally for more than three months.
[b] Other primary health-care centres.

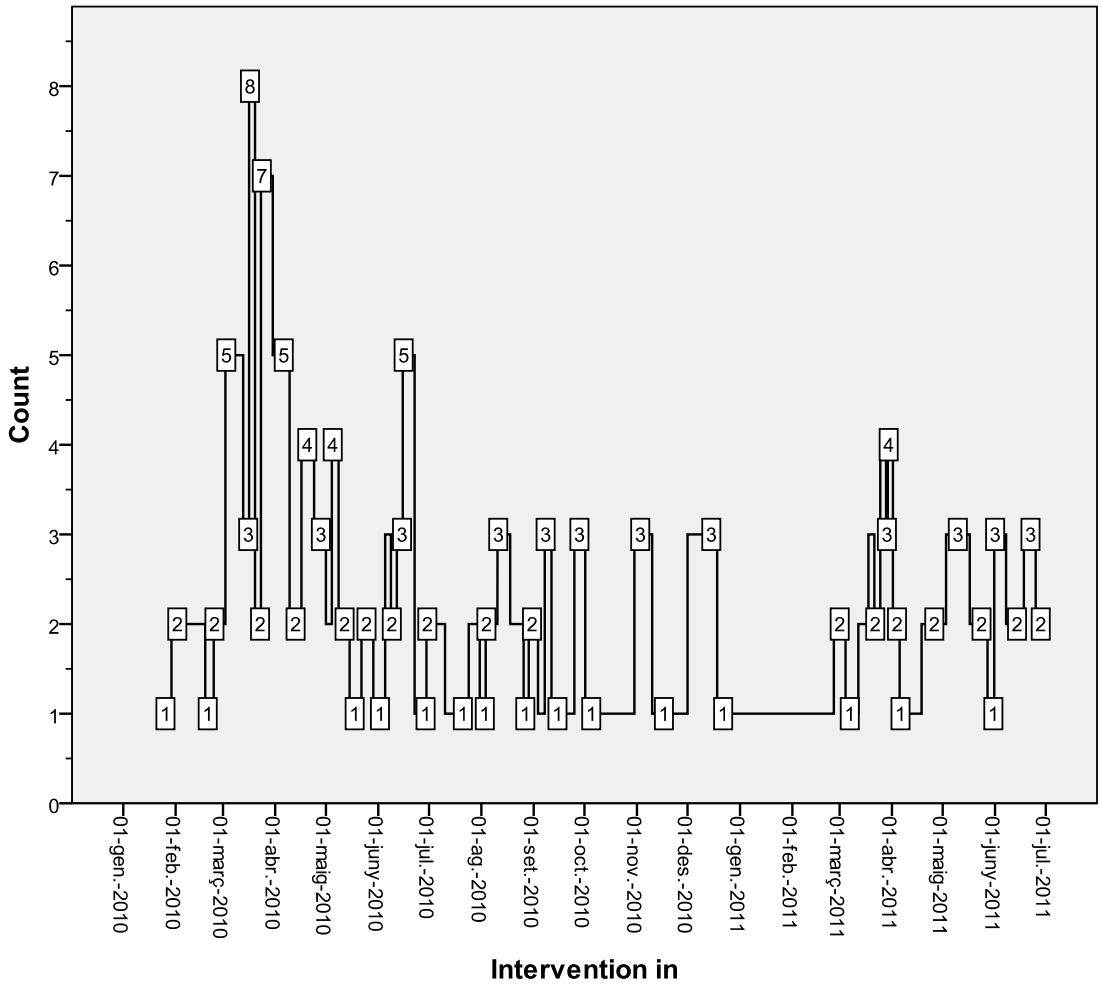

Figure 5.11 Number of cases in the programme during the intervention period.

5.2.3 IMPLEMENTATION

Implementation of the CAMINEM intervention can be considered as the extent to which participants developed as intended. It was measured by assessing participants' adherence and enactment by monitoring their physical activity behaviour and exercise reports. Physical activity behaviour was measured for all participants at baseline (M1) and was used for grouping purposes (see Table 5.24). Adhered participants reported their PA behaviour during (M2a, M2b) and post-intervention (M3), and the results showed that two were insufficiently active, two reported moderately PA, and 22 were very active at six-months (M2a). All 24 respondents (72.73%) at nine-months (M2b) and 21 respondents (95.45%) at post-intervention (M3) reported being very active, see Table 5.25.

Table 5.24 Physical activity behaviour at baseline (M1).

	AD-IN		AD-AC		NA-AC		NA-IN	
	n = 15	(%)	*n* = 20	(%)	*n* = 66	(%)	*n* = 76	(%)
Score								
Insufficiently active								
Inactive (0-1)	7	(46.7)					32	(42.1)
Minimum PA (2-3)	3	(20.0)					19	(25.0)
Slight PA (4-5)	5	(33.3)					25	(32.9)
Sufficiently active								
Moderate PA (6-11)			14	(70.0)	51	(77.3)		
Very active (12-33)			6	(30.0)	15	(22.7)		

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive, PA = physical activity.

Table 5.25 Physical activity behaviour during (M2a, M2b) and post-intervention (M3).

	Six-month (M2a)		Nine-month (M2b)		Twelve-month (M3)	
	n = 35	(%)	*n* = 33	(%)	*n* = 22	(%)
AD-IN						
Sample	15	(100.0)	15	(100.0)	9	(100.0)
Missing	2	(13.3)	2	(13.3)	1	(11.1)
Score						
Insufficiently active		(13.3)		(0.0)		(0.0)
Inactive (0-1)	0		0		0	
Minimum PA (2-3)	2		0		0	
Slight PA (4-5)	0		0		0	
Sufficiently active		(73.3)		(86.7)		(88.9)
Moderate PA (6-11)	1		0		0	
Very active (12-33)	10		13		8	
AD-AC						
Sample	20	(100.0)	18	(100.0)	13	(100.0)
Missing	7	(35.0)	7	(38.9)	0	(0.0)
Score						
Insufficiently active		(0.0)		(0.0)		(0.0)
Inactive (0-1)	0		0		0	
Minimum PA (2-3)	0		0		0	
Slight PA (4-5)	0		0		0	
Sufficiently active		(65.0)		(61.1)		(100.0)
Moderate PA (6-11)	1		0		0	
Very active (12-33)	12		11		13	

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, PA = physical activity.

The assessment of adherence included participants' retention to the intervention, attendance to follow-up meetings and compliance with prescribed exercise. Participants were grouped based on their adherence, which means that AD-IN and AD-AC regularly attended for more than 180 days and were compliant with the exercise prescription (n = 35). However, 12 participants were retained for more than six months without being compliant. 62.4% of all participants regularly attended and 53.5% of those in the non-adhered group, until their last day of intervention (discharge or withdrawal). The exercise programme was followed as intended by 53.4% of all participants and 42.3% of non-adhered participants. Table 5.26 shows the complete distribution of adherence in the four groups.

Table 5.26 CAMINEM adherence distributed by intervention groups.

	ATTENDANCE				RETENTION				COMPLIANCE				
	Irregular (n = 66)		Regular (n = 111)		<180 days (n = 130)		≥180 days (n = 47)		Exercise Px not followed (n = 82)		Exercise Px followed (n = 95)		TOTAL [a] (n = 177)
GROUP		(%)		(%)		(%)		(%)		(%)		(%)	(%)
AD-IN	0	(0.0)	15	(100.0)	0	(0.0)	15	(100.0)	0	(0.0)	15	(100.0)	15 (100.0)
AD-AC	0	(0.0)	20	(100.0)	0	(0.0)	20	(100.0)	0	(0.0)	20	(100.0)	20 (100.0)
NA-AC	27	(40.9)	39	(59.1)	61	(92.4)	5	(7.6)	34	(51.5)	32	(48.5)	66 (100.0)
NA-IN	39	(51.3)	37	(48.7)	69	(90.8)	7	(9.2)	48	(63.2)	28	(36.8)	76 (100.0)

Note. Px = prescription, AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive.
[a] 1 missing.

The relationship between diagnoses and adherence was measured by the χ^2 test. The only significant relationship was found between dyslipidemia and high retention (continuity correction = 5.471, p = .019) and positive compliance (continuity correction = 3.944, p = .047). Samples were large and, consequently, the participant's adherence may be considered as strongly independent from the diagnoses (see Table 5.27).

Table 5.27 CAMINEM adherence distributed by reasons for prescription.

	ATTENDANCE				RETENTION				COMPLIANCE			
	Irregular (*n* = 67)		Regular (*n* = 111)		<180 days (*n* = 131)		≥180 days (*n* = 47)		Exercise Px not followed (*n* = 83)		Exercise Px followed (*n* = 95)	
		(%)		(%)		(%)		(%)		(%)		(%)
Reasons for prescription [a]												
Overweight	36	(40.0)	54	(60.0)	72	(80.0)	18	(20.0)	44	(48.9)	46	(51.1)
Hypertension	26	(32.5)	54	(67.5)	55	(68.8)	25	(31.3)	32	(40.0)	48	(60.0)
Dyslipidemia	23	(35.9)	41	(64.1)	40	(62.5)	**24**	**(37.5)**	23	(35.9)	**41**	**(64.1)**
Diabetes Mellitus	**25**	**(43.9)**	32	(56.1)	39	(68.4)	18	(31.6)	28	(49.1)	29	(50.9)
Musculoskeletal	14	(35.9)	25	(64.1)	27	(69.2)	12	(30.8)	19	(48.7)	20	(51.3)
Cardiovascular	10	(33.3)	20	(66.7)	**26**	**(86.7)**	4	(13.3)	**17**	**(56.7)**	13	(43.3)
Respiratory	5	(20.8)	**19**	**(79.2)**	16	(66.7)	8	(33.3)	13	(54.2)	11	(45.8)
Mental illness	6	(31.6)	13	(68.4)	14	(73.7)	5	(26.3)	7	(36.8)	12	(63.2)
Other	4	(30.8)	9	(69.2)	9	(69.2)	4	(30.8)	5	(38.5)	8	(61.5)
Number of health conditions												
1	20	(37.7)	33	(62.3)	**42**	**(79.2)**	11	(20.8)	26	(49.1)	27	(50.9)
2	**24**	**(47.1)**	27	(52.9)	40	(78.4)	11	(21.6)	**28**	**(54.9)**	23	(45.1)
3	14	(30.4)	**32**	**(69.6)**	29	(63.0)	**17**	**(37.0)**	14	(30.4)	**32**	**(69.6)**
3+	9	(32.1)	19	(67.9)	20	(71.4)	8	(28.6)	15	(53.6)	13	(46.4)

Note. Px = prescription. Bold = the highest rate for each category.
[a] The total sums exceed 100%.

As regards to dropout, 112 (62.92%) participants included in the CAMINEM intervention did not finish the prescribed programme. Forty-five of them were contacted only once which means that they accepted referral and inclusion (signature of the information consent) but never attended a follow-up meeting. More than half of the participants dropped out within the first three months. Figure 5.12 shows participant retention at the end of intervention, when 46 were still active (less than 12 months). The main reasons for withdrawal were continuous absence at three consecutive meetings or that phone contact could not be made. Medical reasons such as feeling acutely ill were the third main reason but only once was it formally reported. A complete chart of reasons cited is shown in Figure 5.13.

Finally, group walks had minimum impact during the whole intervention. Attendance at the monthly walks organised by the ES was regular for some participants who reported being already active at baseline and the average attendance was over a dozen participants, including health practitioners.

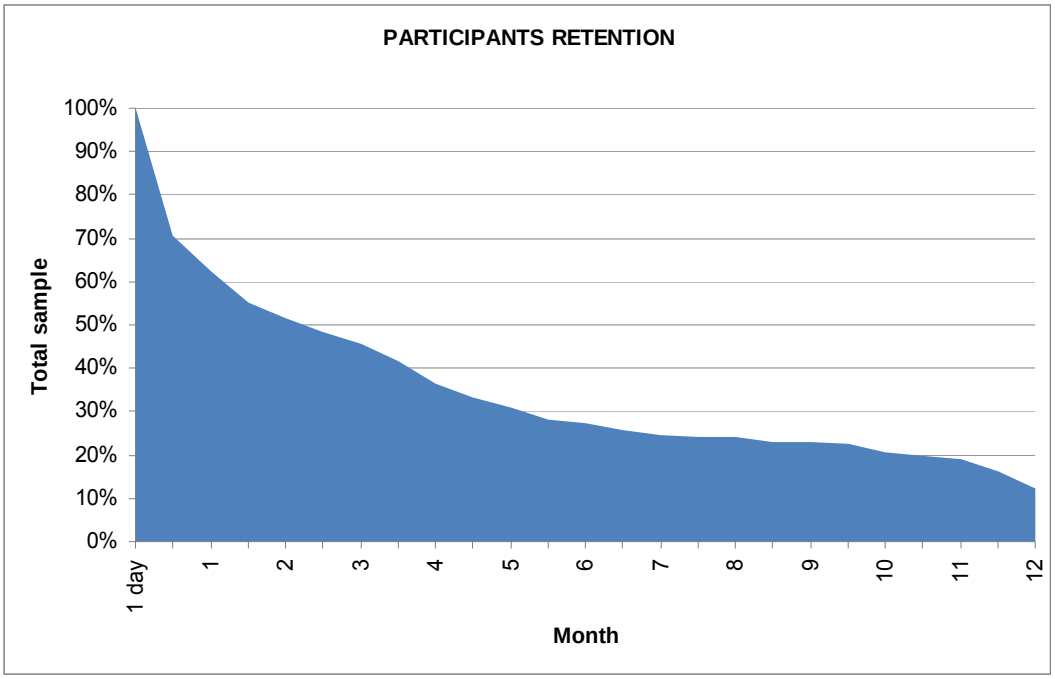

Figure 5.12 Participants retention.

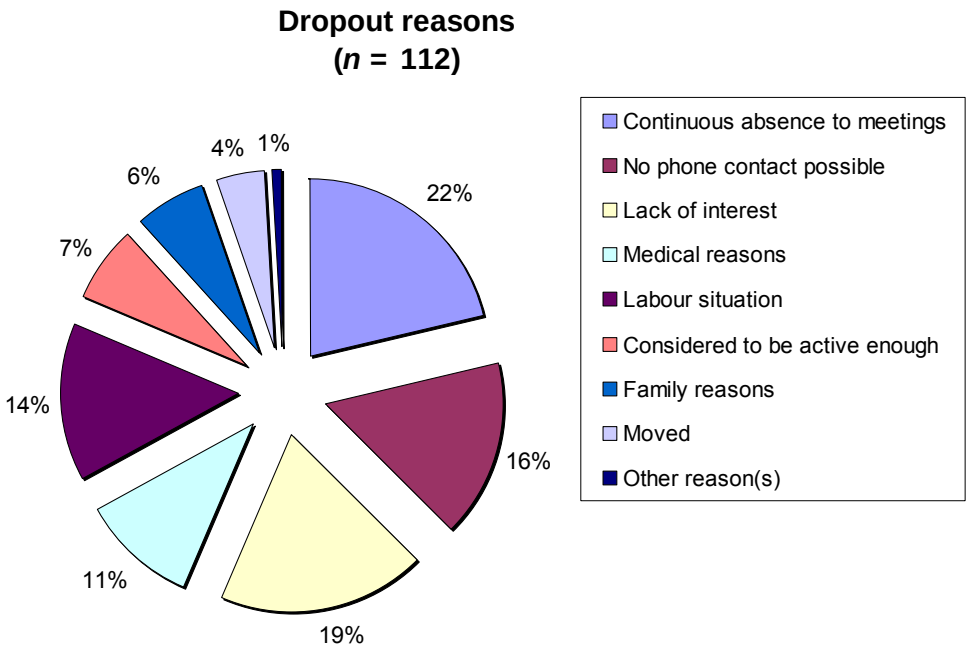

Figure 5.13 Dropout reasons.

5.2.4 MAINTENANCE

Maintenance measure of physical activity behaviour for adhered participants (M4) was scarce due to the small amount of time between participant discharge and data analysis (n = 9). However, the sample of maintenance over time (MOT4), including non-adhered participants, was n = 98 of which 76 were contacted for data collection (77.6%). See Table 5.28.

None of the adhered participants reported being insufficiently active (minimum score = 9-*moderately active*, maximum score = 22-*very active*) while non-adhered participants ranged from 0-*inactive* to 27-*very active*. 12 non-adhered participants who were active at baseline (NA-AC) reported being insufficiently active: 24.3% of the total sample (n = 44). In contrast, 14 who were previously insufficiently active at baseline (NA-IN) reported being sufficiently active (31.1%). However, the mean score for non-adhered subgroups was much lower than for adhered subgroups, with a t = 3.536; p = .001 assuming equal variances. Comparing active participants at baseline (AD-AC & NA-AC) produced a contrast test result of t = 3.665; p < .001, favourable for the adhered group.

Table 5.28 Physical activity behaviour at maintenance over time (MOT4).

	AD-IN		AD-AC		NA-AC		NA-IN	
	n = 2	(%)	*n* = 7	(%)	*n* = 44	(%)	*n* = 45	(%)
Missing	0	(0.0)	2	(28.6)	12	(27.3)	8	(17.8)
Score								
Insufficiently active		(0.0)		(0.0)		(27.3)		(51.1)
Inactive (0-1)	0		0		4		10	
Minimum PA (2-3)	0		0		5		8	
Slight PA (4-5)	0		0		3		5	
Sufficiently active		(100.0)		(71.4)		(45.4)		(31.1)
Moderate PA (6-11)	1		0		8		7	
Very active (12-33)	1		5		12		7	

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive, PA = physical activity.

Participant distribution within groups according to their adherence and long-term PA behaviour after the intervention was unbalanced (see Table 5.4, p. 132), with clinical parameters data from only 7 adhered participants. All adhered participants reported being physically active. As such, clinical parameters of long-term active and inactive participants

after the intervention (MOT4) were compared. There were significant differences between the groups for BMI only (*t*-test = 2.878, *p* = .006), lower for participants reporting being sufficiently active. Active people showed better results in waist circumference and cholesterol parameters while inactive people showed better results in blood pressure, resting heart rate and plasma glucose. (See Table 5.29).

Table 5.29 Clinical parameters at maintenance time (MOT4) by physical activity behaviour.

	Active (*n* = 41)			Inactive (*n* = 35)			Total (*n* = 76)[a]		
PHYSICAL ACTIVITY BEHAVIOUR	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
BMI (kg/m^2) **	21	30.8	4.4	24	35.2	5.7	45	33.2	5.6
Waist circumference (cm)	7	103.4	12.5	10	107.6	13.7	17	105.9	13.0
Systolic blood pressure (mmHg)	23	137.0	14.1	29	133.6	16.9	52	135.1	15.6
Diastolic blood pressure (mmHg)	23	82.5	9.1	29	81.3	12.5	52	81.8	11.0
Resting heart rate (beats/min)	16	80.2	9.3	18	75.7	11.5	34	77.8	10.6
Total blood cholesterol (mg/dl)	22	196.2	31.6	22	209.2	42.7	44	202.7	37.7
LDL blood cholesterol (mg/dl)	14	120.3	36.9	16	137.8	36.0	30	129.6	36.9
Triglyceride (mg/dl)	22	163.6	115.5	22	177.7	92.7	44	170.7	103.8
HDL blood cholesterol (mg/dl)	13	52.4	12.5	16	59.3	33.1	29	56.2	25.8
Plasma glucose (mg/dl)	22	118.6	45.3	22	116.5	34.5	44	117.6	39.8
Glycated haemoglobin (%) [b]	7	7.1	1.2	5	7.1	1.1	12	7.1	1.1

Note. BMI = body mass index, kg = kilogram, m = metre, cm = centimetre, mmHg = millimetre of mercury, min = minute, mg = milligram, dl = decilitre.
[a] 22 participants could not be contacted for follow-up.
[b] Sample size for participants diagnosed with diabetes mellitus: inactive (*n* = 9), active (*n* = 15).
** *p* = .006

SF-12v2 scores were collected from 21 participants. 77 could not be contacted. Table 5.30 shows mean scores and standard deviation. The contrast test between adhered and non-adhered groups was not statistically significant (*t* = 1.483; *p* = .156).

Table 5.30 Quality of life at maintenance over time (MOT4).

	AD-IN (*n* = 15)		AD-AC (*n* = 20)		NA-AC (*n* = 66)		NA-IN (*n* = 76)	
GROUP	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SF-12v2 questionnaire outcomes								
Physical functioning	46.7	5.5	49.0	6.5	42.8	8.2	40.9	9.8
Role physical	55.0	6.7	55.9	5.2	46.5	12.0	43.2	9.0
Bodily pain	23.0	0.0	26.7	5.0	32.2	9.7	46.0	16.0
General health	35.2	0.0	41.5	5.7	42.5	8.5	37.8	5.2
Vitality	54.2	7.7	48.7	10.9	53.1	13.8	48.7	8.9
Social functioning	57.1	0.0	50.8	9.5	45.5	11.7	43.9	13.3
Mental health	52.5	7.9	51.4	10.0	45.2	14.9	35.7	9.1
Role emotional	47.2	4.3	60.0	10.2	51.5	12.1	42.6	11.6
PCS: Summary scale Physical	36.0	4.3	38.1	5.7	38.0	6.7	42.8	5.6
MCS: Summary scale Mental	58.0	4.2	58.8	12.3	52.4	15.5	42.3	15.9

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive.

Mean results on overall physical and mental health (PCS and MCS) from baseline (M1) to maintenance (MOT4) in all groups vary consistently (see Table 5.31). PCS improves from baseline and throughout the intervention for the AD-IN group but decreases at maintenance. It decreases progressively for the AD-AC group, MOT4 is lower than M1 for NA-AC, and higher for NA-IN.

In contrast, MCS increases progressively for the AD-IN. It also increases throughout the intervention for the AD-AC group but MOT4 is lower than the post-intervention measurement (M3). Results for non-adhered groups show an opposite pattern: the previously active (NA-AC) report better results at MOT4 than baseline (M1) while the previously inactive (NA-IN) report worse results.

Table 5.31 SF-12v2 outcomes from baseline (M1) to maintenance over time (MOT4).

	AD-IN			AD-AC			NA-AC			NA-IN		
GROUP	*n*	Mean	SD	*n*	Mean	SD	*N*	Mean	SD	*n*	Mean	SD
SF-12v2 questionnaire outcomes												
PCS: Summary scale Physical												
Baseline - M1	8	39.3	5.5	4	45.1	2.2	44	39.5	6.1	51	39.7	6.2
During - M2a	11	39.7	4.5	17	41.6	4.3						
During - M2b	10	41.1	5.5	13	39.5	6.1						
Post-intervention - M3	9	40.8	5.1	13	39.5	5.9						
Maintenance - MOT4	2	36.0	4.3	5	38.1	5.7	10	38.0	6.7	4	42.8	5.6
MCS: Summary scale Mental												
Baseline - M1	8	48.4	14	4	53.5	9.3	44	51.2	13.3	51	49.4	15
During - M2a	11	53.9	7.8	17	61.5	10						
During - M2b	10	53.4	10.5	13	64.8	4.7						
Post-intervention - M3	9	56.8	7.3	13	64.2	10						
Maintenance - MOT4	2	58.0	4.2	5	58.8	12.3	10	52.4	15.5	4	42.3	15.9

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive.

Self-perception of well-being was measured by a simple question: '*What do you think about your overall health, is it better, worse, or the same as the last day we met in the framework of the CAMINEM programme?'* Participants reporting being insufficient physically active (ClassAF scores 0 to 5) at maintenance (MOT4) mostly felt worse (40%) while only one (2.4%) who was physically active felt worse. See Table 5.32.

Table 5.32 Self-perception of well-being at maintenance (MOT4).

	INTERVENTION GROUP *									
	AD-IN (*n* = 2)		AD-AC (*n* = 7)		NA-AC (*n* = 44)		NA-IN (*n* = 45)		Total (*n* = 98)	
Physical activity behaviour at maintenance	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Inactive										
Worse					4	(33.3)	10	(43.5)	14	(40.0)
Equal					4	(33.3)	6	(26.1)	10	(28.6)
Better					4	(33.3)	7	(30.4)	11	(31.4)
Total					12	(100.0)	23	(100.0)	35	(100.0)
Active										
Worse	0	(0.0)	0	(0.0)	1	(5.0)	0	(0.0)	1	(2.4)
Equal	1	(50.0)	3	(60.0)	9	(45.0)	7	(50.0)	20	(48.8)
Better	1	(50.0)	2	(40.0)	10	(50.0)	7	(50.0)	20	(48.8)
Total	2	(100.0)	5	(100.0)	20	(100.0)	14	(100.0)	41	(100.0)

Note. AD-IN = adhered and previously inactive, AD-AC = adhered and previously active, NA-AC = non adhered and previously active, NA-IN = non adhered and previously inactive.
* 22 missing.

CHAPTER 6 – GENERAL DISCUSSION

The overall goal of this thesis was to evaluate an exercise-on-prescription programme in selected primary health-care settings. The programme was based on the 'Let's Walk Programme' (*Programa CAMINEM*), using an interdisciplinary approach comprised of primary health-care practitioners (general practitioners and nurses) and exercise specialists. The intervention was carried out with the underlying aim of improving regular patients' health by facilitating the adoption and maintenance of exercise levels with safe, home-based exercises.

The pragmatic trial, designed by a steering group of practitioners and researchers, was thought to be easily implemented by time-constrained practitioners with the support of an exercise specialist. Also, it was designed in accordance with recent regional (Catalonia) and national (Spain) policy documents (Departament de Salut. Generalitat de Catalunya, 2009a, 2009b, 2009c; Ministry of Health and Social Policy, 2010 [Internet monograph]), physical activity promotion frameworks (Agencia Española de Seguridad Alimentaria y Nutrición, 2005; Consejo Superior de Deportes, 2010b; Government of Catalonia, 2006; World Health Organization, 2004) and other physical activity prescription programmes developed elsewhere (Aittasalo, et al., 2006; Isaacs, et al., 2007; Kallings, et al., 2008; Leijon, et al., 2008; Patrick, et al., 1994; Smith, et al., 2000; Sørensen, et al., 2007; Swinburn, et al., 1998; van Sluijs, van Poppel, Twisk, Chin, et al., 2005).

The evaluation was focused on the following specific aims:

1. To assess the effects of CAMINEM within the primary-care routine. It was hypothesised that participants would show improvement in cardio-metabolic risk factors, self-perception of quality of life and/or demand less health services if they adhered to the programme.
2. To describe the feasibility of the intervention in a Catalan setting. It was hypothesised that the CAMINEM intervention would reach a representative sample of citizens that may benefit from it; that it would be adopted by health-care personnel; that it would safely ensure participant's adherence to the exercise prescription; that participants would exercise regularly after the intervention; and/or that health practitioners would continue with the exercise prescription time after the intervention trial.

6.1 SAMPLE OF STUDY OBJECTS

Two separate study objects provide the focus for this study. On the one hand, regular patients with chronic health conditions that may benefit from exercise who attended their primary health-care centre were assessed for intervention effects. On the other hand, both patients and health practitioners (i.e. general practitioners and nurses) were to be evaluated for intervention feasibility. In the eighteen-month intervention period, the recruitment of patients was the responsibility of health practitioners and was undertaken during their regular consultations with patients.

Due to the lack of an existing control group, participants were categorised into four groups according to their physical activity behaviour at baseline and their adherence to the Let's Walk intervention: adhered and previously inactive (AD-IN), adhered and previously active (AD-AC), non-adhered and previously active (NA-AC), non-adhered and previously inactive (NA-IN). The four groups were homogeneous at baseline (M1) as regards all variables, except for age and body mass index which meant that those diagnosed as overweight did not show homogeneity at baseline level. Participants reporting higher physical activity behaviour tended to be older and to have a lower BMI than those reporting being insufficiently active. This could be due to variety of reasons. Younger people may have had a shortage of time as was reported in the recent Eurobarometer (European Commission, 2010), and older people may have had an increased motivation to exercise for health and fitness purposes, as 73.4% of elderly people reported in the 2005 Catalan survey (Fàbregas Bosch, et al., 2005). However, adherence to the walking intervention showed no relation to age as highlighted in the results of a correction test between adhered and non-adhered groups (t = 1.55, p = .126). Adhered participants were of similar age compared to the non-adhered, although the AD-AC group was the oldest, with a mean value over 64 years and 95% CI [61.38, 67.52].

The most common reason for referral was being overweight or obese. Differences between primary health-care centres were found in the number of referral reasons per patient: PHC_B tended to refer patients with more than one health condition (82.2%) whereas PHC_A did less so (54.6%). This could be due to the way practitioners filled in prescription referrals, as the most common reasons for referral in both settings were cardiovascular risk factors. It is possible that practitioners in the PHC_A setting reported the cardiovascular risk factor as a reason for referral without noting down other health conditions.

Commonly, participants reported suffering from chronic diseases even though they did not appear in their practitioner referral form. This information was taken into account when planning the exercise prescription and it was also shared with their practitioner for information purposes. It should be noted that the most common health conditions not reported by HPs were not related with heart risk factors, as shown in Table 6.1, but with musculoskeletal diseases (e.g., osteoarthritis, arthritis) and mental health-illnesses (e.g., depression) instead. Although, it should be noted that participant-reported conditions were not recorded as *official* referral reasons due to the possibility of overestimation by the patient. Cardiovascular diseases (not merely heart risk factors) were reported by seven participants and their referral practitioner did not state the information was wrong when s/he was informed, which indicated that these participants did suffer from a cardiovascular disease. Participants reporting suffering from cancer were as common as those referred due to it.

HPs may have focused their attention on health risk factors, as they were encouraged to, but it was interesting that they did not consider some diseases as benefiting from exercise or they thought there was no need to report other diseases when patients already showed cardiovascular risk factors. Exercise planning differs for participants with low back pain and those receiving chemotherapy, even though their referral reason might state overweight.

Table 6.1 Health conditions reported and not reported by referral practitioners.

HEALTH CONDITION	REPORTED BY	
	Practitioner	Participant
Overweight	90	8
Hypertension	80	9
Dyslipidemia	64	4
Diabetes Mellitus	57	3
Musculoskeletal	39	34
Cardiovascular	30	7
Respiratory	24	3
Mental illness	19	15
Other	13	9

The participant sample for maintenance purposes after their adherence (AD-MAC, AD-MIN) was low (n = 9), caused by the short time-period set for the whole intervention trial as well as the low overall sample of referred participants.

6.2 EFFECTS OF THE CAMINEM PROGRAMME

6.2.1 THE EFFECTS ON CLINICAL HEALTH OUTCOMES

Baseline biochemical data was obtained from the participant's regular consultations with their practitioner, physician or nurse. In the case that some data was missing, the information was collected immediately or an appointment scheduled as soon as possible. Once participants were included in the intervention, clinical outcomes were collected either during regular consultations or in specific appointments following the intervention procedure (six- and twelve-month follow-up). Selected outcomes: body mass index (BMI), waist circumference (WC), resting heart rate (HR), blood pressure (SBP, DBP), blood cholesterol (CHO, HDL, TG, LDL), fasting plasma glucose (GLY) and glycated haemoglobin (HbA_{1c}, for diabetes mellitus only), were chosen because of their relationship with health risk factors often assessed as part of routine primary care checks and because these are factors that may be modified after exercising (Departament de Salut. Generalitat de Catalunya, 2007; Pedersen & Saltin, 2006; Swedish National Institute of Public Health, 2010).

It should be noted that measures could have been taken on different dates, even for those participants with all data obtained. For example, blood pressure could have been assessed one month before the participant inclusion, blood sample outcomes one week before inclusion and waist circumference one week after inclusion, even though all are considered as baseline measurements. The same procedure may have been followed for during, post- and maintenance follow-up measurements within the timeframe previously detailed in Chapter 4.3.1.1.

However, this pragmatic procedure resulted in a significant amount of missing data for one or more outcomes at baseline, during and post-intervention. A complete set of data was collected at baseline (M1) in 24% of cases only (n = 43), 49% (n = 17) during the intervention (M2) for adhered participants, and 32% (n = 7) at the intervention end (M3). Thus, the statistical power, when found, resulted to be low and the relevance of multivariate analyses of variance to extrapolate for other populations is also scarce.

Mean values at baseline (M1) are within the normal range for clinical practice except GLY and HbA_{1c}, which are highly biased from diabetic participants. Table 6.2 shows normal values based on regular procedures in Catalan primary health-care and consensus documents

(American College of Sports Medicine, 2006; Rubio et al., 2007; World Health Organization, 2011).

In relation to the adhered participants (n = 35), descriptive analyses after the intervention show overall better values in comparison to baseline values except for SBP, HDL and GLY for the previously inactive group (AD-IN), and HR, CHO and LDL for the previously active group (AD-AC). These changes, which may be globally positive, hardly show real effects on individuals because the sample varies from one measurement to the other. However, biochemical parameters after the intervention for adhered participants are within healthy values except BMI, WC, and GLY for AD-IN, and BMI and WC for AD-AC. At baseline, the same abnormal values were found for AD-IN while BMI, WC, SBP and GLY were high for AD-AC. HbA_{1c} for diabetic people was not within normal levels during the intervention but it decreased throughout.

As well as missing data, samples were low, in which case multivariate analyses that showed changes have a low significance, if any. Mean comparisons by ANOVA tests for HR, CHO, LDL, and HDL show improvements during the intervention (M2), and for DBP post-intervention (M3) compared to baseline (M1). Improvements on HR for the AD-AC group and CHO for adhered participants, regardless of their activity at baseline, are statistically significant. However, external factors may easily bias HR outcomes (e.g., immediate previous activity or food intake). Cholesterol profile easily reacts to any changes in medication patterns, which may have affected cholesterol outcomes. Also, improvements in the cholesterol profile occur only when exercise is combined with weight loss (American College of Sports Medicine, 2011).

Range comparisons for BMI, SBP, TG, and GLY show similar results to the other variables. There were no significant differences between groups at baseline (M1), during (M2) or post-intervention (M3). Significant differences within groups were not found for any variable.

Table 6.2 Normal values for biochemical parameters.

BIOCHEMICAL PARAMETERS	Value
Body Mass Index (kg/m^2) [a]	
Underweight	< 18.5
Normal	18.5 – 24.9
Overweight, class I	25.0 – 26.9
Overweight, class II	27.0 – 29.9
Obesity, class I	30.0 – 34.9
Obesity, class II	35.0 – 39.9
Obesity, class III (morbid)	40.0 – 49.9
Obesity, class IV (extreme)	≥ 50
Waist perimeter (cm) * [a b]	
Men	> 102
Women	> 88
Systolic blood pressure (mmHg) [b]	
Normal	< 120
Prehypertension	120 – 139
Stage 1 Hypertension	140 – 159
Stage 2 Hypertension	≥ 160
Diastolic blood pressure (mmHg) [b]	
Normal	< 80
Prehypertension	80 – 89
Stage 1 Hypertension	90 – 99
Stage 2 Hypertension	≥ 100
Resting heart rate (beats/min)	
Not standard values	
Total blood cholesterol (mg/dl) [c]	
Normal range	150 – 220
LDL blood cholesterol (mg/dl) [c]	
Normal range	65 – 165
Triglyceride (mg/dl) [c]	
Normal range	50 – 220
HDL blood cholesterol (mg/dl) [c]	
Normal range	45 – 85
Plasma glucose (mg/dl) [c]	
Normal range	76 – 110
Hyperglycaemia	> 110
Diabetes Mellitus **	> 125
Glycated haemoglobin (%) [d]	
Diabetes Mellitus ***	> 6.5

Notes. kg = kilogram, m = metre, cm = centimetre, mmHg = millimetres of mercury, min = minute, mg = milligram, dl = decilitre.
* Increased diseases risk if overweight. ** If scored more than one day. *** Lower values do not exclude diabetes diagnosed using glucose tests.
[a] Rubio, M. A., Salas-Salvadó, J., Barbany, M., Moreno, B., Aranceta, J., Bellido, D., . . . Vidal, J. (2007). Consenso SEEDO 2007 para la evaluación del sobrepeso y la obesidad y el establecimiento de criterios de intervención terapéutica. Rev Esp Obes, 7-48.
[b] American College of Sports Medicine. (2006). ACSM's guidelines for exercise testing and prescription. (7th ed.). Philadelphia: Lippincott Williams & Wilkins.
[c] Laboratory range of normal values.
[d] World Health Organization. (2011). Use of Glycated Haemoglobin (HbA_{1c}) in the Diagnosis of Diabetes Mellitus. Abbreviated Report of a WHO Consultation. Geneva: WHO.

The lack of a rigorous procedure for data collection and patient recruitment led to a small sample size and did not permit the assessment of proper exercise chronic effects on biochemical health outcomes. However, adhered participants to the CAMINEM programme did not get worse as a result of their participation and did not report any adverse event due to it.

Intention-to-treat data collection varied broadly for adhered participants and non-adhered participants. The second measurement (MOT2) was collected for retained participants to the intervention, whether they finally adhered (compliant) or not, with a median of 349 days. The third measurement over time (MOT3) was collected after participants were either discharged or dropped, which means that it could have been collected thirteen months after baseline for an adhered participant but two months after baseline for a participant attending only the first visit with the exercise specialist. The fourth measurement (MOT4) had a low number of participants in the adhered groups, due to the short period of time between intervention discharge and data collection.

Descriptive analyses at the last assessment (MOT4) showed that non-adhered participants who were inactive at baseline (NA-IN) had worse values in all clinical parameters except CHO and $HbA_{1c,}$ compared to baseline (M1). Non-adhered and previously active participants (NA-AC) showed worse results for BMI, SBP, HR and TG. Admitting that the sample varies from one measurement to the other and strong conclusions cannot be stated, it seems relevant that the NA-IN group did not improve in almost any clinical parameter, the NA-AC group improved four out of eleven, meanwhile adhered groups improved eight out of eleven parameters from baseline to post-intervention. The values that worsened do, however, remain within the normal range except for BMI, WC and GLY for NA-IN; and BMI for NA-AC, the same biochemical parameters as for adhered groups.

Contradictory results are found from analyses of variance. Most clinical parameters improved for both adhered and non-adhered participants. On the one hand, non-adhered participants significantly improved mean values for CHO: 11.71% from M1 to MOT3 (p = .001). Range comparisons for BMI and SBP also show significantly better results. However, this does not apply for adhered participants. BMI improved for the adhered group as well, but not significantly. It may be due to the lower sample (n = 18) compared to the non-adhered group (n = 44). On the other hand, TG value range improves by 28.77% (p = .009) for adhered

participants but does not improve for the non-adhered group even though the sample is lower (*n* = 13 vs. 21).

Several biases may have affected the final results. Diet habits and medication changes have not been monitored. Participant bias at follow-up measurements may be related to the non-adhered sample. Data for all biochemical parameters (except HbA_{1c}) was collected from 36 participants of NA-AC and NA-IN at baseline, and five participants only at MOT3. Since data collection was done during regular practitioner consultations, it may be that the patients who checked and monitored their health more frequently were also those more concerned with their health and, consequently, those reporting better values within the range of non-adhered groups.

This data collection procedure did not allow us to make any concrete links between the intervention and the adhered participants compared to another group (e.g., non-adhered). Instead, it allowed us to observe the evolution of biochemical parameters that potentially change. Other studies showed similar percentages of improvements for larger samples and so, the results were statistically significant. The intervention group of a study within the Green Prescription framework (C Raina Elley, et al., 2003) showed improvements in SBP (mean value = 2.58 mmHg) and DBP (mean value = 2.62 mmHg). However, results on blood pressure for the intervention group compared to the control in another study within the GRx were not significant, though positive (Lawton, et al., 2009). A Swedish study assessing cardiometabolic factors as primary outcomes exposed significant improvements in BMI, CHO and HbA_{1c} among others for the intervention group compared to the control. However, blood pressure in the intervention group did not improve significantly (L. V. Kallings, Johnson, et al., 2009). Some other programmes showed inverse effects; that is, that participation was ineffective for the intervention group compared to the control, such as in the PACE programme in the Netherlands where the intervention group increased their WC (van Sluijs, van Poppel, Twisk, Chin, et al., 2005).

Despite the aforementioned, every increase in physical activity, even small, entails health gains at both an individual level and public health level regardless of whether they reach the present, recommended level of physical activity (L. V. Kallings, Leijon, Kowalski, Hellénius, & Ståhle, 2009; Leijon, et al., 2009). A recent Taiwanese RCT supports the suggestion, where a large sample (*n* = 416,175) showed that adherence to a minimum amount of exercise (15

minutes a day, or 90 minutes a week) could reduce mortality from heart disease, diabetes, and cancer (Wen, et al., 2011).

6.2.2 THE EFFECTS ON QUALITY OF LIFE

First of all, it should not be forgotten that the 12-item short form questionnaire has shown better sensitivity for larger samples than the 36-item. Also, the high missing data for this study do not permit strong conclusions to be made on the effects of the intervention on quality of life.

Descriptive results of SF-12v2 outcomes at baseline showed that overall previously active people (AD-AC, NA-AC) scored higher values than those previously inactive (AD-IN, NA-IN) except for the "Role emotional" item. It is consistent with the suggested possible associations between psychological benefits and exercise (Pedersen & Saltin, 2006; Raglin, Wilson, & Galper, 2007).

Adhered groups responded to the intervention in different ways. AD-IN participants improved scores for all items. The highest increase in mean values was found for "Social functioning", with a 27% increase (from 41.2 to 52.4 score). Meanwhile, physical-related scores for AD-AC participants decreased, thus 12% for the overall "Summary scale Physical". In contrast, mentally related items improved with an increase of 20% in the "Summary scale Mental" section (from 53.5 to 64.2 score). Analyses of variance were not carried out due to the low sample of participants who filled in the questionnaire at baseline and during or post-intervention. Outcomes of these analyses would have provided stronger association between intervention adherence and self-perception of quality of life.

Other interventions have measured quality of life using the longer version SF-36 questionnaire. Variability in the outcomes is also displayed, as shown in Lawton et al. (2009) where some scores improved after 12 and 24 months from baseline (e.g., "mental health"), while some others decreased (e.g., "role physical"). Other studies with larger samples than the ones assessed herein showed improvements in most items, although not necessarily statistically significant improvements (C Raina Elley, et al., 2003; Grandes, et al., 2011; J. Sørensen, Sørensen, Skovgaard, Bredahl, & Puggaard, 2010).

Results concerning the well-being experienced by participants' 6, 9, and 12 months after their inclusion are clearly favourable for all participants and are strongly associated with being previously inactive at 6 months (p = .014) and 12 months (p = .006). None of the respondents felt worse (in terms of well-being) than before starting the intervention, although previously active participants (AD-AC) reported feeling the same as before at a greater rate than those who were previously inactive.

The assessment of well-being by way of a simple question has been used elsewhere with similarly positive results (L. V. Kallings, Leijon, et al., 2009). However, our study was not designed as a controlled study. This may lead to an overly optimistic assessment of the effects of the intervention. An observation bias (Hawthorne effect) may have led respondents to give excessively positive responses to the follow-up question because of the general support experiences from the programme and greater awareness of the relationship between health and physical activity, as J. Sørensen and colleagues suggested (2010).

6.2.3 THE EFFECTS ON HEALTH SERVICES DEMAND

At baseline, participants averaged 1.5 visits per month to their primary care unit, physician or nurse, and roughly 18 visits per year. The number of visits was not statistically different between groups, although the variability within groups was higher for those patients who did not adhere to the intervention. Variability, that is, the interquartile range, decreases for adhered participants and the non-adhered, previously active group at baseline but did not change for the inactive group who did not adhere.

Outliers are more common in the non-adhered groups as well. For example, the maximum attendance rate for adhered participants was 4.2 visits a month (roughly 50 visits a year) and the maximum rate for non-adhered participants was 11.23 visits a month (roughly 134.75 visits a year). Maximum attendance rates at baseline were also extremely high, 4.58 monthly visits for adhered and 7.33 monthly visits for non-adhered (roughly 55 and 88 visits per year, respectively). In consequence, small changes in health-care attendance by patients suffering from non-communicable chronic diseases may contribute an improvement of the current high-attendance rate, which has been literally considered as *'a true burden of the Spanish health-care system'* (Marqués Molías, 2009, p. 356).

Monitoring the reason for practitioner visits may strengthen the records reported here. Chronic patients may start a behavioural intervention which requires more frequent monitoring and more visits to their practitioner. In this case, health-care attendance is not necessarily related to adverse events. Indeed, the steering group was never notified of any participant attending their practitioner due to adverse effects experienced while exercising.

It should be noted that the minimum value showed for health-care attendance before the intervention is zero. In practice, this is not possible because the patient had to have been referred to the CAMINEM programme during regular practice hours (i.e., visit for the GP or nurse). This minimum value was reported by two participants who were subscribed in a different health-care setting to the two included in the intervention. Computerised medical records are centralised and should not differ between ICS health provider centres. However, there must have been errors in the data records or data accession.

Summary of health-related effects

The lack of a control group makes it difficult to determine possible effectiveness of the intervention. However, a 2011 systematic review of exercise referral schemes did not find consistent evidence in favour of the interventions in outcomes based on health-related quality of life, blood pressure, serum lipid levels, indices of obesity, or glycaemic control among others (Pavey, et al., 2011).

In conclusion, it was considered that AD-IN group participants would benefit the most from the intervention, due to the low levels of physical activity reported at baseline and the fact that they adhered to the programme. Subsequently, the AD-AC group would benefit from an increase in the quality of the regular physical activity they had already reported. It was thought that NA-AC showed better intention-to-treat results than NA-IN because the first had already reported being active, while the latter stated low levels of regular physical activity and, moreover, did not adhere to the intervention. The trends hypothesised above have been confirmed in the process of this study.

6.3 FEASIBILITY OF THE CAMINEM PROGRAMME

The discussion of the results related to the programme's feasibility is intended to answer the recommended evaluative questions suggested by Estabrooks & Gyurcsik across the RE-AIM dimensions (Estabrooks & Glasgow, 2006; Glasgow, et al., 1999). The "efficacy/effectiveness" dimension was substituted by the intervention effects previously discussed.

6.3.1 DID THE PROGRAMME REACH THE TARGET POPULATION?

The target population was comprised of adult patients registered at selected primary health-care settings suffering from chronic conditions that may benefit from exercising. Chronic conditions are coded in the health provider database. Data collection to assess potential participants included codes linked with diabetes mellitus, hypertension, dyslipidemia, ischemic heart disease, and BMI $\geq$ 25. The results flagged up 16,744 patients who fulfilled the inclusion criteria, of which 15,374 (91.82%) had visited their PHC at least once in 2010. The proportion is slightly higher than the average of 87% of Spanish citizens who visited their PHC providers in 2005 (Ministerio de Sanidad y Consumo, 2006). However, this sample is not accurate because it was taken at the end of 2010 and the number of registered patients varies through the time (e.g., deceases, moved in, moved out). The number of patients registered in the same selected settings increased from 43,036 in January 2010 (see Table 4.2) to 49,184 in December 2010 (see Figure 5.8).

Selected nurses volunteered to record the number of patients who were invited, and who did not wish to take part in the study. However, they did not report any data. They were asked to count the number of patients during a normal week and were called several times with reminders, but eventually the steering group decided not to insist due to practitioners' time constraints. If it had been possible to analyse the number of withdrawals at this stage of the intervention, there would have been two possible conclusions: more stress on behaviour counselling should be placed (if the number of patients refusing was high) or more emphasis should be placed on recruitment (if there was a low number of invitations).

The lack of a concrete number of target participants refusing to take part in the physical activity referral intervention was also reported in the EXERT study (Isaacs, et al., 2007). In contrast to the EXERT study, all intended referrals (n = 229) were received by the exercise

specialist, which represents 1.49% of the target population who had visited their PHC. 28 (12.23%) patients did not attend the first visit and the definitive number of included participants was 178, 1.16% of the target population. A similar proportion is reported in other studies. Of all participants referred by a health professional, 27% never made contact with the exercise referral scheme in a British study (Dugdill, et al., 2005). In Sweden, the FaR® scheme reached 1.5% of the total county population, and 1.3% of those who attended their PHC (Leijon, et al., 2008). Less than 1% was reported in a revision in the UK (Fox, et al., 1997).

More intensive interventions have reached a much higher proportion of the target population. One intervention in Switzerland aimed at increasing PA in inactive regular patients invited all patients attending five volunteer general practitioners for an RCT (Jimmy & Martin, 2005). The practitioners were reimbursed with the equivalent of 18€ for each questionnaire that was filled out in their office. The FaR® intervention in one county was supported with incentives to compensate for the extra amount of work (Leijon, et al., 2008). The *Newcastle exercise project* reached 17% for their RCT, facilitated by the fact that the researcher was in the practice to initiate recruitment daily (Harland et al., 1999).

The proportion of included participants in relation to their diagnoses and PHC setting was also obtained. It ranged from 5.19% of potentially beneficial patients suffering from cardiac disease (although the total sample included ischemia only) to 0.75% of potentially overweight people. PHC_A referred a higher proportion of targeted patients compared to PHC_B, despite referring fewer patients in total. PHC_B provided health-care for a higher proportion of older people and people suffering from the targeted health conditions than PHC_A, as shown by the number of patients fulfilling inclusion criteria in relation to the total number of registered patients (37.91% for PHC_B and 28.97% for PHC_A).

However, representativeness of the individuals taking part in the CAMINEM programme is unknown. Socio-demographic data was not obtained from the included participants because it was thought that the face-to-face intervention should be used for practical purposes mainly (e.g., exercise planning and exercise prescription) rather than research-oriented. Objective data could be used to compare included participants with the other patients registered in the two PHC settings but the sample would not be sufficiently representative of the city of Lleida. Both health-care settings are located in socially deprived neighbourhoods, with high rates of

migrant citizens and retired people in PHC_A, and high rates of ethnic minorities and unemployment in PHC_B.

6.3.2 WAS THE PROGRAMME ADOPTED BY THE HEALTH PRACTITIONERS?

Seven publicly-administered settings provide primary health-care in Lleida. All of them receive funding from the public administration and manage similar basic resources. Physicians and nurses practicing in the two selected centres for the intervention were invited to participate and none of them refused. 40% (n = 33) of the practitioners referred at least one patient. However, the number of referrals varied broadly. While 10 practitioners referred more than 10 patients, other 7 practitioners from the two selected settings referred one patient only. Primary care units (PCU) are composed of one GP and one nurse. A higher number of nurses have been working within the 18-month intervention period due to move-ins and move-outs (e.g., maternity leaves, high rate of supply workers). Locum tenentes were less common than supply nurses (4 compared to 12).

It was thought that GPs would be the principal instigator of the referral process due to their influence on the patients' decisions as regards their health behaviour (Tulloch, et al., 2006). However, most PCU were organised with the nurse practitioner as the main collaborator with the intervention, as is shown by the number of patients referred by their nurses in comparison with physicians (186 vs. 43). Yet, the practitioner who referred the most patients was a GP, referring more than half of the total by all GPs (n = 24). In that specific case, the referral form was signed by the GP even though most of the patients were invited by the nurse. That GP worked with different supply nurses throughout the 18-month intervention, which may be the reason behind that PCU particular referral system. Three participants prompted their GP to be included, as it happened in the EXERT study (Isaacs, et al., 2007). Big differences in health management between and within countries, as well as the intervention design for practitioners' recruitment (e.g., offering extra reimbursement), makes a comparison of adoption rate between studies difficult: 32% of GPs participated in the *Active Practice* study (Smith, et al., 2000), and more than 30% in the FaR® (Leijon, et al., 2008).

There were seasonal variations during the intervention. Most participants were included at the beginning, in spring. The numbers then decreased in July and August, perhaps due to it being

the holiday period when many leave the city to escape the hot summer climate. The inclusion of new participants was irregular from October to January and very low until March. Seasonal variations have been found in a Swedish study as well (Leijon, 2009).

Participants may not be included immediately after their referral, as explained in Figure 4.2, Chapter 4.2.1. A possible reason of this flow pattern may be due to two factors. Firstly, the winter climate in Lleida may be a barrier for some to start new physical activity programmes. Secondly, a different exercise specialist was delivering the intervention from October to February. Interdisciplinary work is a big challenge even after coping with regulation duties. Also, personal attributes and skills may affect the development of exercise referral schemes (Fox, et al., 1997), perhaps even more so for small and not widely institutionalised interventions.

Practitioners have informally reported some barriers to the steering group that limit their participation not only in the CAMINEM intervention but overall in health promotion interventions. Time constraint was the major concern of the steering group at the moment of the study design. Aittasalo (2006) reported that the 5-10 min GPs may spend on PA counselling seemed to fit within a 16-min appointment. In a Dutch study, 10-14 min seemed to be feasible for PA counselling (van Sluijs, van Poppel, Stalman, et al., 2004). GPs spent 7 min and nurses 13 min in delivering the Green Prescription (C Raina Elley, et al., 2003). In the Catalan public health system, patients are scheduled for a 6-minute consultation with their GP and up to a 15-minute visit with their nurse. Health provider internal reports of one collaborating PHC (unpublished) showed that GPs visited an average of 22.4 patients daily and nurses visited over 14 patients. The average time GPs visited their patients was 10.9 minutes, and 17.5 minutes for nurses. This extra time had to be taken out from other practitioners' duties such as community interventions or organisational meetings.

Reasons, such as lack of time, lack of community network or lack of institutional support, were regularly stated, as had already been reported in several studies (McKenna, et al., 1998; Patrick, et al., 1994; Petrella, et al., 2007; Petrella & Wight, 2000; Puig-Ribera, et al., 2005). Lack of education about proper exercise counselling, reported as a common barrier for physical activity promotion in other studies, was seldom discussed with the steering group, perhaps because the referring practitioners found the steering group and the intervention procedures reliable. A qualitative study, aimed at generating explanations for the lack of integration of physical activity promotion in Barcelona, showed that medical staff had

reservations about how they would determine who, among exercise professionals, was an expert (Puig-Ribera, McKenna, & Riddoch, 2006).

In our intervention, by contrast, some practitioners were willing to participate in face-to-face consultations with participants and the exercise specialist and participated in the monthly group-led walks. Practitioners may have been motivated by the desire for a more intensive intervention in PA which goes beyond providing simple advice (J. B. Sørensen, et al., 2006). Neither referring practitioners nor non-participating practitioners reported disagreement with the intervention, which can be considered very positive in terms of pragmatism and feasibility.

Nevertheless, practitioners' attitudes towards the CAMINEM intervention have not been assessed objectively. What practitioners did with the feedback provided by the exercise specialist, whether practitioners inserted relevant information into patients' medical records or whether they used the information for future approaches with the patient is unknown. Anonymously-delivered questionnaires or semi-structured interviews may provide more significant information on their attitudes towards the CAMINEM intervention, as has been previously suggested (Graham, et al., 2005; Puig-Ribera, et al., 2005, 2006).

6.3.3 DID THE PARTICIPANTS UNDERSTAND AND USE THE INTERVENTION SKILLS?

Physical activity behaviour was self-reported using a non-validated questionnaire, the ClassAF. However, there is no gold standard on questionnaires for assessing PA (L. V. Kallings, Leijon, et al., 2009; Leijon, Bendtsen, et al., 2010; World Health Organization, 2003a). Also, simple patient questionnaires have been found to be practical and valid for epidemiological studies compared with objective measures, such as heart rate monitoring (C Raina Elley, et al., 2003). ClassAF scores measure PA intensity while other simple questionnaires do not (Leijon, et al., 2009), and can assess PA behaviour in less than 5 minutes (Swinburn, et al., 1998). Having stated this, only 2 (13.3%) adhered participants who were insufficiently active at baseline (AD-IN) reported no changes at 6 months, and 11 (73.3%) were moderate to very active. 2 participants were missing and were included in the final sample for conservative purposes under the assumption that they did not improve their PA behaviour.

However, at the 9-month and 12-month follow-up none of the respondents reported low levels of PA behaviour. Assuming that adhered participants were compliant with the exercise prescriptions, missing participants would seldom report being insufficiently active. All but one active participants at baseline answering the questionnaire reported being very active at the 9-month and 12-month follow-up, and one reported being moderately, but sufficiently active, according to the questionnaire scoring.

There is an obvious risk of recall or social desirability bias with the questionnaire we used, which was also accounted for other studies (Leijon, Bendtsen, et al., 2010). Procedures, that is, intervention protocol, were neither blinded nor externally assessed. Although, adherence evaluation was supported by follow-up attendance, retention and compliance monitoring, rather than dichotomous adherence (yes/no), or retention only, as some suggested (Cyarto, et al., 2006; L. V. Kallings, 2008).

Obviously, adhered participants (AD-IN and AD-AC) assisted regularly, were retained, and were compliant with exercise prescriptions, as adherence was a selected variable for grouping. Meanwhile, 50% of non-adhered participants (NA-AD and NA-IN) assisted regularly to scheduled follow-up meetings, and 42% of them correctly reported their exercise in the logbook provided. Compliance and follow-up assistance fell under normal values, which suggest that the period of time participants were retained seems to make a difference to final adherence.

Although there was a significant correlation between referral reason and future adherence only for dyslipidemia, 20% of overweight participants were retained for more than 6 months. Weight loss was especially avoided during face-to-face consultations. Instead, counselling was focused on long-term health benefits and energy expenditure rather than short-term weight gains (American College of Sports Medicine, 2006). However, immediate feedback on weight changes is easily obtained by individuals (cf. cholesterol profile) and may cause shifts in behaviour, such as a sudden lack of will to continue with the, sometimes demanding, exercise intervention. People suffering from cardiovascular and/or respiratory diseases showed the lowest value for exercise compliance. Perhaps their exercise planning tended to be more conservative and participants did not feel it was successful in the short-term.

To the steering group's knowledge, only one participant reported an adverse event that may have been due to the CAMINEM intervention. The participant suffered from a cardiovascular

disease and regularly joined group walks with peers, and the monthly group walks led by the exercise specialist. During the group walks the participant tended to exercise above the aerobic threshold, monitored with the "Talk Test", and was encouraged by the exercise specialist, nurses and other participants to slow down. This specific case did not regularly attend the ES follow-up meetings and all the above information was periodically reported to the referring practitioner, who chose not to suggest that the participant stop the exercise intervention. The exercise specialist decided to finish follow-up phone contacts after that event, until new referral by the practitioner, who never did. In terms of exercise training, regular follow-ups are a must to avoid excessive training, the consequences of which may be very harmful for health-risk participants. Adverse events, such as an increase of injuries or falls, have been found in one study under the GRx framework (Lawton, et al., 2009) but not in another one (C Raina Elley, et al., 2003). Generally speaking, PA promotion approaches in primary health-care settings have been found to be safe.

More than half of the participants dropped out within the first three months, which may suggest that they were not ready to change their behaviour or were not interested in the participation. Health-enhancing exercise planning for regular patients, with irregular PA behaviour especially, should presuppose high dropout rates. An estimated 20% to 50% do not take their medications as prescribed (Kripalani, Yao, & Haynes, 2007). Exercising is more demanding than just taking pills. Consequently, long-term exercise adherence as a treatment method is, by definition, challenging. Furthermore, 50% of individuals who begin an exercise programme stop within the first 6 months (as cited in Thurston & Green, 2004).

Continuous absence to follow-up meetings, unavailability for phone contact, and a reported lack of interest were reasons cited for 55% of dropouts. Not supplying a telephone contact number was considered by Smith et al. (2000) as exclusion criteria. A 2005 Catalan survey showed that lack of time was the most common reason for dropout (in 38.1% of cases), in concordance with the 2009 Eurobarometer (45% of cases) (European Commission, 2010; Fàbregas Bosch, et al., 2005), and the Finnish Prex intervention (Aittasalo, et al., 2006). In our study, only 21% reported barriers that may be associated with lack of time: labour situation, family reasons and other reasons. Medical reasons were reported by 13% in the Eurobarometer, 31.9% in the Catalan survey, and 11% in our study. None of the respondents argued that the activity prescribed was too demanding, too skilful, that they did not have friends to exercise with or that there were no suitable infrastructures. Evidently, no one stated

it was expensive. All those were common reasons which prevented people doing sport regularly in the EU population.

Physical activity adherence in our intervention can hardly be compared to physical activity promotion schemes reported in other countries, or even compared to the Spanish PEPAF. First of all, PA promotion schemes usually assess PA behaviour as a primary outcome. Even positive results during the intervention, for PA, as well as other behaviours, are not regular along a person's lifespan. Many people start and end programmes while only some maintain weekly routines (Leijon, 2009). The CAMINEM intervention was a more intensive intervention than simple PA advice. It should rather be regarded as PA counselling using exercise training principles, in which case, adhered participants essentially increase their regular PA. From this point of view, the CAMINEM intervention could be compared to supervised group-based activities where the exercise specialist may adapt the training load to the participants' adaptations to exercise.

However, participant adherence to the CAMINEM intervention had not been lower than other PA promotion approaches. One out of eight participants completed the 12-month intervention (n = 22, 12.36%), and one out of four were retained more than six months (n = 47, 26.40%). Elley and colleagues reported that for every 10 GRx written, one person achieved and sustained healthy levels of PA (C Raina Elley, et al., 2003). Sørensen et al. (J. Sørensen, et al., 2010) found that one out of three patients with a sedentary behaviour increased their PA after 4 months of participation, at the end of group training, and one out of six enrolled after the intervention. In a Swedish study within the FaR® a patient majority (65%) fully adhered to the prescription (Hellénius & Sundberg, 2011; L. V. Kallings, Leijon, et al., 2009). A recent review of UK referral schemes showed that 17 inactive people had to be referred for one to become moderately active (N. H. Williams, et al., 2007). One out of five previously inactive participants in the CAMINEM programme has adhered at least six months (AD-IN vs. NA-IN). All interventions referenced herein are much larger than our research and the impact should be also considered as higher. However, the CAMINEM intervention remains potentially beneficial for both, inactive and active patients, suffering from non-communicable diseases, without evidence of adverse events.

Community nurses have reported to the steering group that regular community health promotion interventions organised by the PHC show similar rates of retention, mostly below 50%.

To conclude, the participants' attendance to the monthly led-group walks was very low, in contrast with what was hypothesised. Group walks were thought to be useful for socialising and as a way to increase confidence between the ES and the participants, and also among themselves. Registration of participants' attendance was not monitored because only a dozen patients and health practitioners attended and it was assumed to have a low impact. Some patients reported walking with their own friends when they were encouraged to take part in the group walks. Others preferred to walk alone, so they were not dependent on anyone's preferences or schedule.

However, group walks were organised monthly to keep adherence for those patients who did take part in them. One of the reasons that may explain the low attendance figure is that seniors citizens generally prefer either individual-based activities or group-based activities organised weekly rather than monthly activities.

6.3.4 DID THE PARTICIPANTS SUSTAIN THEIR BEHAVIOUR OVER TIME?

The 18-month timeline was not long enough to collect maintenance data for adhered participants. Few participants (n = 9) completed the 12-month intervention at least six months before the study ended. None of them reported low scores in physical activity behaviour in the ClassAF questionnaire. Adhered participants who were already active at baseline (AD-AC) were found to be very active. Nevertheless, 27.3% of previously active participants who did not adhere (NA-AC) reported being insufficiently active at least six months after last intervention contact. In contrast, 31.1% of previously inactive participants who did not adhere (NA-IN) reported an increase in their PA behaviour reaching recommended levels.

This change of pattern may be due to several factors, some of them out of the scope of the researchers. Sherwood & Jeffery consider that many people move between having a sedentary behaviour and being active at different times in their lives (as cited in Leijon, et al., 2009). In addition, brief interventions may shift behaviour change for people considered to be at a contemplative or pre-action stage of change, such as the referral process itself (Pavey, et al., 2011). The change may be due to a questionnaire bias, as it is not validated. Positive significant differences between adhered and non-adhered groups have been found, but the

relevance power should be considered low assuming the previous possible bias and the low sample.

Active people who remained active for a long time after the intervention showed significantly lower BMI (p = .006) which underlines the positive effects of regular PA and exercise. None of the other biochemical variables were found to be significant, although inactive people showed better mean values in blood pressure (SBP, DBP), resting heart rate, HDL profile and plasma glucose. This inconsistency may be due to external bias factors, such as medication or diet changes.

Some inconsistency has been found in SF-12v2 scores. Adhered participants increased their scores on the overall physical health (PCS) and mental health (MCS) during the intervention, but PCS decreased after 6 months, and MCS decreased for the AD-AC group. Non-adhered participants who were previously active (NA-AC) showed similar scores in PCS and improved MCS. Inactive participants at baseline who did not adhere (NA-IN) improved PCS but MCS worsened. These changes may be due to different measurements in the sample. Also, non-adhered participants who attended the follow-up meeting for data collection may have cared more for their own health than those who did not attend. Despite all this, none of the differences found were statistically significant.

The simple question that compared their perceived well-being a long time after the intervention to the last day the participants were contacted (before being discharged or dropped out) showed expected results. All adhered participants were found to be active after the intervention. None of them reported feeling worse than before, although the sample was very low (n = 7). From the total sample, a higher percentage of those who reported being inactive felt worse (40%) than those who reported being active (2.4%).

The non-adhered participants who were active before the intervention (the NA-AC group) and reported being inactive at maintenance follow-up (MOT4) stated feeling worse, better, and the same as the last day before dropout in equal proportion. In contrast, only one of those who reported still being active after dropout felt worse. None of the active participants at MOT4 who were inactive at baseline but changed their behaviour during the intervention felt worse. Changes in PA behaviour may have been due to the brief intervention effect, but this data could be associated with the potential validity of the ClassAF questionnaire.

Maintenance at a setting level has not been assessed. Similarly, health practitioners informally discussed CAMINEM procedure characteristics and showed interest in adopting the intervention. Several agents have also shown interest in continuing with the intervention. Both Direction Boards of the two PHC settings have shown an interest in continuing with the collaboration alongside health practitioners and exercise specialists. Collaborating practitioners have shown willingness to refer more patients and suggested intervention modifications, for example, establishing a community network. However, even though the study design was aimed at being as pragmatic as possible, the exercise specialist works 10hrs weekly, on average, and financial support is scarce.

6.4 METHODOLOGICAL CONSIDERATIONS

To our knowledge, the CAMINEM framework is the first in Spain where exercise specialists (without any complementing university degree in physiotherapy or nursing) work alongside health practitioners in PHC settings. Spanish exercise specialists are educated in pedagogy and training methods but not in public health. Ibáñez & Medina suggest an association between physical education teachers and sport trainers profiles (Ibáñez Godoy & Medina Casaubón, 1999), but the required skills for exercise specialists working in public health fields is new in Spain.

The steering group designed the study so that it would enable practitioners to benefit from data collection for patient monitoring purposes. In addition, the referral procedure and participant monitoring data can be linked to public health indicators stated by the Catalan health strategy, with the Catalan PAFES programme, and with the Spanish NAOS strategy (Departament de Salut. Generalitat de Catalunya, 2009b; Government of Catalonia, 2007; Ministerio de Sanidad Política Social e Igualdad, 2011), among other local public health policies. Practice-oriented or quasi-experimental designs are not scarce in primary care health promotion, because of the risks involved in relying on busy practitioners to implement randomisation protocols (Leijon, 2009; Smith, et al., 2000).

The CAMINEM practice-driven, rather than research-driven, procedures resulted in poor data collection. Adoption of the programme relied on practitioners who, during their regular practice, were motivated to participate, even though they did not have formal recommendations from the health provider. This resulted in a relatively low number of referrals. Perhaps, tighter control on data collection and referral procedures co-ordinated by the steering group may have shown more positive outcomes. Organisational instructions by decision-makers may have encouraged motivated practitioners and served as a guarantee for some practitioners who did not refer patients or only referred a few.

Another reason for the relatively low final sample may be because both primary health-care settings are located in socially deprived neighbourhoods and some practitioners have reported that health promotion interventions are rarely adopted by some ethnic minorities. The overall intervention was strongly associated with the personal interest of all agents involved, which had to cope with the political and financial situation which led to structural changes in the

public administration (both Catalan and Spanish) in general and health-care administration in particular, such as, staff layoffs or budget reduction, among other organisational issues.

In relation to a possible bias among the participants who were invited to enrol in the study, there was a first filter by referring practitioners. Practitioners may be efficient in selecting those participants that may potentially adhere because of their relationship. However, not all referred patients seemed to be ready for change. Referred patients had to be able and willing to comply with the exercise prescriptions and to attend follow-up meetings but there were already a high number of dropouts at the first meeting with the exercise specialist. In other interventions where participants had to pay a fee, the financial issue may be another selection bias (J. Sørensen, et al., 2010). In our study, it did not occur because the intervention was free of charge for the participants. Thus, included participants who quickly dropped out may have been ready for change, but the intervention was not of their interest.

Referrals did not include all health conditions that may benefit from exercising, which is of great importance when planning an individually-based exercise prescription. Perhaps it was due to the perceived lack of training on the benefits of exercise some practitioners feel they have (Puig-Ribera, et al., 2005). However, the Catalan PEFS handbook was edited to be used in clinical practice and may guide basic recommendations for both physicians and nurses (Departament de Salut. Generalitat de Catalunya, 2007).

Intervention procedures were designed to prescribe aerobic exercise for all patients. Frequency and duration were individually stated, while intensity was individually monitored. Thus, it was thought to be flexible enough to adapt to the needs of most of participants without losing objectiveness in its planning and monitoring. However, the use of overly-detailed procedures may have inhibited the exercise specialist colleague who delivered the intervention for four months. Further training, in areas such as health counselling, would have been required for the specific intervention.

To sum up, the main weaknesses of the study are a lack of tightly-controlled procedures for data collection and the short time available to assess long-time post-intervention effects. A better study design with a longer intervention would allow follow-up for adhered participants. Also, placing a contact person (practitioner or researcher) in charge of the control of data collection and referral procedures would reduce the amount of missing data.

The strongest aspect is the success we had in creating an interdisciplinary work environment among different professionals, bridging the gap between exercise specialists, who are very often isolated from public health practitioners, and practice consultations (Puig-Ribera, et al., 2006). Health professionals reported having enough feedback regarding patient benefits of the intervention. The intervention protocol was also designed to take possible medico-legal responsibilities into account, which acted as a barrier in some cases as reported by health professional in the UK (Graham, et al., 2005). The CAMINEM framework may be used and adapted for further interventions in Catalonia or Spain, because all procedures are developed under regional and national regulations.

Another positive aspect is that exercise prescriptions could be planned, monitored and assessed during short face-to-face counselling interventions. Exercise adherence has been objectively measured (type, frequency, duration, intensity) and physical activity behaviour assessment included intensity and duration, using a short questionnaire. The written prescription form/logbook (which was filled in even by illiterate participants) and the ClassAF questionnaire may be useful not only in clinical practice, but for pragmatic trials as well, as opposed to asking a very simple question of whether a patient adhered to the prescribed activity or not (Leijon, Bendtsen, et al., 2010).

Finally, overall positive health outcomes have been found mainly for adhered participants, and for active patients at maintenance. As a result, we could not find strong, statistically significant improvements in health parameters. Although, the intervention was as safe as other less intensive interventions with the added value of 10 h of work for the exercise specialist.

6.5 FUTURE DIRECTIONS FOR RESEARCH

Pragmatic interventions in primary health-care settings require tight controls on data collection and on possible bias. Efficacy or effectiveness studies on physical activity promotion interventions must, therefore, be supported with financial resources and the collaboration of different bodies and agents. Instead of developing practice procedures from evidence-based studies, some suggest collecting evidence from practice-based research (Green & Glasgow, 2006). Whichever pathway decision-makers and research groups take, there is no doubt that we need to bridge the gaps between research and practice.

The CAMINEM programme emerges from practitioners' collaboration rather than being solely directed by policy-makers. Adoption of the programme by practitioners is fundamental as well as organisational support to implement sustainable interventions. An example of the gap between research and practice, is that one of the largest, if not biggest, interventions on physical activity promotion in primary health-care settings in Spain was developed in 2003 (Grandes, et al., 2011) and its dissemination is not widely known.

Further research may arise from this work. It is suggested that the ClassAF questionnaire would be useful in clinical practice (Departament de Salut. Generalitat de Catalunya, 2007), given its usefulness in this pragmatic trial. ClassAF outcomes have shown concrete associations between SF-12v2 outcomes at baseline (higher ClassAF scores with higher SF-12v2 scores), and BMI and well-being at maintenance (higher ClassAF scores with lower BMI and higher self-perception of well-being).

Objective measurements on physical activity should be used for efficacy or effectiveness studies. The logbook was useful for monitoring participants' compliance with the exercise prescriptions, but it should be correlated with objective measures such as pedometers or accelerometers. Also, studies to assess the ClassAF validity and reliability are needed for further research where physical activity behaviour may be a primary outcome. The core of this study was not physical activity behaviour, but exercise compliance instead. However, physical activity behaviour is of great interest for maintenance follow-up assessment.

The design of the CAMINEM urban routes took into account the correlation between age, gender and urban route distance (Planas, et al., 2010). Regular PA behaviour should not be forgotten because fitness may be more strongly related to individual intensity response to the stimulus than are age and gender.

Both primary health-care centres included in the intervention have shown an interest in further collaboration with the exercise specialists, which is noteworthy. Other health-care centres nearby Lleida have shown an interest in developing the CAMINEM intervention. Larger interventions require larger research resources.

The CAMINEM procedures may be adapted for other types of exercise prescription relevant for health, such as home-based resistance training, flexibility or balance (American College of Sports Medicine, 2011; Departament de Salut. Generalitat de Catalunya, 2007). Written prescription forms and logbooks should report precise information to permit individually-planned procedures and follow-up.

Some data may be collected either by health practitioners or exercise specialists: weight, height, waist circumference, blood pressure, or heart rate. SF-36 is more broadly used and more suitable for small samples, and it may be preferable to the SF-12.

Training the health personnel on the CAMINEM features without the intervention of an exercise specialist may encourage the use of less intensive physical activity counselling in general practice and may encourage the health practitioners to monitor the outcomes and match them to current public health guidelines (Ministerio de Sanidad Política Social e Igualdad, 2011; World Health Organization, 2004, 2010). However, it strongly depends on practitioners' particular motivation to develop physical activity interventions without extra reimbursement.

The RE-AIM framework was set to be used to determine whether efficacy trials may be translated into effectiveness trials, whether effectiveness trials may be used as demonstration studies, and the impact on analysing the impact of demonstration studies (Estabrooks & Gyurcsik, 2003). Large interventions (nation- and regional-wide) may be assessed within this framework to detect possible weaknesses at grass-roots level.

Efficacy trials and pragmatic-design studies regarding exercise-on-prescription in local or regional Spanish settings may lay the foundations for further approaches. In relation to the CAMINEM approach, a larger intervention would allow for more consistent results in terms of the RE-AIM dimensions: more time for maintenance assessment, more human resources for tighter data collection procedures and support to practitioners for referring participants during their clinical practice.

Economic evaluations (e.g., cost-effectiveness) may be included in future trials as well as drugs consumption for exercise participants. Health benefits of physical activity and exercise are already well-known, and health practitioners with the support of an exercise specialist may develop programmes which translate QALY gains below acceptability funding thresholds (Dalziel, Segal, & Elley, 2006; Garrett, et al., 2011). Possible economic benefits of feasible and effective interventions may foster changes in decision makers from the pre-contemplative stage of change into action.

> *Given the seriousness of the situation, work needs to commence urgently at a population level with 'best guess' approaches—built on available evidence—that are closely evaluated. The journey will be long and testing, but like with so many other frontiers, the adventure will be worth it (Catford, 2003).*

6.5.1 FINAL COMMENTS

This thesis is, to our knowledge, the first study assessing an exercise prescription intervention in primary health-care settings based on exercise training principles and public health promotion together. The intervention was assessed over an 18 month time period in relation to its feasibility in public administrated primary health-care settings in the city of Lleida and in relation to the exercise effects on the participating patients.

First of all, there is lack of consensus about specific terminology concerning physical exercise and its components. Some concepts present slight, but important, differences when taken from the perspective of public health, exercise physiology or exercise training. New definitions suggested in this document adapt the classical terminology to health-related exercise purposes, such as *exercise training, exercise planning* and *the principle of specificity*. The term *exercise prescription* is broadly used in research but it should not be used in practice in Spain because physicians are the only professionals with the right to prescribe. However, *exercise planning* may be used in Catalan or Spanish because the training workload refers to the dose that has to be applied.

Physical activity promotion as a primary prevention method is becoming more common in many countries. However, exercise may be part of secondary or tertiary prevention for several non-communicable chronic diseases under the supervision and monitoring of exercise and health professionals.

It seems obvious to state that specific fitness training programmes improve fitness better than just increasing the overall physical activity level. In practice, however, there is a need to assess which approaches are effective and feasible in contexts reaching chronic patients with health conditions that may benefit from exercising.

This approach, based on the 'Let's Walk Programme' (*Programa CAMINEM*), was designed to monitor individualised exercise prescription and not only increase participants' physical activity level. It has been found to be suitable for exercise planning for patients with and without heart risk factors. Also, the intervention was based upon several evaluation indicators set in the Catalan Health Plan, the Spanish Plan A+D, the NAOS Strategy, and from WHO recommendations.

The intervention was safe for the participants, both those with previous high physical activity behaviour and without. Furthermore, positive results on health outcomes have been found for participants who adhered for more than six months, although they are not statistically significant. Given that the intervention did not show negative outcomes and any increase in physical activity behaviour level is positive for public health, it can be said that the 'Let's Walk Programme' was, at least, as beneficial as any other physical activity programme that may have been developed in clinical practice.

Programme adherence by the participants was not lower than in other physical activity programmes developed in other contexts or than in other community health promotion interventions organised by nurses in primary care. Health practitioners generally adopted the intervention although it was associated with individual interest and attitudes towards physical activity promotion. Despite the fact that the proportion of participants who actually benefited relative to the potential patients is similar to other pragmatic-oriented programmes published elsewhere, the methodology on data collection did not allow for conclusive results on exercise effects.

Participants who reported being active for at least six months after the intervention have shown better results in clinical health parameters and quality of life than those who reported being insufficiently active. All participants who adhered to the 'Let's Walk Programme' have reported that they continue to be physically active six months after participation. Health practitioners who actively participated and the Direction Boards of both centres have shown their interest in continuing with the intervention. They seem to be keen to improve the

feasibility of the programme and to continue with the programme as a result of the perceived positive effects seen in their patients.

Finally, this thesis may target an issue of interest for researchers, policy makers and practitioners. Dissemination of the feasibility results could be interesting for local, regional or even national decision makers in the field of health promotion, in Catalonia and Spain. In such case, it should be addressed to all professionals involved in health promotion and also exercise promotion: physicians, exercise specialists and nurses among others. In contrast, research dissemination of the results needs to be adapted to the standards required for peer-reviewed international journals. In that case, it may be needed a precise selection of data to discuss and, for further research, a different study design if accompanied by enough resources.

6.5.2 REFLEXIONS FINALS (in Catalan)

Aquesta tesi doctoral possiblement sigui el primer estudi que avalui una intervenció de prescripció d'exercici físic en centres d'atenció primària basada en els principis de l'entrenament esportiu conjuntament amb la promoció de salut pública. La intervenció s'ha avaluat durant 18 mesos en relació a la seva aplicabilitat en centres de titularitat pública de la ciutat de Lleida, i en els efectes que l'exercici físic ha provocat en els pacients participants.

En primer lloc, es troba en falta una terminologia unificada, en llengua anglesa, referent a l'exercici físic i els seus components, doncs varia des de la perspectiva de fisiologia de l'exercici, entrenament esportiu o promoció de salut pública. En aquest document es proposen noves definicions que adapten la terminologia clàssica als objectius de l'exercici físic per a la salut, com són *entrenament esportiu, planificació de l'entrenament* i *principi d'especificitat*. El terme *prescripció d'exercici físic*, tot i que s'utilitza de manera habitual en recerca, sobretot en la literatura anglosaxona, no és el més idoni en català doncs els metges són els únics professionals que poden prescriure. Tot i així es pot fer referència a *planificació d'exercici físic*, doncs la càrrega d'entrenament és la dosi a aplicar.

La promoció d'activitat física com a prevenció primària és cada cop més habitual en molts països, però l'exercici físic pot ser part de prevenció secundària o terciària per múltiples patologies cròniques no transmissibles, sota la supervisió i seguiment de professionals de l'exercici físic i la salut.

Sembla una obvietat que amb programes específics de condició física es millora la condició física més que no pas augmentant tan sols els nivells generals d'activitat física. A nivell pràctic, però, cal evidenciar quines intervencions resulten efectives i aplicables en contextes on se'n puguin beneficiar persones amb patologies cròniques tributables de millora mitjançant l'exercici físic.

La intervenció basada en el Programa CAMINEM, centrada no només en augmentar els nivells d'activitat física dels participants, sinó en fer un seguiment d'exercici físic individualitzat, s'ha utilitzat de manera satisfactòria en la planificació d'entrenament esportiu per determinats pacients, amb i sense factors de risc cardiovascular. A més, la intervenció tenia en compte indicadors d'avaluació proposats en el Pla de Salut de Catalunya, el Plan A+D, la Estrategia NAOS i l'OMS.

La intervenció ha resultat segura pels participants amb i sense hàbit previ d'activitat física. A més, els participants que s'han adherit durant més de sis mesos han mostrat, en general, resultats positius relacionats amb la salut tot i no ser estadisticament significatius. Tenint en compte que la intervenció no ha mostrat resultats negatius i que qualsevol millora dels nivells d'activitat física són beneficiosos en termes de salut pública, el Programa CAMINEM és, com a mínim, tan beneficiós com qualsevol altre programa de promoció d'activitat física que es pugui portar a terme en la pràctica clínica.

L'adherència al programa no ha estat inferior a la de programes de prescripció d'activitat física portats a terme en altres contextes, ni a la d'activitats de salut comunitària organitzades des dels serveis d'infermeria d'atenció primària. Els professionals sanitaris han mostrat una adopció acceptable de la intervenció, tot i que depèn de l'interès particular que cada professional tingui en la promoció d'activitat física. Tot i que la proporció de participants que se n'han beneficiat en relació als participants potencials és similar a d'altres programes amb intervencions disenyades amb un disseny pragmàtic, la metodologia en la recollida de dades no ha permès fer anàlisis concloentes en relació als efectes de l'exercici físic en els pacients participants.

Els participants que s'han mantingut actius als sis mesos, com a mínim, després de formar part de la intervenció mostren millors paràmetres clínics de salut i de percepció de qualitat de vida que aquells que es mostren inactius. Tots els participants adherits al Programa CAMINEM han mostrat mantenir continuïtat en el seu hàbit d'exercici físic sis mesos després

de finalitzar la intervenció. Professionals sanitaris que han col·laborat activament amb el projecte i els equips directius dels dos centres participants han mostrat interès en continuar amb la intervenció i modificar aquells aspectes necessaris per millorar la seva aplicabilitat tot mantenint els efectes positius per als pacients.

Per acabar, val a dir que la temàtica d'aquesta tesi doctoral enfoca un tema actual que pot ser d'interès tant per a personal de recerca com de gestió, i també per a professionals. La difusió dels resultats en relació a l'aplicabilitat de la intervenció poden interessar a les institucions responsables de promoció de salut i de l'àrea d'esports de diferent abast: des de regidories municipals, departaments i conselleries autonòmiques i, per què no, institucions estatals. En aquest sentit la difusió hauria d'anar adreçada a totes les persones relacionades en la promoció de la salut, però també en l'exercici físic: metges, tècnics esportius (principalment amb formació superior) i infermeres, entre d'altres. La difusió científica dels resultats obtinguts, per contra, necessita una adaptació als estàndards que requereixen les revistes internacionals de qualitat. En aquest sentit, potser caldria una selecció més precisa dels resultats per comentar i, amb la previsió de futures recerques, un disseny de la metodologia més curós sempre que vagi acompanyat de recursos suficients.

6.5.3 REFLEXIONES FINALES (in Spanish)

Esta tesis doctoral posiblemente haya sido el primer estudio que evalúe una intervención de prescripción de ejercicio físico en centros de atención primaria basada en los principios del entrenamiento deportivo conjuntamente con la promoción de salud pública. La intervención se ha evaluado durante 18 meses en relación a su aplicabilidad en centros de titularidad pública de la ciudad de Lleida y en los efectos que el ejercicio físico ha provocado en los pacientes participantes.

En primer lugar, se ha observado un vacío en una terminología unificada, en lengua inglesa, en relación al ejercicio físico y sus componentes, puesto que varía desde la perspectiva de la fisiología del ejercicio, del entrenamiento deportivo o de la promoción de salud pública. En este documento se proponen nuevas definiciones que adaptan la terminología clásica a los objetivos del ejercicio físico para la salud, como son *entrenamiento deportivo, planificación del entrenamiento* y *principio de especificidad*. El término *prescripción de ejercicio físico*, a pesar de ser usado habitualmente en investigación, sobretodo en la literatura anglosajona, no

es el más idóneo en castellano puesto que en España los médicos son los únicos profesionales que pueden prescribir. En cambio se sugiere utilizar *planificación de ejercicio físico*, puesto que la carga de entrenamiento es la dosis a aplicar.

La promoción de actividad física como prevención primaria es cada vez más habitual en muchos países, pero el ejercicio físico puede ser parte de prevención secundaria o terciara para múltiples patologías crónicas no transmisibles bajo la supervisión y seguimiento de profesionales del ejercicio físico y la salud.

Es redundante señalar que la condición física mejora más con programas específicos de condición física que simplemente aumentando los niveles generales de actividad física. De todos modos, es necesario evidenciar a nivel práctico qué intervenciones resultan efectivas y aplicables en aquellos contextos donde puedan beneficiarse las personas con patologías crónicas tributarias de mejora mediante el ejercicio físico.

La intervención basada en el Programa CAMINEM, centrada no solamente en aumentar los niveles de actividad física de los participantes, sino en realizar un seguimiento de ejercicio físico individualizado, se ha utilizado de manera satisfactoria en la planificación de entrenamiento deportivo para determinados pacientes, con y sin factores de riesgo cardiovascular. Además la intervención tuvo en cuenta indicadores de evaluación propuestos por el Plan de Salud de Cataluña, el Plan A+D, la Estrategia NAOS y la OMS.

La intervención resultó segura para los participantes tanto con hábito previo de actividad física como con los que no. También los participantes que se adhirieron durante más de seis meses han reflejado, en general, resultados positivos relacionados con la salud, a pesar de no ser estadísticamente significativos. Teniendo en cuenta que la intervención no ha comportado resultados negativos y que cualquier mejora en los niveles de actividad física son beneficiosos en términos de salud pública, el Programa CAMINEM es, como mínimo, tan beneficioso como cualquier otro programa de promoción de actividad física que se pueda llevar a cabo en la práctica clínica.

La adherencia al programa no ha sido inferior a la de programas de prescripción de actividad física llevados a cabo en otros contextos, ni a la de actividades de salud comunitaria organizadas desde los servicios de enfermería de atención primaria. Los profesionales sanitarios han mostrado una adopción aceptable de la intervención, a pesar de que depende del

interés particular que cada profesional tenga en la promoción de actividad física. A pesar de que la proporción de participantes que se han beneficiado en relación a los participantes potenciales es similar a la de otros programas con intervenciones con un diseño pragmático, la metodología en la recogida de datos no ha permitido llevar a cabo análisis concluyentes en relación a los efectos del ejercicio físico en los pacientes participantes.

Los participantes que se han mantenido activos a los, como mínimo, seis meses después de formar parte de la intervención muestran mejores parámetros clínicos de salud y de percepción de calidad de vida que aquellos que se mostraron inactivos. Todos los participantes adheridos al Programa CAMINEM han reflejado mantener continuidad en su hábito de ejercicio físico seis meses después de finalizar la intervención. Profesionales sanitarios que han colaborado activamente con el proyecto y los equipos directivos de ambos centros participantes han mostrado su interés en continuar con la intervención y modificar aquellos aspectos necesarios para mejorar la aplicabilidad y mantener los efectos positivos para los pacientes.

Para terminar, habría que remarcar que la temática de esta tesis doctoral enfoca un tema actual que puede ser de interés tanto para investigadores como gestores, y también para profesionales. La difusión de los resultados relacionados con la aplicabilidad de la intervención pueden interesar a las instituciones responsables de promoción de salud y del área de deportes de diferente envergadura: desde concejalías municipales, consejerías autonómicas y, por qué no, para instituciones estatales. En este sentido la difusión debería de ir dirigida a todas las personas relacionadas con la promoción de la salud, pero también a los profesionales del ejercicio físico: médicos, técnicos deportivos (principalmente con formación superior) y enfermeras, entre otros. La difusión científica de los resultados, por el contrario, necesita una adaptación a los estándares que requieren las revistas internacionales de calidad. En este sentido, posiblemente se necesite una selección más precisa de los resultados a comentar y, con la previsión para futuras investigaciones, un diseño de la metodología más concreto siempre que vaya acompañado de los recursos suficientes.

CHAPTER 7 – CONCLUSIONS

7.1 ENGLISH

The overall aim of this thesis was to conduct a safe exercise-on-prescription pragmatic trial in Lleida using the 'Let's Walk Programme' (*Programa CAMINEM*) as an interdisciplinary approach, to facilitate the adoption and maintenance of exercise levels by regular patients identified in primary health-care settings, with the underlying aim of improving their physical and mental health.

According to the aim 'to assess the effects of CAMINEM within the primary care routine':

HA1) Adhered participants showed improvement in clinical parameters. Multivariate analyses indicated a decrease in body mass index, diastolic blood pressure, resting heart rate, total blood cholesterol, LDL-cholesterol, and an increase in HDL-cholesterol, despite of the participants' previous physical activity behaviour. Previously inactive participants also saw a decrease in systolic blood pressure and the triglycerides. Previously active participants also saw a decrease in fasting glucose.

HA2) Adhered participants showed improvement in their self-perception of quality of life. Results for previously inactive participants indicated improvement scores for all SF-12v2 items and previously active participants indicated improvements in mentally related items. Experienced well-being increased throughout the intervention for all.

HA3) Adhered participants demanded less health services than those non-adhered. Interquartile range on primary-unit visits decreased throughout the intervention.

As a result, the null hypothesis HA0 – *Possible clinical effects, and/or self-perception of quality of life and/or health-care attendance have no relation to the CAMINEM intervention*, is rejected.

According to the aim 'to describe the feasibility of the intervention in Catalan settings':

HB1) The CAMINEM intervention reached the targeted population. The 1.49% referred is in accordance to other similar intensive interventions elsewhere.

HB2) The CAMINEM intervention had not been adopted by health-care personnel. Despite 40.24% (n = 33) of practitioners referring, only 12.20% (n = 10) referred regularly.

HB3) The CAMINEM intervention was safe and participants adhered to the exercise prescriptions. Only one adverse event was reported, one out of four participants was retained for more than six months, and all adhered participants were compliant with the exercise prescriptions. These are similar to other physical activity promotion approaches.

HB4) Adhered participants exercise regularly after the CAMINEM intervention. The 100% of participants reported being sufficiently physically active after six months post-intervention.

HB5) It is unknown whether health practitioners prescribe physical activity and/or exercise time after the CAMINEM intervention.

As a result, the null hypothesis HB0 – *Possible feasibility in clinical practice and/or post-intervention exercise participation has no relation to the CAMINEM intervention*, is partly rejected because adoption and setting maintenance were not positive.

7.2 CATALÀ

La finalitat d'aquesta tesi fou desenvolupar una intervenció pragmàtica i segura de prescripció i planificació d'exercici físic per a la salut a la ciutat de Lleida, tot utilitzant el Programa CAMINEM d'una manera interdisciplinària. Es pretengué facilitar l'adopció i el manteniment d'exercici físic a pacients identificats als centres d'atenció primària, amb la perspectiva de millorar el seu estat de salut físic i psicològic.

En relació a l'objectiu d'avaluar els efectes del CAMINEM dins la rutina d'atenció primària:

HA1) Els participants adherits mostraren millora en els paràmetres clínics. Les anàlisis multivariant demostraren descens en l'índex de massa corporal, en la tensió arterial diastòlica, en la freqüència cardíaca de repòs, en el colesterol total, en el colesterol LDL i un augment en el colesterol HDL, independentment del nivell d'activitat física previ. Els participants prèviament inactius addicionalment disminuïren la tensió arterial sistòlica i el nivell de triglicèrids, mentre que els prèviament actius disminuïren la glicèmia.

HA2) Els participants adherits mostraren millora en la seva percepció de qualitat de vida. Els participants prèviament inactius milloraren totes les puntuacions del SF-12v2, mentre que els prèviament actius tan sols les relacionades amb salut psicològica. La percepció de benestar augmentà per a tots els participants al llarg de la intervenció.

HA3) Els participants adherits demandaren menys serveis de salut que els no adherits. El rang interquartil del nombre de visites a l'equip d'atenció primària disminuí al llarg de la intervenció.

Així doncs, es refusa la hipòtesi nul·la HA0 – *Possibles efectes clínics i/o de percepció de qualitat de vida i/o en l'assistència al centre d'atenció primària no té cap relació amb la intervenció CAMINEM*.

En relació a l'objectiu de descriure l'aplicabilitat de la intervenció en centres de Catalunya:

HB1) La intervenció CAMINEM arribà a la població diana. L'1,49% de derivacions és similar a la reflectida en altres programes amb intervencions semblants.

HB2) La intervenció CAMINEM no fou adoptada pels professionals d'atenció primària. Malgrat que el 40,24% (n = 33) dels professionals derivaren algun pacient, només un 12,20% (n = 10) en derivaren regularment.

HB3) La intervenció CAMINEM fou segura i els participants s'adheriren a les planificacions d'exercici físic. Tan sols es tingué constància d'un esdeveniment advers, un de cada quatre participants es mantingué més de sis mesos en el programa i tots els participants adherits compliren correctament amb les indicacions sobre exercici físic. Aquests resultats són similars als publicats en altres programes de prescripció d'activitat física.

HB4) Els participants adherits realitzaren exercici físic regularment després de la intervenció CAMINEM. El 100% dels participants eren suficientment actius sis mesos després de la intervenció.

HB5) Es desconeix si els professionals sanitaris prescriviren activitat física i/o exercici físic després de la intervenció CAMINEM.

En conseqüència, la hipòtesi nul·la HB0 – *La possible aplicabilitat en la pràctica clínica i/o el desenvolupament d'exercici físic postintervenció no té relació amb la intervenció CAMINEM*, és refusada parcialment doncs l'adopció per part dels professionals sanitaris i el manteniment a nivell de centre no han estat positives.

7.3 CASTELLANO

La finalidad de esta tesis fue desarrollar una intervención pragmática y segura de prescripción y planificación de ejercicio físico para la salud en la ciudad de Lleida, haciendo uso del Programa CAMINEM de un modo interdisciplinario. Se pretendió facilitar la adopción y el mantenimiento de ejercicio físico a pacientes identificados en centros de atención primaria, con la perspectiva de mejorar su estado de salud físico y psicológico.

En relación al objetivo de evaluar los efectos del Programa CAMINEM dentro de la rutina de atención primaria:

HA1) Los participantes adheridos mostraron mejora en los parámetros clínicos. Los análisis multivariante demostraron descensos en el índice de masa corporal, en la tensión arterial diastólica, en la frecuencia cardiaca en reposo, en el colesterol total, en el colesterol LDL y un aumento en el colesterol HDL, independientemente del nivel de actividad física previo. Los participantes previamente inactivos adicionalmente disminuyeron la tensión arterial sistólica y el nivel de triglicéridos, mientras que los previamente activos disminuyeron la glicemia.

HA2) Los participantes adheridos mostraron mejora en su percepción de calidad de vida. Los participantes previamente inactivos mejoraron todas las puntuaciones del SF-12v2, mientras que los previamente activos solamente mejoraron las relacionadas con salud psicológica. La percepción de bienestar aumentó para todos los participantes a lo largo de la intervención.

HA3) Los participantes adheridos demandaron menos servicios de salud que los no adheridos. El rango intercuartil en el número de visitas al equipo de atención primaria disminuyó a lo largo de la intervención.

Así pues, se rechaza la hipótesis nula HA0 – *Posibles efectos clínicos y/o de percepción de calidad de vida y/o en la asistencia al centro de atención primaria no tiene ninguna relación con la intervención CAMINEM.*

En relación al objetivo de describir la aplicabilidad de la intervención en centros de Cataluña:

HB1) La intervención CAMINEM alcanzó a la población diana. El 1,49% de derivaciones es similar a la reflejada en otros programas con intervenciones similares.

HB2) La intervención CAMINEM no fue adoptada por los profesionales de atención primaria. A pesar de que el 40,24% (n = 33) de los profesionales derivaron algún paciente, solamente un 12,20% (n = 10) lo hicieron regularmente.

HB3) La intervención CAMINEM fue segura y los participantes se adhirieron a las planificaciones de ejercicio físico. Solamente se tuvo constancia de un evento adverso, uno de cada cuatro participantes se mantuvo más de seis meses en el programa y todos los participantes adheridos cumplieron correctamente con las indicaciones sobre ejercicio físico. Estos resultados son similares a los publicados en otros programas de prescripción de actividad física.

HB4) Los participantes adheridos realizaron ejercicio físico regularmente después de la intervención CAMINEM. El 100% de los participantes eran suficientemente activos después de seis meses post-intervención.

HB5) Se desconoce si los profesionales sanitarios prescribieron actividad física y/o ejercicio físico después de la intervención CAMINEM.

En consecuencia, la hipótesis nula HB0 – *La posible aplicabilidad en la práctica clínica y/o la práctica de ejercicio físico post-intervención no tiene relación con la intervención CAMINEM*, es rechazada parcialmente, puesto que la adopción por parte de los profesionales sanitarios y el mantenimiento a nivel de centro no han sido positivos.

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Think Global, act local
(To Ahti)

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ANNEXES

A. Evidence statements and summary of recommendations for the individualized exercise prescription

Cardiorespiratory ("aerobic") exercise		
Frequency	≥5 d·wk^{-1} of moderate exercise, or ≥3 d·wk^{-1} of vigorous exercise, or a combination of moderate and vigorous exercise on ≥3-5 d·wk^{-1} is recommended	A
Intensity	Moderate and/or vigorous intensity is recommended for most adults.	A
	Light- to moderate-intensity exercise may be beneficial in deconditioned persons.	B
Time	30-60 min·d^{-1} (150 min·wk^{-1}) of purposeful moderate exercise, or 20-60 min·d^{-1} (75 min·wk^{-1}) of vigorous exercise, or a combination of moderate and vigorous exercise per day is recommended for most adults.	A
	<20 min·d^{-1} (150 min·wk^{-1}) of exercise can be beneficial, especially in previously sedentary persons.	B
Type	Regular, purposeful exercise that involves major muscle groups and is continuous and rhythmic in nature is recommended.	A
Volume	A target volume of ≥500^{-1}000 MET·min·wk^{-1} is recommended.	C
	Increasing pedometer step counts by ≥2000 steps per day to reach a daily step count ≥7000 steps per day is beneficial.	B
	Exercising below these volumes may still be beneficial for persons unable or unwilling to reach this amount of exercise.	C
Pattern	Exercise may be performed in one (continuous) session per day or in multiple sessions of ≥10 min to accumulate the desired duration and volume of exercise per day.	A
	Exercise bouts of <10 min may yield favorable adaptations in very deconditioned individuals.	B
	Interval training can be effective in adults.	B
Progression	A gradual progression of exercise volume by adjusting exercise duration, frequency, and/or intensity is reasonable until the desired exercise goal (maintenance) is attained.	B
	This approach may enhance adherence and reduce risks of musculoskeletal injury and adverse coronary heart disease events.	D
Resistance exercise		
Frequency	Each major muscle group should be trained on 2-3 d·wk^{-1}.	A
Intensity	60%-70% of the 1RM (moderate to hard intensity) for novice to intermediate exercisers to improve strength.	A
	≥80% of the 1RM (hard to very hard intensity) for experienced strength trainers to improve strength.	A
	40%-50% of the 1RM (very light to light intensity) for older persons beginning exercise to improve strength.	A
	40%-50% of the 1RM (very light to light intensity) may be beneficial for improving strength in sedentary persons beginning a resistance training program.	D
	<50% of the 1RM (light to moderate intensity) to improve muscular endurance.	A
	20%-50% of the 1RM in older adults to improve power.	B
Time	No specific duration of training has been identified for effectiveness.	
Type	Resistance exercises involving each major muscle group are recommended.	A
	A variety of exercise equipment and/or body weight can be used to perform these exercises.	A
Repetitions	8-12 repetitions is recommended to improve strength and power in most adults.	A
	10-15 repetitions is effective in improving strength in middle aged and older persons starting exercise.	A
	15-20 repetitions are recommended to improve muscular endurance.	A
Sets	Two to four sets are recommended for most adults to improve strength and power.	A
	A single set of resistance exercise can be effective especially among older and novice exercisers.	A
	≤2 sets are effective in improving muscular endurance.	A
Pattern	Rest intervals of 2-3 min between each set of repetitions are effective.	B
	A rest of ≥48 h between sessions for any single muscle group is recommended.	A
Progression	A gradual progression of greater resistance, and/or more repetitions per set, and/or increasing frequency is recommended.	A

Flexibility exercise		
Frequency	≥2-3 d·wk^{-1} is effective in improving joint range of motion, with the greatest gains occurring with daily exercise.	B
Intensity	Stretch to the point of feeling tightness or slight discomfort.	C
Time	Holding a static stretch for 10-30 s is recommended for most adults.	C
	In older persons, holding a stretch for 30-60 s may confer greater benefit.	C
	For PNF stretching, a 3- to 6-s contraction at 20%-75% maximum voluntary contraction followed by a 10- 30-s assisted stretch is desirable.	B
Type	A series of flexibility exercises for each of the major muscle-tendon units is recommended.	B
	Static flexibility (active or passive), dynamic flexibility, ballistic flexibility, and PNF are each effective.	B
Volume	A reasonable target is to perform 60 s of total stretching time for each flexibility exercise.	B
Pattern	Repetition of each flexibility exercise two to four times is recommended.	B
	Flexibility exercise is most effective when the muscle is warmed through light to moderate aerobic activity or passively through external methods such as moist heat packs or hot baths.	A
Progression	Methods for optimal progression are unknown.	
Neuromotor exercise training		
Frequency	≥2-3 d·wk^{-1} is recommended.	B
Intensity	An effective intensity of neuromotor exercise has not been determined.	
Time	≥20-30 min·d^{-1} may be needed.	B
Type	Exercises involving motor skills (e.g., balance, agility, coordination, and gait), proprioceptive exercise training, and multifaceted activities (e.g., tai ji and yoga) are recommended for older persons to improve and maintain physical function and reduce falls in those at risk for falling.	B
	The effectiveness of neuromuscular exercise training in younger and middle-aged persons has not been established, but there is probable benefit.	D
Volume	The optimal volume (e.g., number of repetitions, intensity) is not known.	
Pattern	The optimal pattern of performing neuromotor exercise is not known.	
Progression	Methods for optimal progression are not known.	

Note. d = day, wk = week, min = minutes, 1RM = 1-repetition maximum, h = hour, s = second

Extracted from American College of Sports Medicine. (2011). Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults. Medicine and Science in Sports and Exercise, 43(7), 1334-1359. doi: 10.1249/MSS.0b013e318213fefb.

B. Spanish Health Strategies, Physical Activity Aims and Evaluation Indicators

AIMS IN WHICH PA IS INCLUDED	EVALUATION INDICATORS	PAGE
Andalusia (2003-08)		
To promote childhood and youth health	Number of schools with educational programmes including exercise activities	69
To promote women wellness and quality of life	NA	71
To promote quality of life for the elderly	**Percentage of older adults engaged in PA and sports**	72
To promote healthy habits	Evolution of lifestyle habits. Number of intersectorial programmes.	74
To promote health, healthy leisure time and quality of life in towns and cities	NA	76
Global plan for heart diseases...	NA	88
To decrease morbidity, early mortality and disability throughout global plans for cancer (among others)	NA	90
To reduce inequalities in the health sector	NA	98
Aragon (1999-?)		
To modify unhealthy behaviours of drug consumption	NA	203
To encourage physical education with healthy activities	NA	216
To improve quality of sport equipments and their accessibility	NA	216
To promote intersectorial collaboration	NA	216
To modify dietary and exercise habits	Activities aimed at promoting healthy diet and exercise	238
Asturias (2004-07)		
To launch worksite programs of exercise	NA	93
To increase population knowledge towards the importance of exercise for health	NA	126
To include health services as exercise promoters	NA	127
To increase equipments and sport activities with co-ordination of public administrations	NA	128
To introduce exercise advice within primary and specialised care	NA	128
To launch community activities for exercise promotion	NA	128
To edit exercise guides	NA	128
To create home-based exercise programs for non-dwelling people	NA	128
To launch supervised exercise programs for patients suffering from CVD, respiratory, metabolic or musculoskeltal problems	NA	128
To include evidence-based clinical practice for cardiovascular risk factor prevention (not including PA)	**Percentage of population engaging in exercise**	157
Balearic Islands (2003-07)		
To develop permanent activities of PA promotion	Creation of specific programmes. Ratio of health-care settings developing PA promotion programmes. Ratio of health-care and school settings with bycicle parking slots	42
To promote PA, diet and smoke cessation (for people with handicap)	Number of campaigns and interventions	101
To encourage healthy settings	Number of settings registered	102
To promote individual advice from PHC for people above 74	**Percentage of people receiving advice**	102
Basque Country (2002-10)		
To increase the number of people engaging in LTPA	**From 24% (1997) to 32% by 2010**	79 165
Canary Islands (2004-08)		
To encourage a low-calory diet and regular PA for overweight patients	NA	129
To increase effectivity of PA campaigns	NA. Budget information only (p. 234)	130
To inform and educate health practitioners about PA advice	NA	130
To assess 100% of patients with risk factors when attending their PHC	NA	131
To organise annual events to promote HEPA from PHC	NA	131
To advise all patients with ischemic cardiopaty on healthy habits	NA	132
To improve quality of life, PA levels and increase overweight rates on the general population	NA	164
To develop PA targeted programmes for DM	NA. Budget information only (p. 234)	168
To include a health educator in PHC	NA	169

To promote PA throught media and other settings for older people	NA. Budget information only (p. 234)	201
To provide exercise promotion materials	NA. Budget information only (p. 234)	234
Cantabria (1996-2000)		
To promote healthy habits (for respiratory conditions)	NA	171
To promote healthy lifestyle, especially diet and exercise (for musculoskeletal health conditions)	NA	173
Castile and León (2008-12)		
To promote exercise and PA for all ages (for musculoskeletal problems)	NA	212
To increase LTPA for women	**Prevalence of sedentarism in women**	225
To increase LTPA by 10% in the total population	**Percentage of population engaging in LTPA**	225
To promote leisure activities for the youth	NA	225
To promote PA for school-aged children	**Prevalence of sedentarism in children of school age**	225
To reduce the time on videogames for children under 16	**Prevalence of sedentarism in children under 16**	225
To educate on the creation of healthy habits	Indicators from "Sport Programmes" programme	226
To financially support municipalities for the promotion of [walking and cycling] routes	Indicators from "Programme to improve quality of tourist services"	226
To promote accesible routes and paths	Indicators from "Programme to improve quality of tourist services"	226
To promote environmental sustaineble transportation	Indicators from "The city without my car" programme	226
To promote sport activities as healthy habit	Indicators from "Sport Programmes" programme	226
To promote walking as transportation	Indicators from "The city without my car" programme	226
To implement PA advice in primary health-care	NA	227
To promote exercise and PA for all ages (for overweight people)	NA	229
Castile La Mancha (2001-10)		
To increase health in youth through promotion of healthy lifestyles	Agreement between departments to include healthy lifestyles in teacher training and in the school curriculum	185
Catalonia (2009-10)		
To reduce the impact of inactivity (PAAS)	Activities developed through the PAAS plan	45
To develop campaigns for detection and treatment of inactivity	Percentage of health electronic records with information on PA advice or prescription	46
To develop campaigns for health and community interventions	Activities developed by both health and community settings	46
To execute campaigns for healthy environments	NA	46
To promote PA in school, health, work and community settings	**Level of insufficient PA from 32.4% (2006) to 28.8 (2010). Percentage of people walking at least 30 min a day from 45.5% (2006) to 54.6 (2010)**	46
To include healthy diet and PA in school curriculum	NA	49
To develop a healthy diet and PA promotion at work	Activities developed through the PAAS plan	50
To encourage healthy habits for patients with risk factors (including PA)	Activities developed through the PAAS plan	85
To encourage healthy habits including PA (for DM)	Activities developed through the PAAS plan	88
To promote healthy choices on diet and PA (for overweight)	Activities developed through the PAAS plan	91
To promote healthy PA and smoke cessation for COPD	Activities developed through the PAAS plan	94
Extremadura (2009-12)		
To promote healthy habits (for respiratory conditions)	Activities of health education activities	369
To develope campaigns for diet and PA promotion (for overweight people)	Rate of campaigns per year	377
To educate practitioners towards diet and PA	Number of courses taught	377
To keep "Exercise look after you" programme as tool for healthy habits promotion	Number of people and municipalities participating	377
To support health promotion from school settings	Percentage of settings with specific programmes	423
To include electronic records on exercise for women (among others)	Percentage of electronic records	448
To include electronic records on exercise for adults (among others)	Percentage of electronic records	452
To include electronic records on PA for seniors (among others)	Percentage of electronic records	453
Galicia (?-2014)		
To develope promotion of healthy habits and disease prevention	NA	32
La Rioja (2009-13)		
To develope campaigns for PA promotion	Number of campaigns	117
To encourage physical education with healthy activities	Number of activities in collaboration with the Education Department	117
To increase PA levels	**Percentage of people engaging in PA**	117
To include exercise advice as part of clinical practice	Percentage of practitioners advising and counseling on exercise	117
To teach how to plan health-enhancing exercise for diabetic people	Percentage of diabetic patients receiving individualised exercise advice	261
To launch health promotion programmes and increase	Percentage of people engaging in PA	266

the levels of exercise		
To encourage healthy habits on diet and exercise for children	Percentage of people engaging in PA	266
To inform about the importance of exercising (for the elderly)	Number and percentage of elderly people engaging in exercise and sports participation	299
To prevent functional impairment	Number and percentage of elderly people engaging in exercise and sports participation	301
Madrid (NA)		
Murcia (2010-15)		
To promote walking and cycling as transportation	Kilometers of cycle and trekking paths, from 185 (2009) to 464 (2015)	83
To achieve higher levels of exercise and less sedentary activities	NA	83
To promote exercise for all ages	NA	83
To improve access to sports facilities	Sports facilities per citizen, from 27.4 (2009) to 45 (2015)	83
To promote exercise environments	Percentatges of parks with exercise items, from 15% (2009) to 50% (2015)	83
To offer CVD patients treatment including PA or exercise (among others)	NA	153
Navarre (2006-12)		
To promote healthy diet and exercise for general population	NA	28
To promote individual activities for diet and exercise	NA	28
To develop a global care plan for COPD	NA	44
Valencian Community (2005-09)		
To promote HEPA and exercise	NA	172
To promote PA and exercise aimed at decreasing sedentary levels	Number of activities of PA and health promotion	172
To train practitioners on exercise and PA prescription	Number of courses and participants	172
To disseminate information about the correct PA ergonomics	Material edited for information dissemination	173
To edit materials for PA promotion	Number of activities of PA and health promotion	173
To execute a health promotion and disease prevention programme for risk populations	Development of the program	173
To execute regular recommendations on daily walking	Recommendations recorded on electronic health records	173
To include PA advice into health electronic records	Fulfilment of records. Information available at the website	173
To organise educational programmes for professionals at school, health, and community settings	Number of courses and participants	173
To recommend strategies to increase active lifestyles	Number of campaigns done	173
To recommend PA activities at work	Development of promotion materials for work environments	173
To execute campaigns about correct PA in dailylife (for musculoskeltal disorders)	Number of campaigns	200
To execute health education programmes (for musculoskeletal prevention)	Number of programmes	200
To prescribe PA in medical care (for musculoskeletal disorders)	Log of electronic records	200
To promote healthy habits (including PA) (for osteoporosis)	NA	201
To recommend local administrations to develop PA for the elderly	Number of recommendations	207

Note. PA = physical activity, PHC = primary health care, LTPA = leisure-time physical activity, HEPA = health-enhancing physical activity, DM = diabetes Mellitus, CVD = cardiovascular disease, COPD = chronic obstructive pulmonary disease, PAAS = Catalan plan for healthy diet and physical activity, NA = not available. Bold: Indicators focused on people participation, italics: up-to-date documents by 2010.

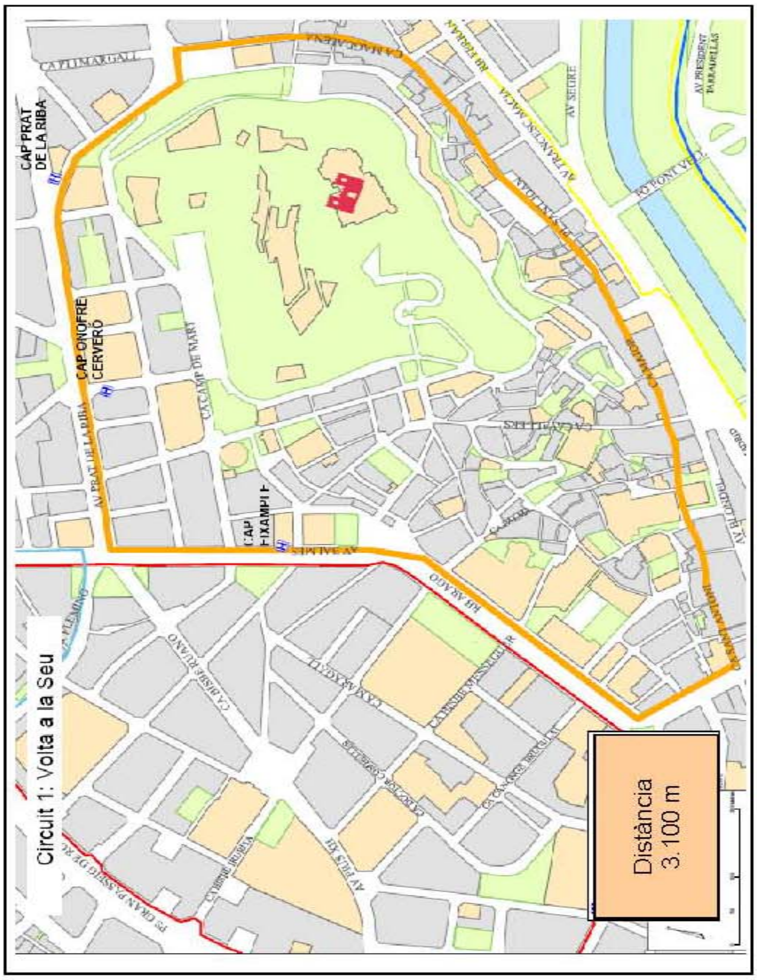
C. CAMINEM Urban Route – Correlation between distance and time by age

Institut Català de la Salut

edat	exercici suau ♥ més de …	exercici ♥♥ moderat entre	♥♥♥ exercici intens menys de …
25	35min	⇕	24min
30	36min	⇕	26min
35	38min	⇕	27min
40	39min	⇕	28min
45	40min	⇕	29min
50	41min	⇕	30min
55	42min	⇕	31min
60	44min	⇕	33min
65	45min	⇕	34min
70	46min	⇕	35min
75	47min	⇕	36min
80	48min	⇕	37min
85	49min	⇕	39min
	50%	%FC_Max	80%

INEFC Institut Nacional d'Educació Física de Catalunya Lleida

Generalitat de Catalunya



EXERCISE PRESCRIPTION - CAMINEM

Institut Català de la Salut INEFC

HEALTH PROFESSIONAL (GP or NURSE): ..... HEALTHCARE CENTER: .....
PATIENT NAME: ..... HEALTHCARE PHONE NUMBER: .....

Number of recommended walks per week: ..... **Time proposed to exercise:** ..... **minutes**

Date	Route	Starting time	Ending time	Route completed		Level of fatigue after completing the route (cross the line) Easy ⬇ Hard ⬇
				YES	NO	
				YES	NO	
				YES	NO	
				YES	NO	
				YES	NO	
				YES	NO	
				YES	NO	
				YES	NO	

NEXT CONSULTATION: .....

OBSERVATIONS: .....

When completed please deliver the logbook to your health professional or exercise specialist

E. ClassAF – Physical Activity Behaviour quick classifier

Based from Departament de Salut. Generalitat de Catalunya. (2007). Guia de prescripió de l'exercici físic per a la salut (PEFS) C. Vallbona Calbó, E. Roure Cuspinera & M. Violan Fors (Eds.), Retrieved from http://www.gencat.cat/salut/depsalut/pdf/guiexe2007.pdf.

The ClassAF questionnaire includes three questions regarding a) type of regular occupational & household physical activity for a typical day (8 h), b) type of regular leisure-time physical activity for a typical week*, c) frequency of leisure-time physical activities, if any, during a typical week**.

OCCUPATIONAL AND HOUSEHOLD PHYSICAL ACTIVITY – OPA			
Score	*Intensity*	*Examples*	*Energy expenditure*
0	Inactive	Sitting most of the day	> 1.2 MET
1	Low	Standing up most of the day without moving	> 2.0 MET
2	Moderate	Walking frequently	> 3.0 MET
3	Vigorous	Physically demanding activities	> 5.0 MET
LEISURE-TIME PHYSICAL ACTIVITY – LTPA			
Score	*Intensity*	*Examples*	*Energy expenditure*
1	Low	Walking, boul, yoga, etc.	> 3.0 MET
2	Moderate	Cycling, gymnastics, aerobics, jogging, tennis, swimming, etc.	> 5.0 MET
3	Vigorous	Squash, football, basketball, hockey, etc.	> 7.0 MET

The numeric score is then qualitatively recoded using the following equation:

$$\text{ClassAF} = 2 * \text{OPA} + \text{LTPA} * \text{freq}^2$$

CLASSAF Outcome		
Code	*Physical activity behaviour*	*Equation outcome*
0	Sedentary	0 - 1
A	Minimum physical activity	2 - 3
B	Slight physical activity	4 - 5
C	Moderate physical activity	6 - 11
D	Very active	12 - 33

** For the CAMINEM study, the highest intensity was considered when more than one type of activity was reported.*
*** Answers were from "0" to "3 or more".*

F. Patient referral form – case example

Institut Català de la Salut

Sol·licitud de derivació / interconsulta clínica Data registre 01/03/11

Unitat que fa la sol.licitud

Nom [redacted]

Adreça [redacted]

Localitat i CP [redacted] LLEIDA

Unitat de destinació (Etiqueta identificadora)

Nom de la unitat

Adreça

Localitat i CP

Dades del/ de la pacient

Cognoms, Nom [redacted] Data de naixement

Servei sol.licitat

Cal emplenar el que correspongui: X Diagnòstic ☐ Seguiment ☐ Cribratge Data recomanada de realització:

Cal indicar la prioritat: X Ordinària ☐ Preferent ☐ Urgent Justifiqueu la prioritat urgent o preferent

Prova:
VISITA SUCCESIVA

(SERVEIS MEDICS:ALTRES) CAMINEM

Diagnòstic

Codi: E66.9 **Descripció:** OBESITAT, NO ESPECIFICADA

Informació sanitària - dades clíniques rellevants

Segons el Reial Decret 815/2001, de 13 de juliol, sobre justificació de l'ús de les radiacions ionitzants (BOE núm. 188 de 14.07.01), el personal sol·licitant de qualsevol tècnica diagnòstica o terapèutica, que comporta exposició a les radiacions ionitzants, ha de justificar la seva sol·licitud i ha d'especificar també si es presenta alguna de les situacions següents o no: gestació, diabetis, al·lèrgies o tractament anticoagulant.

Dona de 55 anys d´edat amb els problemes de salut actius rellevants:
2011 - (E66.9)-OBESITAT
2007 - (M54)-DORSÀLGIA
2003 - (I47.1)-TAQUICÀRDIA SUPRAVENTRICULAR
2010 - (H81.3)-VERTIGEN PERIFÈRIC
2007 - (M54.4)-LUMBAGO AMB CIÀTICA
Agrairia valoració d'aquesta pacient HTA, darrera analítica hiperglucèmia
Habitualment camina més d'una bora diaria i está motivada. Ve a consulta per perdre pes.

Cordialment,

Al·lèrgies registrades:
(Z88.0)-ANTECEDENTS PERSONALS D'AL-LÈRGIA A LA PENICIL·LINA Important

Entregar per la unitat de destinació.

[redacted]
INFERMERIA
[redacted]
INSTITUT CATALA DE LA SALUT
Tel. [redacted]

01/03/11 [redacted]

ICS 1024 M (05/04)

G. Data collection referral form

DUI _____

Atès que el Sr. / la Sra. _____
participa en el Programa CAMINEM de manera activa i estable sol·licitem la realització de les valoracions següents corresponents als sis mesos (6) de la seva inclusió en el programa, tot seguint amb el protocol establert per l'equip de recerca:

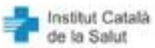
- Pes, talla, perímetre abdominal
- FC, TA
- Analítica

Atentament,

Sebastià Mas

Lleida, a _____ de/d' _____ de 201

H. Informed consent form



DOCUMENT D'ACCEPTACIÓ DE PARTICIPACIÓ

NOM i COGNOMS:_____

DNI:_____

TELÈFON:_____

Amb la signatura del present document manifesto que he acceptat participar de forma totalment lliure i gratuïta en aquest estudi pilot de valoració dels efectes de l'exercici físic sobre la salut de les persones.

De la mateixa manera expresso que no tinc cap objecció a que durant la durada de la caminada es mesurin amb els aparells adients tots aquells paràmetres clínics (pols, pressió arterial,...) que els investigadors considerin oportuns, donat que es tracta de proves que no són invasives ni infligeixen dolor ni les lesions més mínimes sobre el meu organisme, així com també altres proves escrites amb la mateixa finalitat (tests de qualitat de vida, motivacionals...)

Autoritzo de bon grat a que les dades resultants dels mesuraments abans expressats s'utilitzin per a la realització de treballs d'investigació, sempre i quant es salvaguardi el meu dret a la intimitat i el meu anonimat en quant a la publicació d'aquestes dades.

Lleida, _____de_____ de 201_

La alienación/3

Alaistair Reid escribe en *The New Yorker*, pero va poco a Nueva York.

Él prefiere vivir en una perdida playa en la República Dominicana. En esa playa había desembarcado Cristóbal Colón, algunos siglos antes, en una de sus excursiones al Japón, y desde aquellos tiempos nada ha cambiado.

De vez en cuando, el cartero asoma entre los árboles. El cartero viene doblado bajo la carga. Don Alaistair recibe montañas de correspondencia. Desde los Estados Unidos, lo bombardean las ofertas comerciales, folletos, catálogos, lujuriosas tentaciones de la civilización del consumo exhortando a comprar.

Una vez, entre el mucho papelerío, llegó la propaganda de una máquina de remar. Don Alaistair la mostró a sus vecinos, los pescadores.

–¿Bajo techo? ¿Se usa bajo techo?

Los pescadores no lo podían creer:

–¿Sin agua? ¿Se rema sin agua?

No lo podían creer, no lo podían entender:

–¿Y sin peces? ¿Y sin sol? ¿Y sin cielo?

Los pescadores dijeron a don Alaistair que ellos se levantaban cada noche, mucho antes del alba, y se metían mar adentro y echaban sus redes mientras el sol se alzaba en el horizonte, y que ésa era su vida, y que esa vida les gustaba, pero que remar era la única parte jodida de todo el asunto:

–Remar es lo único que odiamos –dijeron los pescadores.

Entonces don Alaistair les explicó que la máquina de remar servía para hacer gimnasia.

–¿Para qué?

–Gimnasia.

–¡Ah! Y gimnasia, ¿qué es?

Eduardo Galeano
El libro de los abrazos (1989)