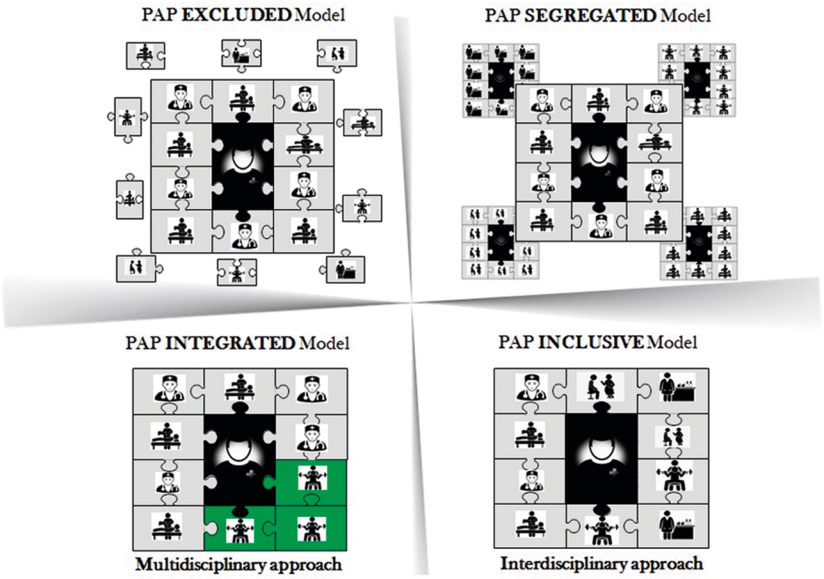
INTERNATIONAL Ph.D. THESIS

DOCTORAL INTERNACIONAL TESIS

Context analysis in the development for future implementation of Exercise is Medicine® initiative as prevention and treatment resource for chronic diseases at Primary Healthcare settings.

Análisis del contexto de Atención Primaria para implementar la iniciativa *Exercise is Medicine®* como recurso de prevención y tratamiento de las enfermedades crónicas.



Exercise is Medicine® Spain

SERGIO CALONGE PASCUAL

2019

UNIVERSIDAD POLITÉCNICA DE MADRID

FACULTAD DE CIENCIAS DE LA ACTIVIDAD FÍSICA Y DEL DEPORTE (INEF)

Context analysis in the development for future implementation of Exercise is Medicine® initiative as prevention and treatment resource for chronic diseases at Primary Healthcare settings

International Ph.D Thesis
Tesis Doctoral Internacional

Sergio Calonge Pascual

Licenciado en Ciencias de la Actividad Física y del Deporte

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"I can accept failure, everyone fails at something, but I cannot accept not trying"
Michael Jordan
Puedo aceptar el fracaso, todo el mundo fracasa en algo, pero lo que no puedo aceptar es no intentarlo

"Twenty years from now you will be more disappointed by the things you didn't do than by the ones you did do. So throw off the bowlines. Sail away from the safe harbor." Mark Twain
Dentro de 20 años te sentirás más defraudado por las cosas que no llegaste a hacer que por las que realmente hiciste. Así es que arriésgate, navega lejos de los puertos seguros..

Thanks to everyone who trusted and helped me on this way
Gracias a todos por confiar y ayudarme en este camino

Muito obrigado
Muchas gracias

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En Madrid, 1 de Junio de 2019

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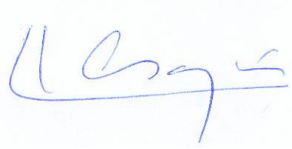

Fdo. José Antonio Casajús Mallén

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List of Abbreviations and Symbols

ACSM	American College of Sports Medicine
ANOVA	Analysis of variance
β	Standardized coefficients
BMI	Body Mass Index
CAFYDE	Ciencias de la Actividad Física y del Deporte
CDC	Center for Disease Control and Prevention
CI	Confidence interval
cpm	Counts per minute
CV	Coefficient of variation
CVD	Cardiovascular disease
ECTS	European Credit Transfer System
EIM	Exercise is Medicine®
EIM-S	Exercise is Medicine® Spain
et al.	*et alii* (= and others)
EXERNET	Spanish Research Network on physical exercise and health.
ExQ	Cuestionario EXERNET
FLASS	Fédération Luxembourgeoise des Associations de Sport de Santé
GPs	General practitioners
h	Hour(s)
HAPA	Health Action Process Approach
HEPA	Health Enhancing Physical Activity
I.C.	Interval Coefficient
i.e.	id est (=that is)
INE	National Statistics Institute (Spain)
ISPAH	International Society for Physical Activity and Health
KDQOL	Kidney Disease Quality of Life
LPA	Light Physical Activity
LSA	Lifestyle Adviser
m	Meter(s)
MEDLINE	U.S. National Library of Medicine®
METs	Metabolic equivalents
min	Minute(s)
MPA	Moderate Physical Activity
MVPA	Moderate-Vigorous Physical Activity
n	Number of
NCDs	Non-communicable diseases
NERS	National Exercise Referral Scheme
NICE	National Institute for Health and Clinical Excellence
ND-Wrist	Non-dominant wrist
OMS	Organización Mundial de la Salud
PA	Physical activity
PAC	Physical Activity Coach
PACs	Physical Activity Coaches
PACE	Physician-based Assessment and Counselling for Exercise
PAL	Physical activity level/s
PHC	Primary Health-care
PNTSS	Programme National Thérapeutique Sport-Santé
PAP	Physical activity on prescription

PAPRICA	Physical Activity Promotion in PRImary Care
PAVS	Physical Activity Vital Sign
PAVS-EIM	Physical Activity Vital Sign- Exercise is Medicine®
PEPAF	Programa Experimental de Promoción de la Actividad Fisica
R^2	Coefficient of determination
sec.	Seconds
SD	Standard Deviation
SF-36	SF-36 Health questionnaire
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
USA	United States of America
VAT	Visceral adipose tissue
VO_{2max}	Maximal oxygen Uptake
VMCounts	Vector Magnitude Counts
VPA	Vigorous Physical Activity
vs.	Versus
WHA	World Health Assembly
WHO	World Health Organization
wk	Week
y	Years
α	Alpha
®	Registered Trademark
7d	7 days

List of articles from the Ph.D. thesis

1. Calonge-Pascual Sergio, Casajús-Mallén José Antonio, González-Gross Marcela. Physical activity as prevention and treatment resource of chronic diseases in the syllabus of medicine and sport sciences at Spanish universities. Nutr Hosp. 2017;34:961-8.
2. Calonge-Pascual Sergio, Casajús-Mallén José Antonio, González-Gross Marcela. Physical exercise training in the syllabus of Bachelor of Science in nursing degrees. Contemporary Nurse (submitted).
3. Calonge-Pascual Sergio, Casajús-Mallén José Antonio, González-Gross Marcela. Adherence factors related to exercise prescriptions in healthcare settings: a critical appraisal of the scientific literature. Research Quarterly for Exercise and Sport (submitted).
4. Sergio Calonge Pascual, et al., on behalf of EXERNET Study Group. Physical exercise barriers related to a multivariable adherence model in chronic adult kidney patients.
5. Calonge-Pascual Sergio, Francisco Fuentes Jiménez, González-Gross Marcela, on behalf of EXERNET Study Group. Focus group sessions of physical activity on prescription with general practitioner and nurses of Madrid Primary Healthcares.
6. Calonge-Pascual Sergio, Francisco Fuentes Jiménez, Casajús-Mallén José Antonio, González-Gross Marcela, on behalf of EXERNET Study Group. Design and validity of a choice-modelling questionnaire to analyze physical activity on prescription with general practitioner and nurses of Madrid Primary Healthcare settings.
7. Calonge-Pascual Sergio, et al., on behalf of EXERNET Study Group. Self-perception assessment in physical activity on prescription by general practitioners and nurses in Madrid Primary Healthcare settings.
8. Calonge-Pascual Sergio, Villa-González Emilio, Santos María Paula, Casajús-Mallén José Antonio, Mota Jorge, González-Gross Marcela. Assessment design of physical activity and sedentary patterns as a vital sign anamnesis for Primary Healthcare settings (to be submitted in Health Science Reports).

Granted Research Projects

The present Ph.D. Thesis is primarily based on data from the EXERCISE IS MEDICINE SPAIN (EIM-S) project.

The EIM-S study is a cross-sectional study about the assessment and implantation of Exercise is Medicine® strategy in Spain and its relation with physical activity promotion and exercise prescription in Madrid healthcare centers. Funded by the ImFine Research Group of the Universidad Politécnica de Madrid and supported by the Ministry of Health of the Region of Madrid.

Coordinator: Prof. Dr. Marcela González-Gross.

Principal investigators: Prof. Dr. Marcela González-Gross, Prof. Dr. José Antonio Casajús Mallén

Implication of the PhD candidate: The PhD candidate was involved in the fieldwork in Madrid. The PhD candidate has been processing data and working on the data analysis. Finally, the PhD candidate has been writing the scientific papers.

Grants and Funding

- Predoctoral Grant supported by the UPM own programme - contract join to the ImFine Research Group of the Universidad Politécnica de Madrid. (PIF: Personal Investigador en Formación). 2015-2019.
- Iberoamérica Santander Grant from the Banco Santander and the Universidad Politécnica de Madrid for internship abroad:
    - Internship in the Universidade do Porto (Facultade de Desporto), Physical activity, health and leisure time Group, Porto, (Portugal). 22nd August 2018- 24th December 2018 (4 months and 2 days).
- The ERASMUS+ KA103 practice student mobility:
    - CIAFEL research center in health, physical activity and leisure, supported by Portuguese science and technology foundation, Portugal. 22nd August 2018- 1st January 2019 (4 months and 9 days).
- The E10 Meeting of younger researches on public health, supported by the net CIBER (Biomedical research center)
    - XXVIII Escuela de salud pública de Menorca, Maó, Menorca, Spain. 20th to 22nd September 2017 (3 days).

Structure of the Ph.D. thesis

This Ph.D. thesis consists of 6 sections. The first section is a general introduction. The second section includes the objectives. Section 3 has the general material and methods explanation of the Ph.D. thesis. Section 4 includes the scientific work presented in the format of 8 articles, each one following the format used by the scientific journals (introduction, material and methods, results, discussion and conclusions). Within this section, all submitted or published articles and summarized in Table 1. Article 1, Physical activity as prevention and treatment resource of chronic diseases in the syllabus of Medicine and Sport Sciences at Spanish universities. Article 2, Physical exercise training in the syllabus of Bachelor of Science in Nursing degrees. Article 3, Adherence factors related to exercise prescriptions in Healthcare settings: a critical appraisal of scientific literature. Article 4, Physical exercise barriers related to a multivariable adherence model in chronic adult kidney patients. In article 5, Focus group sessions of physical activity on prescription with general practitioners and nurses of Madrid Primary Healthcare System. In article 6, Design and validity of a choice-modelling questionnaire to analyze physical activity on prescription with general practitioners and nurses of Madrid Primary Healthcare settings. In article 7, Self-perception assessment in physical activity on prescription by general practitioners and nurses in Madrid Primary Healthcare settings. Article 8, Assessment design of physical activity and sedentary patterns as a vital sign anamnesis for Primary healthcare settings. Section 5 contains a general discussion of the entire Ph.D. thesis and summarises the main outcomes of the different studies. Lastly, section 6 includes the specific and general conclusions of the Ph.D. thesis. For the reader's benefit, references of each article have been removed and placed at the end of this Ph.D. thesis.

ABSTRACT

The current Ph.D. thesis is based on the Exercise is Medicine® initiative of the American College of Sports Medicine (ACSM), regarding the use of physical activity (PA) as a preventive resource and exercise prescription as a non-pharmacological adjuvant resource in Primary Health-Care (PHC) settings.

The results of this Ph.D. thesis have a social, scientific and health interest for the community and could be used by the Healthcare System as a cost-effectiveness resource.

Physical inactivity and sedentary patterns currently represent one of the major threats to public health with pessimistic perspectives for the future. Approximately one-third of the population has insufficient PA behaviours.

Many strategies have been developed regarding health promotion since the Ottawa Charter in 1986. Currently, the "WHO Global Action Plan for the Prevention and Control of Non-Communicable Diseases 2013–2020" and the "PA strategy for the World Health Organization (WHO) European Region 2016–2025", are trying to increase PA levels in the population, including PA on prescription at healthcare settings. The WHO target is to reduce physical inactivity levels by 15% in 2030 worldwide by the "Global action plan on physical activity 2018–2030: more active people for a healthier world".

The main objective of this Ph.D. thesis is: To analyze the feasibility of physical activity on prescription (PAP) implementation as a preventive and treatment resource for non-communicable chronic diseases in PHC settings.

Secondary objectives are: (1) To analyze the inclusion of PA and exercise as a preventive and treatment resource for chronic diseases in the syllabus of Bachellors in Medicine, Sports Science and Nursing at Spanish universities. (2) To review studies which have reported adherence to exercise prescribed to chronic patients, according to the WHO multi-dimensional adherence model. (3) To analyze exercise training programmes adherence in dialysis patients. (4) To analyze in depth attitudes, self-perception, barriers, facilitators and knowledge of nurses and physicians towards the implementation of PAP at Madrid PHC settings. (5) To compare PA and sedentary patterns, measured objectively (by accelerometer) or subjectively (by the PAVS-EIM and the IPAQ short version questionnaires), for contributing to the design of a patient anamnesis tool at PHC centers.

The main outcomes of this Ph.D. thesis are: a) ECTS regarding physical activity promotion and exercise prescription in the Bachelor syllabus at Spanish universities are for Sport Sciences 17.7±4.6%, Nursing 5.8±3.9% and Medicine 3.6±1.7%. b) In the reviewed literature, adherence to exercise prescriptions was mainly related to the social/economical dimension (97 factors), followed by condition-related dimension (59 factors) and patient-related factors (n=58). Dimension related to Healthcare team and System was less cited with only 20 factors. c) In chronic kidney patients, 75% of exercise training programme adherence (attendance to at least 75% of 40 total sessions scheduled) was 33.20% predicted with our logistic regression model when considering all the dimensions together. The increase in one unit of the Therapy-related dimension (measured by symptoms/problems, KDQOL™-36 test) increases 7.8% of non-adherence. The increase in one unit of the Condition-related dimension (measured by BECK depression test) increases the probability of non-adherence in 11.8%. The increase in one unit of the Patient-related dimension (measured by Emotional well-being, KDQOL™-36 test) increases 4.6% of adherence. Finally, an increase in one unit of the Patient-related dimension (measured by Self-perceived State-Anxiety, STAI test) increases the probability of adherence in 12.2%. d) Two choice modelling questionnaires had been designed for physicians (https://goo.gl/forms/zkygjoULFoBYRWwR2) and for nurses (https://goo.gl/forms/t3xsHage6k8E0rXv2) according to the self-perception barriers shown by a randomized sample of PHC nurses and physicians chosen in the focus groups sessions developed. e) The two choice modelling questionnaires were validated by a group of ten experts each, with Aiken's V coefficient values of 0.84 and 0.89 for physicians and nurses questionnaire, respectively. f) Almost 100% of PHC professionals admitted health preventive benefits of PA and exercise, although, 24.3% to 37.0% of respondents, considered it only for some adult age range and sex. Only 14.7% of GPs knew current WHO PA guidelines, in contrast to 75.7% of nurses. In spite of the lack of PA guidelines knowledge of some PHC professionals, more than 80.15% (78.1% GPs and 82.8% nurses) recognized to be physically active. According to the Transtheorical model of change in human behavior, more than 79.5% PHC staff (81.5% GPs and 77.5% nurses) indicated to maintain the PAP routine with their patients since more than 6 months. PHC staff was more confident in the self-perception knowledge to promote PA 70.85%, (71.5% GPs and 70.2% nurses) than to prescribe exercise 39.8%, (44.2% GPs and 35.4% nurses, p= 0.02). A mean of 63.2% (62.3% in

PA promotion and 64.2% in exercise prescription) of PHC professionals assessed, agree to the collaboration with Sports Scientists for PAP.

The 98.0% of both PHC professionals showed total agreement to collaborate with other PAP community resources from the PHC System. Moreover, there were some discrepancies between PHC staff assessed in the community resources proposed. Categorized by PHC areas, they totally agreed in Sport and Younger Government, Private Gyms collaboration. However, there were significant differences in the collaboration with Town Hall services ($p<0.001$), Local Sports centers ($p<0.001$), Schools ($p<0.05$), Physiotherapy and Wellness centers ($p<0.001$).

57.6% of PHC respondents had never done previous PA promotion courses (63.0% GPs and 52.3% nurses, $p= 0.006$). 70.4% of all PHC professionals showed no academic training background in exercise prescription (72.4% GPs and 68.4% nurses). The 94.95% of the respondents (93.4% GPs and 96.5% nurses) are interested in PAP training courses.

Significant differences were found for GPs and nurses in the following barriers: lack of space ($p<0.05$); lack of time-management ($p<0.05$). And total agreement for the following barriers: lack of PHC professional awareness, lack of material and economic resources; lack of PAP awareness in patients, lack of use and collaboration with another public external PAP resources.

For the multi-choice solutions proposed for GPs and nurses, discrepancies were observed in the improvement of PAVS tool for anamnesis ($p<0.001$); specific PHC spaces for PAP ($p<0.001$); materials and economic resources improvements ($p<0.001$); PAP leader at PHC ($p=0.006$); PAP use of the first-time visit at PHC ($p<0.05$); collaboration with another public external resources ($p=0.002$). In addition, PAP Networking team, PAP Training courses, PAP Diffusion strategies, Progressive PAP Implantation and to increase Consultation Time are the solutions with maximum consensus among both PHC professionals (with more than 90.0% of agreement). g) PA and sedentary patterns measured by the PAVS-EIM, the IPAQ short version questionnaires and the accelerometer data register, depending of the place position, frequency, epoch register and cut-off points values chosen in the raw processing data, showed high inter and intra-variability for the 7 days sedentary ($p<0.05$) and physical activity levels (PAL) registered.

This holistic and novel approach can contribute to establish PA public health policies and new interventions in PHC settings.

UNESCO Key words: Behavioural therapy; Exercise physiology, Preventive Medicine, Public Health.

Table 1.Summary of state of the art and what this Ph.D. thesis adds.

Nº article	What is already known on this topic?	What does this Ph.D. Thesis add?
1 and 2	Primary Health-Care (PHC) settings are a good resource to promote physical activity, regarding the high number of patient visits received annually and the good reputation of PHC professionals. However, there are doubts about physical activity on prescription (PAP) knowledge of PHC staff.	A review of Bachelor Science in Medicine, Sports Science, and Nursing at Spanish universities has shown a total average of ECTS 17.7±4.6%, 3.6±1.7%, and 5.82 ±3.99%, respectively, that are related to PA promotion and exercise prescription in the educational degrees.
3	The effects of physical exercise on health are well-known; however, it is unknown how to modify sedentary behavior towards a physically active lifestyle. There is no consensus on how PHC factors have an effect on PAP compliance between patients and PHC staff relationship.	This review has shown a low treatment of factors related to healthcare team and system (n=20) or therapy-related factors (n=23) against the social/economic (n=97), condition-related (n=59) and patient-related factors (n=58) to assess PAP adherence based on the WHO 5 dimension model.
4	It is well-known that chronic kidney patients (CKP) present low health status and high physical inactivity levels. Nevertheless, little is known about how to understand and manage individualized exercise prescription training programmes to increase adherence levels in CKP.	Following the WHO multi-dimensional adherence model, condition-related (depression levels), therapy-related (actual side effects), patient-related (state-anxiety) and patient-related (KDQOL self-perception) factors could predict from 33.20% to 75% of attended/scheduled sessions in CKP.
5	Many studies have investigated the implementation of exercise prescriptions by their healthcare systems. Lack of time, PAP knowledge, lack of collaboration with local sports institutions or with other health care providers are some of the main predominant barriers for a good PAP implementation. Consequently, only one-third of healthcare professionals use PAP as a non-pharmacological treatment.	The main self-perceived PAP barriers and facilitators of a randomized sample of 5 Madrid PHC nurses and 5 physicians were identified through two focus groups sessions. Two choice modelling questionnaires were created with the focus groups results. Physicians´questionnaire: https://goo.gl/forms/zkygjoULFoBYRWwR2 and nurses ´questionnaire: https://goo.gl/forms/t3xsHage6k8E0rXv2
6	There is not a validated test to assess Healthcare team dimension as an issue to implement exercise prescription at PHC settings.	This Ph.D. thesis has validated two choice-modelling questionnaires for identifying the barriers and facilitators of GPs and nurses in Madrid PHC settings by a group of ten experts each. Aiken's V coefficient were 0.84 and 0.89 for physicians and nurses.
7	There is insufficient progress about the development of a efficient PA promotion strategy to increase PA levels. Nowadays, there is a trend to increase PA levels from healthcare sector. the benefits of exercise are well-known, however, exercise prescription is not a fundamental routine in PHC settings. There is a need to know the self-perception barriers of PHC staff to implement PAP at Spanish PHC settings as a prevention and coadjutant medicine treatment.	Almost 100% PHC staff admitted PA health benefits but only 14.7% GPs and 75.7% nurses know WHO PA guidelines. 70.4% of respondents had no academic exercise prescription background. 63.2% of PHC staff wants to collaborate in PAP with Sports Scientists. The 98.0% of respondents want to collaborate with PAP community resources. Main selected PAP barriers were: lack of space ($p<0.05$) and time ($p<0.05$) and consensus for lack of awareness, material, economic and PAP community resources.
8	There are currently disagreements regarding how to measure PA and sedentary levels in PHC settings as another vital sign such as blood lipid profile, blood pressure or blood glucose profile, among others.	PA and sedentary patterns measured by the PAVS-EIM against patterns objectively measured by accelerometer show a high variability inter and intra-method, depending of the placement position, frequency, epoch register and cut points intensities of the gold standard method (accelerometer) used.

RESUMEN

Esta tesis doctoral se fundamenta en la idea del American College of Sport Medicine (ACSM) a través de Exercise is Medicine®, iniciativa que pretende utilizar la actividad física como recurso preventivo y el ejercicio físico como tratamiento coadyuvante rehabilitador/recuperador en los centros médicos de Atención Primaria.

El tema de estudio que persigue esta tesis posee un interés científico y social, sobre la salud y calidad de vida de las personas, aportando al sistema de salud nuevos recursos que mejoren su eficiencia y disminuyan el impacto económico si la prescripción de actividad y ejercicio físico se integrase en nuestro sistema.

En los últimos años, la inactividad física constituye la cuarta causa de muerte a nivel global y el aumento desmesurado de muchas de las enfermedades crónicas de mayor prevalencia a nivel mundial. El sedentarismo sigue aumentando de forma constante, a pesar de conocer los riesgos que posee este estilo de vida sobre la salud. Una situación que hace necesario reconducir los parámetros modificables de ambos comportamientos para erradicar esta situación pandémica que aumenta de forma global y progresiva a nivel mundial.

Diferentes estrategias a nivel global se han intentado instaurar, desde la Primera Conferencia Internacional sobre promoción de salud, celebrada en 1986 en Ottawa, Canadá, a través principalmente de la Organización Mundial de la Salud (OMS), concienciados por los alarmantes resultados de inactividad física y las consecuencias directas sobre la salud que se han obtenido desde los últimos años. En 2013, la OMS diseñó el Plan de acción Global para la prevención y control de las enfermedades no transmisibles 2013-2020 con el objetivo de incrementar los niveles de actividad física de la población, siendo reforzado en la actualidad con la estrategia '*Physical activity strategy for the WHO European Region 2016–2025*", intentando incrementar los niveles de actividad física de la población, entre otros medios, a través de los centros de salud. El objetivo final para 2030 pretende reducir los niveles de inactividad física un 15% entre la población mundial a través del *"Global action plan on physical activity 2018–2030: more active people for a healthier world"*.

El objetivo principal de esta tesis doctoral es ofrecer una serie de ideas claves en el análisis de una factible implementación de prescripción de ejercicio físico como medida preventiva y de tratamiento rehabilitador para las enfermedades crónicas no transmisibles, en los centros de Atención Primaria. A través de los siguientes objetivos

secundarios: (1) Comprobar la formación académica universitaria que poseen los médicos, enfermeros y graduados en Ciencias de la Actividad Física y del Deporte en relación a la promoción y prescripción de actividad y/o ejercicio físico para prevenir o tratar enfermedades crónicas en sus currículos universitarios en España. (2) Realizar una revisión crítica de la literatura científica sobre la adherencia en promoción y prescripción de ejercicio físico realizada a pacientes con enfermedad crónica, siguiendo las 5 dimensiones del modelo de adherencia de la OMS. (3) Analizar la adherencia a programas de ejercicio físico prescrito a pacientes de hemodiálisis (4) Analizar en profundidad la actitud, auto-percepción, potencialidades y limitaciones del conocimiento de los médicos y enfermeros de Atención Primaria de la Comunidad de Madrid para implementar la promoción y prescripción de ejercicio físico en sus centros. (5) Comparar el patrón de actividad física y sedentarismo medido de forma objetiva (acelerómetro) y subjetivamente mediante el cuestionario PAVS-EIM o la versión corta del IPAQ, para contribuir al diseño de una herramienta útil en la anamnesis del paciente de Atención Primaria.

Los principales resultados de esta tesis son los siguientes: a) El bajo promedio de créditos relacionados con promoción y prescripción de ejercicio físico en las guías docentes del currículo de los grados de Ciencias de la Actividad Física y del Deporte (17.7±4.6%), Enfermería 5.82±3.99% y Medicina 3.6±1.7% de todas las universidades españolas. b) En la revisión crítica de la literatura científica llevada a cabo, los factores de adherencia en prescripción de ejercicio físico más abordados han sido todos los relacionados con la dimensión socio-económica (97 factores), seguidos de los que se integraban dentro de la dimensión de condición (59 factores) y dimensión del paciente (58 factores). La dimensión relacionada con el sistema y los profesionales de los centros de salud fue la menos abordada (20 factores) a la hora de considerar los factores que influyen a largo plazo, en el grado de adherencia hacia tratamientos terapéuticos no farmacológicos realizados mediante ejercicio físico. c) La adherencia a un programa de ejercicio (75% de cumplimiento de un total de 40 sesiones planificadas) para pacientes crónicos renales, se predice en un 33.20% con nuestro modelo de regresión logística cuando se consideran las siguientes variables independientes juntas. El incremento de la dimensión terapia (medidos a través de la dimensión de síntomas/problemas del test KDQOL ™ -36) aumenta la probabilidad de no adherirse un 7,8%. El incremento de una unidad de la dimensión relacionada con la condición del paciente (medido a través del nivel de depresión del cuestionario BECK) incrementa un 11,8% la probabilidad de

no adherencia del paciente de hemodiálisis, el incremento de una unidad de la misma dimensión relacionada con el estado auto-percibido de bienestar emocional del paciente del test KDQOL ™ -36, aumenta un 4,6% el grado de adherencia y el aumento de una unidad de la dimensión relacionada con el paciente (medida a través del estado de ansiedad auto-percibido por el paciente) aumenta un 12.2% la probabilidad de adherencia del enfermo renal crónico. d) En dos sesiones grupales de discusión, se han constatado las principales barreras auto-percibidas por los médicos y enfermeros de Atención Primaria, para promocionar y prescribir ejercicio físico, diseñando a través de ellas, dos cuestionarios, uno para médicos: https://goo.gl/forms/zkygjoULFoBYRWwR2 y otro para enfermeros: https://goo.gl/forms/t3xsHage6k8E0rXv2, para comprobar su grado de auto-percepción e implementar la promoción y prescripción de ejercicio físico en sus centros de Atención Primaria. e) Se ha validado por dos grupos de expertos, los cuestionarios de médicos y enfermeros previamente diseñados, con valores del coeficiente V de Aiken de 0.84 (médicos) y 0.89 (enfermeros), respectivamente. f) Aproximadamente, el 100% de los profesionales de Atención Primaria evaluados, admite los beneficios preventivos y rehabilitadores/recuperadores del ejercicio físico para la salud, aunque del 24.3% al 37.0% considere éste solamente para algún rango de edad y/o sexo concreto. Además, solo el 14.7% de los médicos y un 75.7% de los enfermeros conocía las recomendaciones exactas de actividad física de la OMS. A pesar de la mencionada falta de conocimiento, más de un 80.15% (78.1% médicos y 82.8% de enfermeros) reconoció ser físicamente activo. De acuerdo al Modelo Transteórico del cambio de comportamiento humano, más del 79.5% del personal de Atención Primaria evaluado (81.5% médicos y 77.5% enfermeros) indicó estar en el máximo estadio, el cual indica mantener la promoción y prescripción de ejercicio físico a sus pacientes desde hace más de 6 meses. Sin embargo, el 70.85% de los profesionales manifiestan sentirse más seguros con la promoción de actividad física (71.5% médicos y 70.2% enfermeros) que prescribiendo ejercicio físico 39.8%, (44.2% médicos y 35.4% enfermeros, p= 0.02). De media, el 63.2% de los profesionales evaluados están a favor de la colaboración con los graduados en CAFYDE para promocionar (62.3%) y prescribir (64.2%) ejercicio físico. El 98.0% de los encuestados, respondió estar a favor de colaborar desde Atención Primaria, con otros recursos locales para mejorar la promoción y prescripción de ejercicio físico. Categorizado por las 7 áreas regionales de la Comunidad de Madrid, no existen discrepancias entre ambos profesionales para hacerlo con la Consejería de

Deportes y Juventud (a favor) y con gimnasios deportivos privados (en contra). Sin embargo, hay diferencias significativas entre los dos grupos de profesionales en la colaboración con los servicios del Ayuntamiento ($p<0.001$), Centros Deportivos Municipales ($p<0.001$), Colegios ($p<0.05$) y centros de Wellness y Fisioterapia ($p<0.001$).

Otro dato reseñable, fue ver como el 57.6% de los profesionales sanitarios evaluados indicaban que no habían realizado ningún curso previo de promoción de actividad física (63.0% médicos y 52.3% enfermeros, $p= 0.006$). Además, el 70.4% mostró falta previa de formación académica en prescripción de ejercicio físico (72.4% médicos y 68.4% enfermeros). Aunque el 94.95% de los encuestados (93.4% médicos y 96.5% enfermeros) están interesados en este tipo de cursos para su formación continua.

Diferencias significativas se encontraron entre médicos y enfermeros a la hora de seleccionar las barreras auto-percibidas en promoción y prescripción de ejercicio físico en sus centros de atención Primaria, de entre ellas: falta de espacios ($p<0.05$) y de tiempo en consulta ($p<0.05$). Y total acuerdo en las restantes: falta de concienciación profesional y de los pacientes, falta de recursos materiales y económicos; así como falta de colaboración con otros recursos locales externos a los centros de salud.

De las múltiples soluciones propuestas para solucionar las barreras, los profesionales mostraron discrepancias en la mejora de la herramienta de diagnóstico que utilizan en la anamnesis del paciente para evaluar su patrón de actividad física y sedentarismo ($p<0.001$); adecuar espacios en los centros ($p<0.001$); mejoras económicas y de material ($p<0.001$); liderar la promoción y prescripción de ejercicio físico por parte de un grupo de Atención primaria especializado ($p=0.006$); Utilizar la primera consulta de visita de enfermería ($p<0.05$); Colaborar con otros recursos externos ($p=0.002$). A demás, crear un equipo de trabajo multidisciplinar, fomentar cursos de formación continua en prescripción de ejercicio físico, Establecer una estrategia de difusión y conciencias desde Atención Primaria para profesionales y pacientes, una progresiva implementación y aumentar el tiempo de consulta del paciente-profesional sanitario fueron las soluciones con un consenso entre ambos profesionales sanitarios encuestados, con más de un 90.0% de acuerdo positivo. g) Los patrones de actividad física y sedentarismo medidos a través del cuestionario PAVS-EIM y la versión corta del cuestionario IPAQ frente a un registro medido objetivamente por acelerometría, mostró una gran inter e intra-variabilidad en sus registros de 7 días, dependiendo del lugar de colocación,

frecuencia y tiempo de registro y puntos de corte de intensidad empleados por los participantes ($p<0.05$).

Este novedoso enfoque de intervención global, podría contribuir a establecer políticas de beneficio social y de gran utilidad para el Sistema Sanitario de Atención Primaria.

Palabras Clave UNESCO: Terapia del comportamiento; Fisiología del ejercicio, Medicina Preventiva, Salud Pública.

Tabla 2. Resumen del estado de arte y los resultados que añade la Tesis Doctoral.

Artículo	¿Qué se sabe y no se sabe en este ámbito?	¿Qué añade esta Tesis Doctoral?
1 y 2	Existe la creencia de que los centros de Atención Primaria son un buen recurso para promocionar actividad física. Sus profesionales sanitarios poseen buena reputación social y un gran número de pacientes les visita periódicamente. Sin embargo, existen dudas sobre su conocimiento para prescribir ejercicio físico	En la revisión de los planes de estudio de todas las Universidades españolas de Medicina, CAFYDE y Enfermería, el promedio de créditos relacionados con promoción y prescripción de ejercicio físico relacionadas con enfermedad crónica fue del 3.6±1.7%, 17.7±4.6% y 5.82±3.99%, respectivamente.
3	Son bien conocidos los beneficios que posee el ejercicio físico sobre la salud, pero se desconocen los cambios que afectan en la mejora de conductas inactivas. No existe un consenso sobre los factores que afectan en la relación paciente-profesional sanitario para incrementar el grado de adherencia a un programa de ejercicio físico prescrito.	La revisión ha mostrado un bajo tratamiento de factores relacionados con los profesionales y el sistema de salud (n=20) o dependientes de la terapia (n=23) frente a factores socio-económicos (n=97), de su condición (n=59) o personales (n=58), para evaluar la adherencia a un tratamiento de ejercicio físico, según el modelo de la OMS.
4	Los pacientes crónicos renales, poseen un estado de salud y un patrón de actividad física inadecuado. Sin embargo, se desconoce cómo manejar prescripciones de ejercicio físico individualizadas para incrementar sus niveles de adherencia en este tipo de pacientes crónicos.	Según el estado de depresión, ansiedad, efectos secundarios y estado de bienestar auto-percibido por el paciente, se podría predecir al 33.20%, el grado de cumplimiento ≥75% de las sesiones de un programa prescrito, siguiendo el modelo multidimensional de adherencia de la OMS.
5	Muchos estudios están investigando sobre la implementación de ejercicio físico en centros de salud, pero barreras como la falta de tiempo, conocimiento o ausencia de colaboración con otros recursos locales o personales han imposibilitado integrar una propuesta con éxito hasta la fecha. Además, sólo un tercio de profesionales sanitarios promocionan o prescriben ejercicio físico.	En dos sesiones grupales, se hallaron las principales barreras auto-percibidas para promocionar y prescribir ejercicio físico. Con los resultados se diseñaron dos cuestionarios, para comprobar la opinión del resto de médicos y enfermeros de Atención Primaria de Madrid, respectivamente: https://goo.gl/forms/zkygjoULFoBYRWwR2 https://goo.gl/forms/t3xsHage6k8E0rXv2
6	Todavía no se ha validado un test para evaluar los factores que influyen en la dimensión del sistema-equipo profesional sanitario, como posible problema para implementar programas de promoción y prescripción de ejercicio físico en centros de salud de Atención Primaria.	Esta tesis ha validado dos cuestionarios a través de expertos, para analizar las barreras y limitaciones auto-percibidas de los profesionales de Atención Primaria para promocionar y prescribir ejercicio. El coeficiente V de Aiken fue de 0.89 y 0.84 en el cuestionario de enfermería y medicina.
7	Existen controversias sobre la forma de implementar estrategias de promoción para incrementar los niveles de actividad física. En los últimos tiempos, se han diseñado estrategias para promocionar actividad física desde los centros de salud. Son bien conocidos los beneficios del ejercicio físico sobre la salud. Sin embargo, los profesionales sanitarios no lo utilizan como recurso coadyuvante y existe una necesidad de conocer las limitaciones para sus uso.	Casi el 100% de los profesionales admite beneficios saludables de la actividad física, pero sólo un 14.7% de médicos y un 75.7% de enfermeros conocen las recomendaciones de la OMS. El 70.4% no posee formación académica para prescribir ejercicio. El 63.2% muestra predisposición para colaborar con CAFYDE y un 98.0% con recursos locales. Las barreras mostradas: falta de espacio ($p<0.05$), tiempo ($p<0.05$), concienciación, colaboración externa, material y economía.
8	No existe un consenso en la forma de evaluar los niveles de actividad física y sedentarismo en los centros de Atención Primaria de Madrid, que debería utilizarse por los profesionales sanitarios como otro signo vital en la anamnesis del paciente.	Se ha comprobado la variabilidad existente en los niveles de actividad física y sedentarismo medido objetivamente (acelerometría) y subjetivamente (cuestionario PAVS-EIM), con diferencias inter e intra-método reseñables.

1 INTRODUCTION

1.1 Research Background

Non-communicable diseases (NCDs) are the most common cause of death worldwide, mainly induced by unhealthy lifestyles (1, 2). Physical inactivity is considered one of the leading risk factors causing NCDs and death (3-8), as it is related at least to 35 different NCDs (9). Physical exercise is one of the most powerful resources to treat until 26 different NCDs (10), and higher physical activity levels (PAL) have been demonstrated as an effective prevention strategy for some NCDs such as depression, among others (11). Otherwise, sedentary levels in humans are another health risk of morbi-mortality, independently of the physical active behavior (12-15). Both patterns represent currently one of the biggest threats for public health with pessimistic perspectives for the future (3, 16), being considered "the biggest public health problem of the 21st century" (17, 18). In spite of the physical, mental and social benefits that physically active behaviors can produce, inactive human lifestyles are increasing in the world everyday (3, 9, 10, 19). In fact, more than 27% of the population is physically inactive (3). Although the health benefits of physical activity (PA) and exercise are well-known (20-23), damages or side effects according to the load training performed are unclear (24, 25). Higher total PAL have significantly been associated with lower risk of NCDs, but it could be established that major gains occurs in a middle point around of 3000-4000 metabolic equivalent (MET) minutes/week (7). Some studies have shown that the relationship between PA and health is dose-response (7, 26). Other authors identify a curvilinear association, by a U- or J-shaped curve when time spent jogging with health benefits is compared (27-29) mainly when the individual is not accustomed to regular exercise and undertakes an inadequate physical stimuli to a fitness level (25). Besides, it is logical to think that there is a point of overtraining causing an inflammation process or another unhealthy symptom produced by a non-well-structured over stressful physical exercise stimuli (30), independently of the exercise task that has caused it (31).

Cardiovascular (CV) fitness (32, 33) and strength fitness performance are associated with better health benefits and decrease all cause morbi-mortality risk (34-36). Furthermore, fitness vital sign method is used to estimate health status in patients at Healthcare settings (34, 35, 37-39) or at least, PAL (40-42). Fitness levels are related to

the adaptation response of a measured external or internal training load; while PAL only measures an external one. The concepts of external and internal load do not have a single or gold standard measurement and at the same load training produce different fitness and health adaptive processes in people (43). Because that, in spite of the general health benefits of an exercise, not everybody responds equally to the same applied exercise stimulus (44-46). In this sense, people who do not have a positive fitness effect when treated by a specific exercise training programme, are called "non- responders"; however, it is not clear if these people do not respond to this specific stimulus, to this kind of variable measured or if other factors are interfering (47). Besides, it is still under study if human skeletal muscle has an epigenetic memory in last exercise stimulus events (48) or how other stress factors are affecting the psycho-physiological response to exercise (43). Nevertheless, it is clear that exercise produces a variety of molecular adaptations, inducing changes to the skeletal muscle transcriptome (49). Furthermore, molecular changes are going to be the result of the different physiological and biologically range of responses to the same kind of external and internal load training (43, 45, 50).

The load training management only by the kind of exercise is able to offer different structural, metabolic and functional responses against many chronic diseases (51, 52). As well, intensity of load training can produce different adaptations (53) and depends of the method or sample used in the research to take different results (responder/non-responder) (54). Nevertheless, it is a good indicator for reducing the risk for all-cause and CVD mortality (55). The management of load training could be effective in different co-morbidities (56-58) and improving health in the aging process (59, 60). The research trends are considering more important the ratio intensity/volume in favour of the first one to achieve acute and chronic adaptations benefits in the prevention or treatment of chronic diseases (20, 53, 56, 61, 62). However, all kind of physical activities intensities seem to have positive health effects and accumulation of activity in bouts $\geq$10 min did not appear to be important beyond total volume of activity in older men (21). Biological features could offer different exercise responses to the same load training (47, 48). Even, specific genes seem epigenetically more sensitive after a resistance stimulus, adding the largest increase in gene expression and muscle mass after the new exercise stimulus offered previously (48). Lawrence M. Schwartz has shown recently that extra nuclei gained during exercise background experiences persist

even after a muscle atrophy from disease, disuse or aging and could be quickly retrained later (63). Additionally, all kind of load training variables should be individually managed when an exercise training programme is provided (64, 65) in the way to offer an individualized exercise precision medicine (46, 54, 66). Another factor supporting exercise prescriptions would be a good nutritional status to guarantee and to help the health of the patient, mainly in aging and long-term mandatory rest periods (67, 68). All of them would improve sarcopenia levels because a progressive loss of muscle mass and function, represent fundamental biological aging processes intrinsic to most cellular systems and related to diseases associated with this physiological aging effect (69-72). Mitochondria dysfunctions as the focusing outcome of several pathologies, could be reverted by exercise stimuli (57, 73, 74).

Another key point related to the other mentioned factors is muscle mass. There is compelling evidence that there is lower muscle mass at diagnosis for a variety of cancer types and different non-chronic diseases (75). Muscle mass as endocrine organ in humans is progressively more studied and will have an important role in preventive and therapeutic medicine in the future (9, 10, 19, 69, 72, 75-77). All the mentioned factors such as genotype, baseline fitness, training history, nutritional intake, psycho-emotional states, session recovery, age, weight, etc. influence the magnitude of subsequent adaptive responses to exercise stimuli (47). However, it is important to apply an effective physical stimulus as well as to know if it is able to be followed-up by a person in a period of time, but less is known about PA adherence and changes of human behavior to be more active (78-80). Estimated data suggests that around 40% of patients do not comply with the pharmacological treatments, rising up to 70% for lifestyle treatments (81). Recent data about exercise prescriptions reported dropout rates of 20-50% in the first 3-6 months (82). Likewise, few primary care physicians provide regular or effective information and support to physically inactive patients (83, 84). One of the most cited barriers related to PA adherence is lack of time (56, 85, 86). There is no consensus about how to analyze barriers in Physical Activity on Prescription (PAP) (87-89). However, following the WHO multi-dimensional model, established in the WHO Adherence meeting in June 2001, these five dimensions: social/economic, healthcare system, condition, therapy, and patient-related are interfering in PAP adherence all together (90). According to the model, lack of time barrier is considered as a consequence of the lack of familiar, job or another lack of social support or as a

personal belief or perception such as an excuse for the incorrect personal time management (90). Fletcher et al. have evaluated the impact of heritability on PA behaviour and they had determined that 25% could be explained by genetic factors, with no consensus on differential heritability factors that could have a different effect in males versus females (27). Nonetheless, it seems to be clear, that knowing the specific associations between them in a specific context of the people, may provide improved directions for community, governmental and health care leaders to improve exercise programs (27). PA health promotions are needed in order to improve active levels in everybody as well as to promote it in different institutions such as schools, universities, business places, social or sport centers (87, 91-93).

Hippocrates said: "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". Physicians as Susruta (600 year before Common Era) used to prescribe exercise among their patients (94), and nowadays, different researchers have shown the health benefits of exercise on the human being (8, 76, 95, 96). Since the Ottawa Charter in 1986, many PA strategies have been developed based on health promotion strategies such as increasing PAL among the population worldwide (97). In the last years, the international WHO, autonomous in its decisions with its own interests and operating independently, has developed different strategies to enhance the health and quality of life of the population aiming at decreasing physical inactivity levels. The "WHO Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013–20", the "Physical Activity strategy for the WHO European Region 2016–25" and the "Global Action Plan on Physical Activity 2018–2030", among other WHO strategies, are trying to increase PAL among the population (98), some of them lead by healthcare institutions (99). The results are showing small, but positive effects in the use of exercise prescriptions for patients at healthcare settings, in spite of the powerful resource that it could be (19, 100-102). Indeed, national Healthcare Systems require national policies and a clear set of actions based on PA promotion and exercise prescription (102). In France, the article 144 of the new law 2016-41 dated 26 January 2016 (Modernization of the health system n° 2016-41. France promoted PAP. Article L. 1172-1. Decree nº 2016-1990 of 30th December 2016), established the mandatory exercise prescription for patients with long-term conditions (100). In this sense, there is not a consensus about the modernization of the health policies in spite of different

European initiatives launched in this sense in Spain (103-105). A new pilot law on public health for the prevention of obesity, food disorders and chronic diseases by exercise prescription at PHC centers was presented in 2018 in the Region of Madrid.

There are a lot of initiatives worldwide that promote PA and exercise prescription as a preventive and adjuvant treatment for chronic diseases (4, 100, 102, 104, 106, 107). However, insufficient progress is observed regarding the implantation of a model to increase PAP (102, 108). Besides, a well-structured PA promotion strategy would reduce NCDs and its economic-related burden (2, 109, 110).

Healthcare settings are considered a good resource to promote PA (101, 111), as a high number of patients visit Healthcare settings annually (101, 112). Nonetheless, PAP success relies upon the acceptability and efficiency to promote and prescribe exercise by health professionals and compliance from patients in the relationship health provider-patient (100).

PAP studies have proliferated; however, exercise prescription adherence is often only focused on patient features (113). Additionally, most research on adherence in PHC settings has been focused on medication (114, 115). Exercise treatments induced 50% more substantial reduction on visceral adipose tissue than pharmacological interventions in some NCDs such as obesity, uncontrolled glucose intolerance, blood lipid regulation, blood pressure, and thrombosis (116). Long-term therapies to chronic diseases combine medication with simultaneous instructions and lifestyle recommendations reported by healthcare professionals (117). Nonetheless, few studies have analyzed knowledge of PAP as non-pharmacological treatment on chronic diseases in the Spanish syllabus degrees related to health promotion (118). In this sense, insufficient educational opportunities for PHC providers are considered as one of the major contributors to the under- exercise prescription (119). The awareness of health professionals to use PAP seems necessary (120), because low self-reported confidence to provide PAP counselling is associated with low rates of exercise prescriptions (119). According to the scientific literature, knowledge, medical schools training and residency programs should be one of the key points to improve PAP in PHC settings (112), because only one-third of patients are counselled with PA recommendations by their healthcare professionals (117). There is some evidence that General practitioners (GPs) and nurses discusses often PA with their patients, however; it would be more likely that patient engage in regular PA in the future (17). Finally, main barriers and facilitators that are

influencing to enhance PAP in healthcare settings should be a priority (100, 111, 121). Furthermore, PA and sedentary behavior patterns of patients should be assessed and followed-up in the healthcare treatments (90). A quick and accurate PA and sedentary screening tool would contribute to identifying patients at PHC settings who are not meeting the current PA guidelines as possible risk factor to suffer a chronic disease (122).

However, in spite of the well-known effects of PAP on chronic diseases (9, 10, 66, 76, 123) and knowing that 80% of PHC consultations in our country are related to chronic diseases (124), the Spanish healthcare system should be reorganized (124). PA patterns or fitness assessment and subsequently exercise prescription have not a fundamental part of routine on primary care practice yet (117, 122, 125). Current use of a brief and validated assessment of PAL and consequent exercise referral in PHC patients is unclear (122, 125-127). The Physical Activity Vital Sign (PAVS) proposed by Coleman, et al. (41), contains two questions to get PA patterns in a range estimated such as in other similar surveys (128) related to the Exercise is Medicine® initiative (PAVS-EIM) (41). PAVS should be assessed by clinicians as a strong predictor of multi-morbidity (129), being PAL considered an effective prevention strategy when is objectively measured (11). The strategy to implement this measure is not clear in Spain (124) and neither in another places such as is shown in the scientific literature (124, 130, 131). Although, it is well-known that exercise prescriptions and PA promotion guidelines would improve the patient´s health and reduce the use of medicine drugs on patients and healthcare costs in the System (22, 66, 132-134).

This Ph.D. thesis, based on a feasibility analysis for a future implementation of the ACSM-Exercise is Medicine®-Spain initiative in a PHC System, is a current top trend topic based on the use of PA as preventive resource and exercise prescription as adjuvant non-pharmacological treatment of NCDs.

The last ACSM's Worldwide Trends Survey, based on 4133 health fitness professionals' responses, in 42 different countries, has shown that Exercise is Medicine is included among the top twenty trendy topics from 2017 in the health & fitness sectors (Figure 1).

2017		2018	
1	Wearable technology	1	High-intensity interval training
2	Body weight training	2	Group training
3	High-intensity interval training	3	Wearable technology
4	Educated, certified, and experienced fitness professionals	4	Body weight training
5	Strength training	5	Strength training
6	Group training	6	Educated, certified, and experienced fitness professionals
7	Exercise is Medicine®	7	Yoga
8	Yoga	8	Personal training
9	Personal training	9	Fitness programs for older adults
10	Exercise and weight loss	10	Functional fitness
11	Fitness programs for older adults	11	Exercise and weight loss
12	Functional fitness	12	Exercise is Medicine
13	Outdoor activities	13	Group personal training
14	Group personal training	14	Outdoor activities
15	Wellness coaching	15	Flexibility and mobility rollers
16	Worksite health promotion	16	Licensure for fitness professionals
17	Smartphone exercise apps	17	Circuit training
18	Outcome measurements	18	Wellness coaching
19	Circuit training	19	Core training
20	Flexibility and mobility rollers	20	Sport-specific training

Figure 1. ACSM Fitness Trend 2017,2018 and 2019. (Modified from Walter R. Thompson, 2016, 2017 and 2018; https://www.acsm.org/read-research/acsm-fitness-trends).

The Healthcare system should support PAP for patients, but this is currently a big problem and worthwhile to study, in spite of the scientific literature has shown a progressive interest during the last years, as it is shown in figure 2.

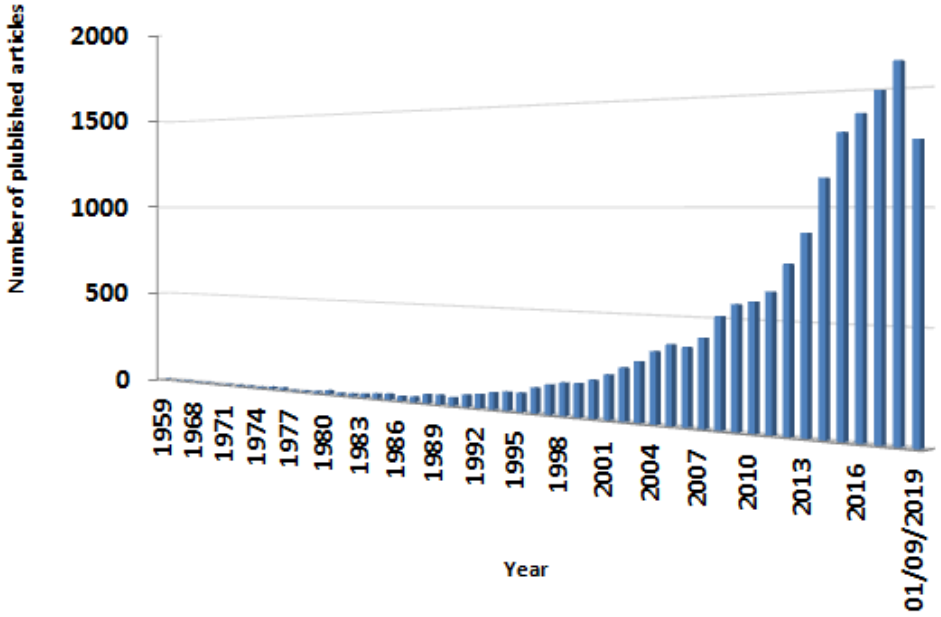

Figure 2. Number of PubMed-referenced articles published between 1959 and 1st of September of 2019, concerning "physical activity" and "primary care".

Many health promotion policies have been performed in the world in the last years without highlighted outcomes to reduce physical inactivity levels and to improve PAP in healthcare. Some of the most representative Spanish and worldwide strategies and initiatives developed about PAP in the last years, here are summarized:

1.1.1 Physical activity health promotion strategies:

Over the years, there were varieties of approaches used to increase PAL and to reduce sedentary levels in the population as a public health promotion strategy. However, any of them had been considered as powerful as to be universally implemented to date (19, 100, 101).

Table 3 summarizes different strategies:

Table 3. Global health promotion strategies related to physical activity

Policy or strategy	Range of time	Institution
Ottawa Charter (97)	1986	WHO
WHA53.17	2000	WHA
Global Strategy on Diet, Physical Activity and Health (135)	2004	WHO
White Paper on Sport	2007	Commission European Communities
WHO Global Action Plan for the Prevention and Control of Non-communicable Diseases	2008–13	WHO
Global recommendations on physical activity for health (136)	2010	WHO
The Toronto Charter for Physical Activity: A Global Call for Action	2010	ISPAH
WHO Global Action Plan for the Prevention and Control of Non-communicable Diseases (137)	2013–20	WHO
Agenda 2030 para el Desarrollo Sostenible	2015	WHO
WHO European Region (138)	2016–25	WHO
Global Action Plan on Physical Activity (139)	2018–30	WHO
Promotion in Health Care Settings – Policy, Practice & Evidence (84)	2016	HEPA
The Bangkok declaration on physical activity for global health and sustainable development (140)	2017	ISPAH
Promoting physical activity in the health sector (107)	2018	WHO

Notes: WHO: World Health Organization; WHA: World Health Assembly; ISPAH: International Society for Physical Activity and Health; HEPA: Health Enhancing Physical Activity.

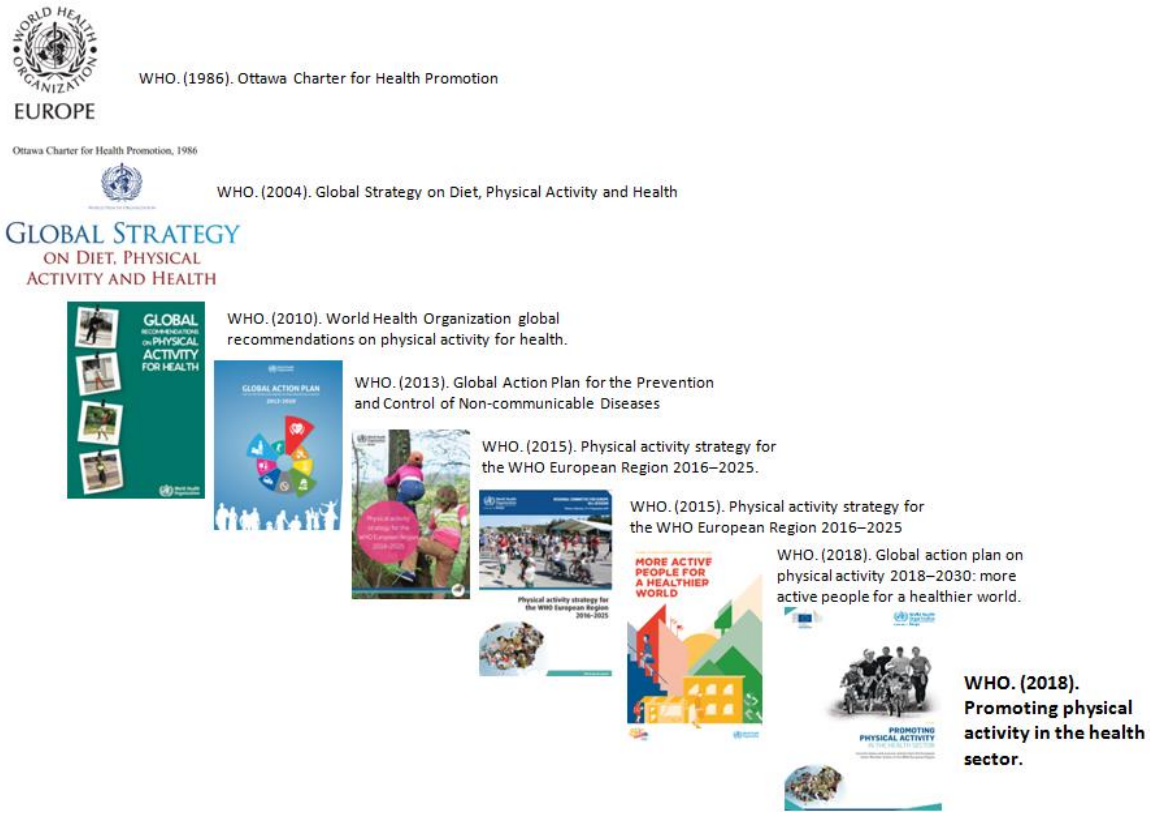

Figure 3. Physical activity promotion strategies by WHO for the last 32 years.

1.1.2 International PAP strategies:

Over the years, there were varieties of approaches used to implement PAP in PHC settings (Table 4).

Table 4. Initiatives providing a physical activity or exercise prescription form (modified from Lion, A. et al. 2018 (100)).

Initiative name	Country/nation	Website
Exercise is Medicine®	Australia	http://exerciseismedicine.com.au/
Sport sur ordonnance	France	https://sport-ordonnance.fr/
Exercise is Medicine®	Canada	http://exerciseismedicine.org/canada/
Motion pa˚ recept	Denmark	https://www.sst.dk/da/sundhed-og-livsstil/fysisk-aktivitet
Physical Activity Prescription (PAP)	Finland	http://www.ukkinstituutti.fi/en/products-services/physical-activity-prescription
Rezept für Bewegung & Exercise is Medicine®	Germany	https://www.bundesaerztekammer.de/aerzte/versorgung/praevention/sport-und-praevention/rezept-fuer-bewegung/ & https://www.exerciseismedicine.eu/
Green Prescription	New Zealand	https://www.health.govt.nz/our-work/preventative-health-wellness/physical-activity/green-prescriptions
Healthwise: Physical	Northern	http://www.publichealth.hscni.net/sites/default/files/3674-Healthwise Flyer (low res).pdf

Initiative name	Country/nation	Website
Activity Referral Programme	Ireland	
Grønn resept & Exercise is Medicine®	Norway	http://www.absentia.no/Article.aspx?articleID=359 & https://www.exerciseismedicine.org/norway/
Exercise is Medicine®	Poland	https://www.exerciseismedicine.org/poland/
Diabetes em Movimento & Exercise is Medicine®	Portugal	http://www.diabetesemmovimento.com/ & http://exerciseismedicine.fmh.ulisboa.pt/media
Qatar National Physical Activity Guidelines & Exercise is Medicine®	Qatar	https://www.namat.qa/NamatImages/Publications/75/QATAR%20PA%20GUIDLINE%20ENGLISH.PDF & https://www.namat.qa/
Exercise is Medicine®	Singapore	http://exerciseismedicine.org/singapore/
Caminem programe & Exercise is Medicine®	Spain	http://www.infotabacweb.com/web.asp?mod=boletines&acc=mostrar&id=%7B14CC70BA-4E1C-4FE2-98D8-4DA4CDFBC288%7D & http://www.exerciseismedicine.org/spain/
Fysisk Aktivitet pa° Recept, FaRV	Sweden	http://www.farledare.se/
Physical Activity Promotion in Primary Care (PAPRICA)	Switzerland	http://www.paprica.ch/WP_1/
Care Sport Connectors & Beweegkur	The Netherlands	https://www.wur.nl/en/activity/The-Care-Sport-Connector-in-the-Netherlands-1.htm & http://beweegkuur.nl/
Counselling for Exercise (PACE) &Exercise is Medicine®	United States of America	http://www.paceproject.org/Home.html & http://www.exerciseismedicine.org/
Let's Get Moving	United Kingdom	http://letsgetmoving.org.uk/
National Exercise Referral Scheme	Wales	https://www.wlga.gov.uk/national-exercise-referral-scheme-ners
Walk Your Way to Better Strength and Balance	Scotland	https://www.pathsforall.org.uk/walking-for-health/strength-and-balance
Neuvokas perhe (the Smart Family) & Aktiivix	Finland	https://neuvokasperhe.fi/en/smart-family-card & https://www.hel.fi/helsinki/en/culture/sports/well-being/sports-information/aktiivix
Physical Activity Coach (PAC)	Belgium	https://ec.europa.eu/sport/sites/sport/files/physical-activity-factsheets-2018/physical-activity-factsheets-2018/belgium-physical-activity-factsheet-2018_en.pdf
The Sport-Santé Project	Luxembourg	https://www.sport-sante.lu/index.php/en/

According to the gathered information for participant members from Health Enhancing Physical Activity (HEPA) annual meetings, in the 2014-15 meeting, two main approaches to PAP at health-care settings were identified (84):

A). "The brief interventions":

The United Kingdom (UK) National Institute for Health and Clinical Excellence (NICE) denominated brief intervention as a verbal advice, discussion, negotiation or encouragement, with or without written or other support or follow-up (141). Three levels of "brief intervention" are identified and the main is to give information on PA promotion and direct them to any need to increase PAL. It is the first stage and it can take a range time from 30 to 120 seconds. The second stage is "ask, advise, assist" and the third one is to direct to another individualized services for additional support, depending on the patient´s response. Finally, there is a "extended brief intervention" focused on an individually discussion with patient. This could be a single or multiple sessions and it takes more than 30 minutes of duration.

The 2013 NICE public health guidance showed that there is moderate evidence about the increased of self-reported PAL in those participants who received any kind of brief advices. There is a general consensus among healthcare practitioners that more exercise training and resources are needed to have efficient results (84).

The following bullets present brief intervention examples proposed by HEPA:

I Physician-based Assessment and Counselling for Exercise (PACE) – USA:

This project had been trained PHC providers and office staff to promote PA amongst patients since 1990 in North America. PA guidelines were offered by most of the healthcare providers in less than 5 minutes. The first assessment was done in 1992 and it suggested that programme was generally acceptable to healthcare providers, office staff, and patients (84). In this project, there are an interdisciplinary team of over forty health professionals with expertise in exercise and sport sciences, preventive medicine, health promotion, paediatrics, internal and family medicine, health psychology, behavioural medicine, experimental psychology, nutrition, engineering, computer sciences, media technology and graphic arts. PACE project has created research, development and dissemination in Portugal, Canada, Czech Republic, The Netherlands, Russia, Japan and Brazil besides than USA.

II Green Prescription – New Zealand:

In 1998, the Sport and Recreation New Zealand (SPARC) created the Green Prescription initiative. SPARC was transferred into the Zealand Ministry of Health from 2009 until now. The main aim of this initiative was that health professionals (usually GP or practice nurse) can give a PA written advice to their patients or families. They encourage and support them to become more physically active and healthier diet habits, as part of a full healthy plan, following the next stages:

1. Health professional gives to their patients a Green Prescription, provided by the stability of patient condition.
2. Written or electronically PA guidelines are given to the patients. If the patient wants extra support to improve nutrition or increase their PAL, they will send them to the nearest Green Prescription certified provider.
3. Green Prescription provider supports patients to become more active by the following stages:

    - 3-4 months of Monthly telephone calls support.
    - 3-4 months of face-to-face meetings.
    - 3-6 months of community-group support.

4. Healthy lifestyle progress is followed up with feedback from the healthcare professional to patients.
5. If the patient feels they would benefit from continuous support, they should say to the healthcare professional to continue with the strategy.

Green prescription is a cost-effective initiative, which is widely implemented throughout primary cares in New Zealand. It has been shown to produce enhancements in PAL and quality of life among physically inactive adults (142). Counselling on PA were offered from a general practitioner and practice nurse in this initiative (143).

III Physical Activity Promotion in Primary Care (PAPRICA) Switzerland:

The Physical Activity Promotion in PRImary CAre (PAPRICA) was developed in Switzerland to offer the knowledge, skills and didactic tools to deal the PA promotions by the use of motivational interviewing techniques with patients.

This strategy offered:

- Continuous four-hour training in PA counselling,
- A reference manual for doctors,
- A brochure for patients,
- Additional information and teaching tools classified by treatments,
- An independent evaluation of the University Institute of Social and Preventive Medicine in Lausanne attested the quality of training.

Family physicians and specialists are invited to follow this approach as a prevention treatment.

IV Neuvokas perhe (the Smart Family) - Finland:

Smart Family initiative provides tools on promote healthy lifestyles by public healthcare nurses and another healthcare professionals since the first phase in 2006. Health professionals are instructed on motivational interviewing techniques to encourage their patients to acquire healthier lifestyles (related to nutrition, physical activity, smoking, hygiene and sleep habits) according to the Health Action Process Approach (HAPA) model (84).

Based on the first development phase, the following main barriers and facilitators founded were:

Facilitators:

- Interest, awareness and need for an interventional project.
- Family acceptance.
- Multi-professional networking.
- Availability to individualized patient adaptations.

Barriers:

- Insufficient economic resources.
- Lack of exercise training and consensus in the implementation: A method misused by professionals, can result in the opposite expected effect.

Another PAP strategies showed in the 2014-15 HEPA annual meeting were:

B). Exercise Prescription or exercise referral schemes (ERS):

ERS are also known as "exercise prescription" or "GP referral". Both terms involve a patient for risk of a NCDs. Health professional or allied health professional refers patients to an exercise specialist receiving an exercise programme, in a segregated PAP approach (144).

There is a controversial rule between exercise referral that involves patients being formally referred from health professional to a third professional which generally an exercise professional trainer or a Sports scientist (local Sports centers).

There are several models of exercise referrals or exercise prescriptions in Northern Europe. All of them use a records baseline clinical, physiological and personal data and prescribe exercise activities tailored to the individuals needs varying from personal, home-based exercises, supervised classes or other community activities.

A common exercise prescription model consists of:

- A PAL assessment by PHC or allied health professional.
- An exercise referral patient for a PAP specialist or service.
- Design of a contextualized exercise programme for the patient.
- To offer the opportunity to participate in the exercise programme. (The exercise guidelines do not consider exercise referral schemes designed to treat specific diseases).

There is a wide variation on exercise prescription interventions and healthcare system or other resources. Some exercise prescriptions models use previous structures; while others develop new ones. All the models reviewed led significantly to increases PAL in patients. Printed and electronic supporting resources are a feature in exercise prescription or referral strategies for health professionals and patients. The effectiveness of interventions is diverse (84). Some of the most representative examples of exercise prescription according to above mentioned HEPA meeting were (84):

I NICE institute - UK:

Exercise referral schemes have been developed in UK since 1990 (144, 145). NICE was originally set up in 1999 to improve the quality of National Health System treatments and health care. In 2005, there were developing public health guidance to reduce chronic diseases and promoting healthy lifestyles. NICE was originally established in England; however, there are recently agreements to provide certain NICE products and services to Wales, Scotland and Northern Ireland. According to exercise referral schemes, they have their recommendations and guidelines based of scientific evidence since 2014 (146) and a high-quality review about different factors that affect in PAL of patients and PAP of health professionals in a brief PA advice (141). Structured exercise programmes are recommended on the following NICE guidance for a few chronic diseases. An interdisciplinary healthcare team tried to modify the sedentary or physically inactive behavior of patient, mainly by exercise referral to local sports canters and walking and biking activities.

II Fysisk Aktivitet pa˚ Recept (FaRV) - Sweden:

From 2003 (145), This PAP has been a patient-centred PAP approach by patient-healthcare professional dialogue to detect the state of health, potential risk factors, prior experiences, facilitators and barriers of patients to PAP. The PAP is a written prescription form composed by a knowledge bank "Physical Activity in the Prevention and Treatment of Disease" (147). The exercise prescription is done by his or herself or an organised exercise programme. Healthcare system should cooperate with local sports communities (NGOs, sports-patient associations, municipal or regional sports facilities and private sports centers) to maintain or increase their PA patterns. Follow-up is an important key factor to adjust the exercise prescription, including the patient´s motivation when it is necessary (148).

III Walk Your Way to Better Strength and Balance – Scotland:

Scottish Government provides a printed resource promoting walking, strength and balance exercises as an exercise training programme for older adults (>65 y.) since 2012. This program is promoted in a local care home setting and walk places chosen by

each community. The pilot initiative was send to an interdisciplinary community of walking groups, physiotherapists, occupational therapists, health advisers and "active ageing" staff (84).

IV Aktiivix - Finland:

Aktiivix PA initiative promotes PA lifestyles by trained personal in health stations. Patients with type 2 diabetes, or in high risk of developing it, and/or BMI values ≥30 kg/m^2) are encouraged to increase PAL and improve their wellbeing.

V Beweegkur - Netherlands:

This initiative focuses on delivering a lifestyle package to overweight patients (BMI 25-35) recruited through PHC and directed by a Lifestyle Adviser (LSA), frequently a practice nurse since 2007. One out of 3 exercise programmes are prescribed with different intensities by a physiotherapist. 6-8 motivational interviewing sessions are also developed during programme. Besides, all patients are referred to a dietician for 4 -7 sessions (84).

VI Care Sport Connectors (CSCs) – Netherlands:

From 2012 to 2017, this initiative tried to connect PHC and Sports Centers to guide PHC patients on health programmes managed by the local Sports entities promoting physically active health habits. Patients are assessed (general fitness with BMI values) by a physiotherapist three times (beginning, during, immediately after and half year after to the intervention). The results of this initiative have done to increase the number of patients being physically active by local sports facilities (84).

VII Physical Activity Coach (PAC) - Belgium:

This initiative connects patients from PHC and Sport Centers by a Physical Activity Coaches (PACs) as exercise expert intermediary. This study investigated the main barriers experiences by GPs for exercise referral. Likewise, it explores whether PAC is an added value to the healthcare System. The results showed the need for develop

tailored exercise programmes for patients and motivate them to change exercise behavior for a long term-time (84).

VIII National Exercise Referral Scheme – Wales.

The Welsh National Exercise Referral Scheme (NERS) was established to reduce the sedentary levels of patients associated to the NCDs risks since 2007. Patients are referred from a primary or secondary healthcare professional to a certified NERS exercise instructor of a local leisure-sport center. According to an initial test, patients will perform a supported 16-48 wk exercise training programme with specific adaptations on load training , regarding to patient criteria and needs (84).

IX Healthwise- Physical Activity Referral Programme – N. Ireland:

This initiative has been working with physically inactive adults at risk or suffering at least one NCDs (meeting the inclusion criteria programme) since 2004. Patients are referred from a primary or secondary healthcare professional to a local community or leisure setting to do a 12 wk exercise programme by a qualified exercise professional. The results showed that this strategy return 9£ for each 1£ invested (84).

X The Sport-Santé Project - Luxembourg:

The *Fédération Luxembourgeoise des Associations de Sport de Santé* (FLASS) as part of *Sport-Santé created an* exercise programmes for risk health patients in combination of community and health providers since 2006. The main aim of Sport-Santé Project has been to increase participation of patients with chronic diseases in therapeutic exercise classes, reducing risks of diseases and improving quality of life. This project is under-supervision of the Programme National Thérapeutique Sport-Santé (PNTSS), developing their efforts regarding to four key points: coordination, promotion, training and research.

1.1.3 Spanish PAP initiatives developed in the last years:

The most representative strategies on PA promotion and exercise prescriptions developed in Spain are described below:

I ***Protocolo para la evaluación multicéntrica del Programa Experimental de Promoción de la Actividad Física*** **(PEPAF):**

PEPAF developed a randomised clinical control trial with physically inactive adult patients (≥20yr.) during 24 months in 13 PHC centers of 9 different Spanish regions since 2003. The interventional plan to prescribe exercise was to have the patient in the "action stage" of the behavior change model. GP agrees with patient to achieve the PA recommendations of the Centre for Disease Control and Prevention (CDC) (149). Control group patients did not received an exercise prescription intervention until 2006, excepting those patients with problems related to a sedentary life-style. PAL at 3, 6, 12 and 24 months were also measured using 7-day PA recall, health-related quality of life (SF-36 test) and physical fitness (149).

I ***Pla d'Activitat Física Esport i Salut*** **(PAFES):**

This initiative piloted had three outcomes since 2005: 1) Clinical PA guidelines; 2) Local PA resources; 3) PA anamnesis and advice in PHC settings, based on stage of change behavior. Central and local level implementation activities included exercise professional training, support between local PA resources, web page diffusion, and promotion by world PA day (150). This strategy could be considered as one of the most important pioneer strategies in Spain associated with PA promotion and exercise prescription in PHC settings.

II ***Programa de Promoción de la Actividad Fisica*** **(PPAF):**

Spain has been developing different versions of the PEPAF pilot study in the region of Catalonia since 2006 (151). In 2008 in Barcelona, nine PHC centers offered to their patients a possibility to participate in a 3-months exercise-training programme in their own Healthcare settings. Nurses and physical therapists of PHC settings developed the sessions. All patients during last sessions had information about the nearest local PA resources (sports centers, civic centers and other health centers) and a visit to these centers was organized to continue a similar exercise practice there. Inclusion criteria was to be an adult patients (>18yr.), with low PAL (measured by IPAQ) and diagnosed with any chronic pathology (152).

III *Vallecas Activa* (Madrid, Spain):

This project begun in 2016 and the aim is to offer an individualized exercise referral by PHC of the Puente de Vallecas District of Madrid. PHC sends patients to a local Sports Center. Exercise trained manager evaluated each patients and send them to a Sports scientist instructor, who developed a 66 exercise group sessions. Furthermore, health education workshops are done with patients approximately during 9 months. Local governmental reduced the price of the program to 50%. Patients were, the person was expelled of the financed exercise programme, if they had 2 unjustified exercise programme absences.

More information and details:
http://www.aecosan.msssi.gob.es/AECOSAN/docs/documentos/nutricion/premios/2016/3_Vallecas_Activa.pdf

IV *Programa Comunitario para prescripción de ejercicio físico terapéutico: Programa Activa* (Murcia, Spain)

PAP project was developed in Murcia region (Spain) since 2011. The aim is to enhance PAP coordination between GPs and nurses of PHC settings and some closest local services. This initiative has treated to increase PAL and improve health status in patients. The project is based on 3 main axis: PHC settings, where patient was referral to a local Sports Center to developed an exercise training group sessions. Second, the "*Consejería de Sanidad y Política Social"* regional governmental institution manages the relationship between both local institutions, and finally, offering Sports scientist technicians are offered using economic resources of the project.

More information and details:
http://www.aecosan.msssi.gob.es/AECOSAN/docs/documentos/nutricion/5_Presentacion_Francisca_Tornel_ACTIVA__.pdf

V Caminem programme:

The CAMINEM Programme was carried out in two PHC centers of Lleida by a team composed of PHC physicians, nurses and sport scientists. The main aim was to provide tools to health professionals to prescribe and plan physical exercise in a urban walking

ways, such as a simple and safe strategy, taking the individual needs and resources for each person and trying to increase the health status of patients.

More information and details:
http://www.infotabacweb.com/web.asp?mod=boletines&acc=mostrar&id=%7B14CC70BA-4E1C-4FE2-98D8-4DA4CDFBC288%7D

VI "Live active"

The "Live active" programme in Benicarló (Spain) comprises assessment and prescription of customized exercise programmes to their NCDs patients, between Sports centers and PHC settings. A multidisciplinary network team have been working together during the last years by GPs, nurses, physiotherapists and exercise professionals. GP examine patients and he sent them to an exercise professional which, interviews them and offers either an individual exercise programme comprising local walks or group sessions. All patients are monitored annually and individual reports emitted (107).

More information and details:
http://www.ajuntamentdebenicarlo.org/r2h/files/19634.pdf

1.1.4 Exercise is Medicine initiative:

The Exercise is Medicine® initiative was launched by the American College of Sports Medicine (ACSM) in 2007 (4). In 2014, this initiative was introduced in Spain by EXERNET which is Spanish research networking on physical exercise, sport and health. EXERNET consider important to determine contextual lines for implementing PAP in healthcare settings by a multidisciplinary network according to Exercise is Medicine® initiative proposed in other places (4, 9, 10, 17, 76, 153-155) or other strategies with similar aims (19, 84, 101, 105, 112, 145, 151, 156, 157).
The main aim has been focused on encouraging Healthcare providers to include PA referral and exercise prescription such as treatment plans in healthcare settings or referring their patients to Exercise is Medicine® Credentialed Exercise Professionals at accredited organizations.

Exercise is Medicine® believes that PA is essential in the prevention and treatment for chronic diseases through exercise promotion. PA anamnesis would be treated as part of a PHC routine. Exercise is Medicine® initiative tries also to get most people as possible to incorporate PA and exercise into their daily lifestyle.

The main idea is to adapt Exercise is Medicine® global goals considering the differences on specific features such as health and work policies, education systems, official healthcare providers, Healthcare systems, PA awareness and exercise culture in all the countries.

Figure 4. Exercise is medicine global health initiative presence

(https://www.exerciseismedicine.org/eim_map/)

All the strategies with additional information are summarized in table 5:

Table 5. Summarized comparison of Physical Activity Intervention Projects and programmes in Health Care Settings. (Modified from HEPA 2016).

Programme/Project	Country	Target patients	Intervention	Healthcare setting	Referral Sector	Effectiveness		
						Clinical	PA	Cost
International PAP programmes and projects								
Brief interventions:								
Let's Get Moving	United Kingdom	Primary and Secondary Prevention: NCDs	PA and Nutritional Brief Intervention with support resources	Primary Healthcare	Health and social care	++	+	++
PACE	USA	Secondary prevention: Diabetes, Overweight, Depression	General lifestyle brief intervention	Primary and Secondary Healthcare	Health	+	++	-
Green Prescription	New Zealand	Secondary prevention: CVD, Diabetes, Overweight,	PA brief intervention with exercise referral	Primary Healthcare	Sport and Community	++	++	++
Paprica	Switzerland	Secondary prevention: NCDs	General lifestyle brief intervention with written advice	Primary Healthcare	Health	-	-	-
Smart Family	Finland	Primary and Secondary Prevention: NCDs	PA and Nutritional Brief Intervention with support resources	Primary Healthcare	Health	-	-	-
Physical Activity Coach	Belgium	Primary and Secondary Prevention: *NCDs*	PA Brief Intervention	Primary Healthcare	Health and Sport	-	-	-
Aktiivix	Finland	Secondary Prevention: *Diabetes, Overweight*	PA Brief Intervention with follow up	Primary Healthcare	Health, Environment and Community	++	-	-
Exercise prescriptions or exercise referral schemes:								
Beweegkur	Netherlands	Secondary Prevention: *Overweight*	Exercise Referral	Primary Healthcare	Health and Community Sport	++	++	++
Rezept für Bewegung	Germany	Primary and Secondary Prevention: All patients	Exercise Referral	German Physician associations (DGSP and DOSB)	Health	-	-	-
Grønn resept	Norway	Primary and Secondary Prevention: Overweight, Type II Diabetes and CVDs	Exercise Referral	Primary Healthcare	Health	-	-	-
Diabetes em Movimento	Portugal	Primary and Secondary Prevention: Type II Diabetes	Supervised Exercise Referral	Primary Healthcare	Health	++	+	-
Motion pa˚ recept	Denmark	Primary and Secondary Prevention: 31 NCDs	Exercise Referral	Primary Healthcare	Health and Community Sport	++	-	-
Qatar National	Qatar	Primary and Secondary	Exercise Referral	Primary Healthcare	Health and	+	+	+

Programme/Project	Country	Target patients	Intervention	Healthcare setting	Referral Sector	Effectiveness		
						Clinical	PA	Cost
Physical Activity Guidelines		Prevention: Diabetes Mellitus, CVD Osteoarthritis and Metabolic Syndrome			Community			
Fysisk Aktivitet pa˚ Recept, FaRV	Sweden	Primary and Secondary Prevention: NCDs	Exercise Referral	Primary Healthcare	Healthcare, Community and Sports	++	++	-
Sport sur ordonnance	France	Primary and Secondary Prevention: 30 NCDs	Exercise Referral	Primary Healthcare	Health and qualified sport trainers	++	++	++
NICE	UK	Health, public health and social care	Exercise Referral and PA brief advices	National Institute Health and Care	Walking and biking activities and Community resources	+	+	+
Walk Your Way to Better Strength and Balance	Scotland	Primary and Secondary Prevention: *Older and frailty adults*	Health Walks and Falls Prevention Training	Care Homes	Health, Environment and Community	-	-	-
Care Sport Connectors	Netherlands	Primary and Secondary Prevention: *Overweight, NCDs*	Exercise Referral	Primary Healthcare	Community Sport	-	-	-
National Exercise Referral Scheme	Wales	Secondary Prevention: *NCDs*	Exercise Referral	Primary and Secondary Healthcare	Health, Community, Environment and Sport.	++	Limited	++
Healthwise	North Ireland	Secondary Prevention: *NCDs*	Exercise Referral	Primary and Secondary Healthcare	Health, Community, Environment and Sport.	++	++	++
The Sport-Santé Project	Luxembourg	Secondary Prevention: NCDs	Exercise Referral	Primary and Secondary Healthcare	Health, Community and Sport	-	-	-
Exercise is medicine Initiative	Worldwide	Primary and Secondary Prevention: All NCDs	Exercise Referral	Primary and Secondary Healthcare	Health, Community and Sport	++	++	++
National PAP programmes and projects:								
Brief interventions:								
Caminem	Spain (Lleida)	Primary Prevention: NCDs patients	Urban Walks Referrals	Primary Healthcare	Urban areas	-	-	-
PEPAF	Spain, (9 Spanish regions)	Primary Prevention: NCDs with physically inactive or sedentary behaviors	Brief PA prevention and PA promotion	Primary Healthcare	Health, Community and Sport	+ Self reported health status	+	+ Decreasing rates of healthcare visits

Programme/Project	Country	Target patients	Intervention	Healthcare setting	Referral Sector	Effectiveness Clinical	PA	Cost
Exercise prescriptions or exercise referral schemes:								
PAFES	Spain, (Catalonia)	Primary Prevention: CVDs patients	Exercise Referral	Primary Healthcare	Health, Community and Sport	+	++	+
PPAF	Spain, (Catalonia and Malaga)	Primary Prevention: Adults NCDs patients physically inactive and overweight	Exercise Referral	Primary Healthcare	Healthcare settings and Local Sports resources	++	++	++
Vallecas Activa	Spain, (Madrid)	Primary Prevention: NCDs patients	Exercise Referral	Primary Healthcare	Healthcare settings and Public Sport Centres	+	++	-
Pragrama Activa	Spain (Murcia)	Primary Prevention: NCDs patients	Exercise Referral	Primary Healthcare	Healthcare settings	+ Self reported health status	++	-
Live active	Spain (Castellon)	Primary Prevention: Diabetes and obesity patients	Local walks or exercise group activities referrals	Primary Healthcare	Urban walks and local sport centres	+	-	-

Unknown evidence: - ; Some evidence: +; Higher evidence: ++; PA: Physical Activity; CVD: Cardiovascular diseases; NCDs: Non-communicable Diseases.

PAP is a big problem and worthwhile to study; therefore, this Ph.D. thesis has tried a first appraisal of the real situation in the Region of Madrid to developed a health policy based on PAP at PHC settings according to the interdisciplinary strategy of Exercise is Medicine® initiative.

2 HYPOTHESIS

The National Healthcare system is not prepared to implement a cost-effectiveness strategy, to promote PA and prescribe exercise by the Healthcare System, according to the philosophy of Exercise is Medicine.

3 OBJECTIVES

General objective

- To analyze the feasibility of PAP implementation as a preventive and treatment resource for non-communicable chronic diseases in PHC settings

Specific objectives

- To analyze the inclusion of PA and exercise as a preventive and treatment resource for chronic diseases in the Bachelor syllabus of Medicine, Sports Science and Nursing of Spanish universities.

- To review studies which have reported adherence to exercise prescribed to chronic patients, according to the WHO multi-dimensional adherence model.

- To analyze adherence to exercise training programmes in dialysis patients.

- To analyze in depth attitudes, self-perception, barriers, facilitators and knowledge of nurses and physicians towards the implementation of PAP at Madrid PHC settings.

- To compare PA and sedentary patterns, measured objectively (by accelerometer) or subjectively (by the PAVS-EIM and the IPAQ short version questionnaires), for contributing design of a patient anamnesis tool at PHC centers.

4 GENERAL MATERIAL AND METHODS

This Ph.D. thesis is based on data obtained from the studies developed by the ImFINE research group, Exercise is Medicine initiative in Spain and the support of the "*Dirección General de Salud Pública. Consejería de Sanidad de la Comunidad de Madrid*":

4.1 The Madrid Primary Healthcare PAP project-study design

The Madrid Primary healthcares PAP study is a qualitative review and a cross-sectional study supported by the ImFINE research group which aimed to evaluate PAP at Madrid PHC settings, under coordination of Prof. Marcela González Gross (Universidad Politécnica de Madrid) and Prof. José Antonio Casajús Mallén (Universidad de Zaragoza), scientific manager and president of Exercise is Medicine in Spain, respectively.

This Ph.D. thesis was developed following the following stages:

I. The analysis of Bachelor of Medicine, Nursing and Sports Science degrees of all Spanish universities in order to know the PAP Knowledge of consequent-related health providers.

II. Theoretical review of the scientific literature about PAP adherence factors according to the WHO 5 dimensions adherence model.

III. Practical applications of the WHO 5 dimension adherence model to identify common factors associated with chronic kidney patients about exercise training programme adherence prescribed in their dialysis sessions.

IV. PAP barriers and facilitators self-perceived by PHC nurses and physicians to promote and prescribe physical exercise at PHC setting of the region of Madrid (Study protocol shown in Appendix 2):

   a. Pre-analysis by a focus group sessions of a randomized sample.
   b. Design and validation of two choice-modelling Google-form questionnaires.
   c. Results of barriers and facilitators self-perceived of PHC staff .

V. Assessment of PA and sedentary patterns anamnesis comparing two validated surveys and different accelerometer methodologies.

4.2 **Assessments and Materials**

The detailed descriptions of all assessments, material and methods used are described in the material and methods section of each article.

4.3 **Ethical issues**

The study was performed according to the principles established with the Declaration of Helsinki 1964 and further amendments and other national regulations for research projects involving human participants: Protection of personal data, Law 15/1999 of 13 December on the Protection of Personal Data provided in the current legislation (Royal Decree 1720/2007 of 21 December) and the Law 14/2007, of 3 July, of biomedical research. The protocol study was approved by the Ethical Committee of the "Hospital Universitario Fundación Alcorcón" and the Central Commission for research of the Region of Madrid. Study supporting article number 3 was approved by the institutional review board (P141115303, Fundación Universitaria Hospital de Alcorcón,Madrid, Spain).

4.4 **Statistical Analysis**

All data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 21.0 for Windows (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0., Chicago, IL, USA, NY: IBM Corp). Descriptive statistics are shown as mean ± standard deviation (SD) unless otherwise stated (OR; 95%CI). P-values <0.05 were considered as statistically significant. The detailed description of statistical analysis is presented in each article.

5 **RESULTS AND DISCUSSION**

The results and discussion are presented below in the form in which they have been published or submitted to scientific journals, and they are referred as articles in this Ph.D. thesis.

5.1 ARTICLE 1: PHYSICAL ACTIVITY AS PREVENTION AND TREATMENT RESOURCE OF CHRONIC DISEASES IN THE SYLLABUS OF MEDICINE AND SPORT SCIENCES AT SPANISH UNIVERSITIES

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Trabajo Original

Otros

La actividad física en el currículo universitario español de los grados de Medicina y Ciencias de la Actividad Física y del Deporte como recurso en la prevención y tratamiento de las enfermedades crónicas

Physical activity as prevention and treatment resource of chronic diseases in the syllabus of Medicine and Sport Sciences at Spanish universities

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Nutrition & Dietetics Q4 (70/83) (JCR: 0.845).

5.1.1 Abstract

Introduction: Currently, there is scientific evidence about the benefits of physical exercise over human health. The aim of this study was to review the curricula of Medicine and Sport Sciences at Spanish universities, specifically regarding the contents related to physical exercise in the promotion, prevention and treatment of non-communicable chronic diseases.

Material and Methods: In a systematic way, all syllabus, programs and contents of the different subjects were reviewed for all Spanish universities which offer the Bachelors of Medicine and Sport Sciences. Total, compulsory and optional European Credit Transfer System (ECTS) were analyzed and added for each university. Practicum and Bachelor thesis were not considered.

Results: In the mean, Medicine studies dedicate 3.62% (2.38% mandatory and 1.20% optional) of the total 360 ECTS to these contents. In Sport Sciences studies, of the total 240 ECTS 17.78% (9.87% mandatory and 7.92% optional) were identified as related to these areas of knowledge. Contents ranged from 36 to 4.5 ECTS in Medicine and from 48 to 28 ECTS in Sport Sciences.

Conclusion: There is a great disparity between universities for both degrees among Spanish universities. Contents related to the efficient use of physical exercise for the prevention and treatment of non-communicable chronic diseases are scarce, especially in Medicine. Results indicate the need of increasing these contents in undergraduate studies and/or include them in Master or other programs.

Key words: Physical Fitness, teaching, preventive medicine, training, chronic illness, Health Education.

5.1.2 Introduction

La inactividad física está considerada en la actualidad como el cuarto factor de riesgo de mortalidad por todas las causas (158), asociada hasta con 30 tipos diferentes de enfermedades crónicas no transmisibles (ECNT) (19). De hecho, la inactividad física y el sedentarismo han ido aumentando de forma progresiva en las últimas décadas, pasando de aproximadamente 25 horas semanales de comportamientos sedentarios en el año 1960 a 45 horas en 2016 (16).

De igual modo, la actividad física, en todas sus facetas (laboral, doméstica, ocio y transporte) se ha visto reducida de 216 *Metabolic Equivalent* (METs) en 1961 a 173 METs horas/semana en 2005, con previsiones de reducción a 153 METs horas/semana para 2020 en Reino Unido. Datos similares se manejan para países como la lndia, Brasil, China y EEUU (16). En España, ante la ausencia de datos longitudinales, datos recientes sitúan al 27,0% de la población comprendida entre 18 y 75 años y el 55,4% de niños y adolescentes de 9 a 18 años entre los que no cumplen con las patrones de actividad física recomendados (159). Los adultos de 20 a 80 años permanecen de media 580 minutos/día en comportamientos sedentarios (160). Sin duda, las estresantes y amplias jornadas laborales, el desarrollo tecnológico o la falta de recursos económicos, entre otros, provocan una complicada realidad actual con una pandemia en auge de ENCT a nivel mundial (158).

Al mismo tiempo, en las sociedades con más recursos económicos, cada vez son más frecuentes los tratamientos farmacológicos para tratar estas enfermedades (161). Los medicamentos aminoran el estado de dolor, alargan la vida de los ciudadanos y su estado de salud en la patología que sufren, aunque no en todas las ocasiones aumentan su calidad de vida (162). Además, suponen un aumento del gasto sanitario, que en España está considerado en 990 millones de Euros y un gasto total de 5000 millones de euros y con progresión de aumento durante los próximos años (163). En Suecia, los médicos generalistas indican que la formación académica que han recibido se basa en la prescripción de medicamentos y poseen escasos conocimientos sobre medicina preventiva y prescripción mediante ejercicio físico (111).

Por otro lado, el conocimiento de los efectos y mejoras que provoca el ejercicio físico sobre la salud de las personas, no es algo reciente. En la antigua Grecia, Hipócrates ya argumentaba que el cuerpo humano estaba diseñado para realizar actividad física y el hecho de no hacerlo, podía provocar enfermedades y acelerar el envejecimiento de las

personas. Sus palabras anticipaban la situación pandémica que causa la inactividad física en la actualidad. También, durante la primera guerra Mundial, McKenzie comprobó y utilizó el ejercicio físico para disminuir el tiempo de rehabilitación de los militares que sufrían lesiones incapacitantes (164). En 1953, *Morris et al*. comprobaron los efectos que tenían los estilos de vida sedentarios, con largos periodos de inactividad física en el trabajo, sobre la salud cardiovascular de los trabajadores (165). De forma creciente con el paso de los años, se ha ido obteniendo mayor evidencia sobre los efectos que posee el ejercicio físico sobre la salud, la prevención y el tratamiento de las enfermedades crónicas (166). El ejercicio físico supone una mejora de la condición física muscular y cardiovascular, con efectos notables tanto en niños y adolescentes (167) como en adultos y mayores (168). Estos efectos se ven potenciados cuando se combina con una correcta alimentación y se anulan ciertos hábitos nocivos, como el abuso de alcohol y tabaco (169).

Los datos que ofrecen otros países muestran que más del 80% de sus ciudadanos visitan los centros de atención primaria todos los años, y prefieren obtener información para su salud a través de su médico de familia. Datos recientes indican que los médicos no evalúan, ni utilizan el ejercicio físico como medicina preventiva ni rehabilitadora (112). Las barreras que argumentan los médicos son la falta de recursos, de tiempo, de conocimiento especifico, la falta de rigor científico para constatar la dosis exacta que se debe prescribir para cada patología y los efectos adversos que posee sobre la salud (111, 170).

Existe consenso de que estos profesionales deberían poseer mayor conocimiento del papel del ejercicio físico y transferirlo en beneficio de la salud y calidad de vida de sus pacientes, además de optimizar los recursos económicos del sistema sanitario (171). Así mismo, el sector de graduados en Ciencias de la Actividad Física y el Deporte (CAFYDE) debería participar en el contexto de la salud pública (172). El personal sanitario que promociona o prescribe ejercicio físico en España es muy diverso y limitado el potencial que poseen para ello (173). En otros países, también se ha comprobado una reducida especialización entre médicos (174, 175), fisioterapeutas (176), enfermeros y profesionales de CAFYDE (120), evidenciando una falta de apoyo en el currículo de los graduados y postgraduados. En EEUU, un reciente estudio muestra como tan sólo el 6% de los contenidos del currículo, aborda contenidos relacionados con la prescripción de ejercicio físico, siendo sólo el 10% de los decanos

de las 72 Universidades encuestadas, quienes indican que sus estudiantes poseen una adecuada formación para prescribir ejercicio físico (177).

Debemos asegurar que los futuros médicos y profesionales de CAFYDE estén bien preparados para hacer frente a los principales problemas de salud del siglo XXI, aumentando el conocimiento en la promoción de actividad física, así como la dotación con recursos tanto personales, como materiales para evaluar, promocionar, prescribir y ejecutar las recomendaciones de actividad física consensuadas internacionalmente (178). Con los antecedentes observados en otros países, el objetivo de este estudio, ha sido revisar la formación curricular de los grados de Medicina y CAFYDE, a través de los planes de estudios y planes docentes de todas sus asignaturas, con el fin de comprobar cómo se aborda la promoción, prevención y el tratamiento de las enfermedades crónicas no transmisibles a través de la acción principal del ejercicio físico en los currículos universitarios de ambas carreras universitarias en España.

5.1.3 Material and methods

En el presente estudio se han revisado de forma sistemática los planes de estudio de todas las Universidades y centros adscritos a las facultades españolas que poseen la acreditación para poder impartir en España los grados de Medicina y CAFYDE, a través del REAL DECRETO 1509/2008, de 12 de septiembre, por el que se regula el Registro de Universidades, Centros y Títulos. Se han identificado un total de 42 y 40 universidades, respectivamente, de las cuales se han descartado 3 para el grado de CAFYDE. Dos por no impartir la citada carrera en la actualidad, pese a poseer la acreditación de la Agencia Nacional de Evaluación de la Calidad y Acreditación y otra de ellas por no cumplir los criterios de inclusión de nuestro estudio al impartir los créditos de su plan de estudios de forma no presencial.

En primer lugar, se analizaron los planes de estudio vigentes publicados en el Boletín Oficial del Estado (BOE). Esta revisión se efectuó entre el 08/01/2016 y el 01/02/2016. En el caso de que dichos planes no ofreciesen toda la información suficiente, se contrastó con la ofrecida en la página web de dichas universidades. La valoración se realizó por duplicado por dos investigadores, optando a una evaluación extra por un tercer investigador, cuando no había consenso entre los dos análisis iniciales. En aquellos casos donde la información web era incompleta o no se podía determinar por

estar en una lengua distinta del castellano, se contactó con el servicio de administración o secretaría de la Universidad correspondiente mediante correo electrónico. Se utilizó la vía telefónica para confirmar la impartición de la titulación en las universidades en las que se carecía de información suficiente para saber si durante el curso escolar 2015-16 se estaba impartiendo el grado de CAFYDE. En ningún caso hubo la necesidad de excluir ninguna asignatura por imposibilidad de obtener la información o interpretar los planes de estudio o planes docentes de ambos grados universitarios.

De los planes de estudio obtenidos se utilizaron los siguientes descriptores de búsqueda: actividad física, ejercicio físico, salud, promoción, prevención, tratamiento o rehabilitación; y dichos descriptores tenían que tener relación con la promoción, prevención y tratamiento de ENCT a través de la actividad o el ejercicio físico y su respectiva implicación con la salud. Se hizo un análisis del título de todas las asignaturas de los planes de estudio. Para aquellas asignaturas cuya denominación podía generar dudas y/o no pertenecían al área de salud en el grado de CAFYDE, se analizó el plan docente publicado en la página web del título universitario. Se comprobó que los contenidos indicados en el mismo, abordaban contenidos para promocionar, prevenir, evaluar y/o rehabilitar las ENCT a través del ejercicio físico. Se excluyeron las asignaturas en las que se trataban aspectos relacionados con la fisiología, anatomía o nutrición cuando no tenían relación con la actividad física o el ejercicio físico, así como aquellas asignaturas en las que se trataban contenidos relacionados con enfermedades o alguna actividad físico-deportiva que no tenían relación directa con la promoción, prevención y/o el tratamiento de las ECNT. Algunas universidades ofertan más créditos optativos de los que se tienen que cursar según el plan de estudios vigente. En este caso, se han incluido todas las asignaturas en las tablas, aunque para el cómputo global se ha tenido en cuenta los créditos a cursar.

Una vez obtenidas las asignaturas que cumplían los requisitos preestablecidos, se hizo una secuenciación de todas las asignaturas en cada una de las universidades y se contabilizó la media de créditos totales y el promedio de créditos optativos y obligatorios del total de cada una de las dos titulaciones universitarias. Se descartaron en ambas titulaciones los créditos de las asignaturas de prácticum o practicas externas, así como los trabajos fin de grado.

Por último, se estableció un ranking ordenado de mayor a menor, con las universidades que más créditos obligatorios poseían en la actualidad con los datos obtenidos.

5.1.4 Results

En las tablas 6 y 7 se muestran los créditos ECTS relacionados con contenidos de promoción, prevención y tratamiento de las ENCT mediante la actividad física y el ejercicio, por orden decreciente de créditos obligatorios, para los grados de Medicina y CAFD, respectivamente.

Table 6. Promedio de créditos de todas las asignaturas de las Universidades Españolas que imparten el título de Grado en Ciencias de la Actividad Física y del Deporte (CAFYDE), que tratan la actividad y el ejercicio físico como recurso de promoción, prevención o tratamiento de las enfermedades crónicas.

Universidades Españolas de CAFYDE *	% Total créditos asignaturas troncales	% Total créditos asignaturas optativas	Total créditos	% Total Grado
1. Universidad de Murcia	17,50	2,50	48,00	20,00
2. U. de Almería	17,50	0,00	42,00	17,50
3. U. de Huelva	15,00	10,00	60,00	25,00
4. U. de Castilla-La Mancha	15,00	7,50	54,00	22,50
5. U. Católica de Valencia San Vicente Mártir	15,00	5,00	48,00	20,00
6. U. Pablo de Olavide	15,00	5,00	48,00	20,00
7. U. Pompeu Fabra	15,00	5,00	48,00	20,00
8. U. de Cádiz	13,75	10,00	57,00	23,75
9. U. Católica San Antonio	13,75	5,63	47,00	19,38
10. U. de Valencia	13,75	2,50	39,00	16,25
11. U. Miguel Hernández de Elche	13,33	2,50	42,00	15,83
12. U. San Jorge	12,50	10,00	54,00	22,50
13. U. de Girona	12,50	5,00	42,00	17,50
14. U. Rovira i Virgili	12,50	2,50	36,00	15,00
15. U. de León	10,63	10,63	51,00	21,25
16. U. Autónoma de Madrid	10,00	17,50	66,00	27,50
17. U. de Deusto	10,00	12,50	54,00	22,50
18. U. de Zaragoza	10,00	12,50	48,00	22,50
19. U. Pontificia de Salamanca	10,00	5,00	36,00	15,00
20. U. de A Coruña	10,00	2,50	30,00	12,50
21. U. de Barcelona	10,00	2,50	30,00	12,50
22. U.de Las Palmas de Gran Canaria	10,00	2,50	30,00	12,50
23. U. Alfonso X El Sabio	8,33	10,00	44,00	18,33
24. U. Camilo José Cela	7,50	12,50	48,00	20,00
25. U. de Alcalá	7,50	10,00	42,00	17,50
26. U. de Vigo	7,50	10,00	42,00	17,50
27. U. Europea Miguel de Cervantes	7,50	5,00	30,00	12,50
28. U. de Extremadura	7,50	5,00	30,00	12,50
29. U. de Sevilla	7,50	5,00	30,00	12,50
30. U. de Alicante	7,50	2,50	24,00	10,00
31. Universidad de Lleida	7,50	2,50	24,00	10,00
32. U. del País Vasco/ Euskal Herriko U.	6,25	15,00	51,00	21,25
33. U. Politécnica de Madrid	5,00	17,50	54,00	22,50
34. U.de Vic- U. Central de Catalunya	5,00	17,50	54,00	22,50
35. U. Europea de Madrid	5,00	15,00	48,00	20,00
36. U. Francisco de Vitoria	5,00	12,50	42,00	17,50
37. U. de Granada	5,00	10,00	36,00	15,00
38. U. Ramón Llull	2,50	12,50	36,00	15,00
39. U. Europea del Atlántico	0,00	7,50	18,00	7,50

Universidades Españolas de CAFYDE *	% Total créditos asignaturas troncales	% Total créditos asignaturas optativas	Total créditos	% Total Grado
U. Europea de Valencia	Tiene acreditación, pero no se imparte. (No validada).			
U. Cardenal Herrera-CEU	Tiene acreditación, pero no se imparte. (No validada).			
U. Internacional Isabel I de Castilla	No tiene modalidad presencial.			

* Ordenadas de mayor a menor por número de créditos troncales de asignaturas que cumplen los requisitos de estudio. U.: Universidad

Table 7. Promedio de créditos de todas las asignaturas de las Universidades Españolas que imparten el título de Grado en Medicina, que tratan la actividad y el ejercicio físico como recurso de promoción, prevención o tratamiento de las enfermedades crónicas.

Universidades Españolas de MEDICINA *	% Total créditos asignaturas troncales	% Total créditos asignaturas optativas	Total créditos	% Total Grado
1. U. de Málaga	**5,83**	4,17	36,00	10,00
2. U. Cardenal Herrera-CEU	**5,83**	0,00	21,00	5,83
3. U. Rey Juan Carlos	**4,44**	0,00	16,00	4,44
4. U. de Alcalá	**3,75**	0,00	13,50	3,75
5. U. de La Laguna	**3,33**	3,33	24,00	6,67
6. U. de Zaragoza	**3,33**	2,22	20,00	5,56
7. U. Complutense de Madrid	**3,33**	0,00	12,00	3,33
8. U. de Córdoba	**3,33**	0,00	12,00	3,33
9. U. de Extremadura	**3,33**	0,00	12,00	3,33
10. U. de Lleida	**3,33**	0,00	12,00	3,33
11. U. Autónoma de Madrid	**3,33**	1,67	6,00	1,66
12. U. de Las Palmas de Gran Canaria	**2,92**	1,67	16,50	4,58
13. U. Alfonso X El Sabio	**2,78**	1,67	16,00	4,44
14. U. de Sevilla	**2,50**	0,00	21,00	5,83
15. U. de Granada	**2,50**	2,50	18,00	5,00
16. U. de Oviedo	**2,50**	2,50	18,00	5,00
17. U. de Barcelona	**2,50**	2,22	17,00	4,72
18. U. de Salamanca	**2,50**	1,67	15,00	4,17
19. U. de Cádiz	**2,50**	0,83	12,00	3,33
20. U. Católica de Valencia San Vicente Mártir	**2,50**	0,83	12,00	3,33
21. U. Católica San Antonio	**2,50**	0,83	12,00	3,33
22. U. Miguel Hernández de Elche	**2,50**	0,00	9,00	2,50
23. U. San Pablo-CEU	**2,22**	0,00	8,00	2,22
24. U. de Sevilla	**1,67**	3,33	18,00	5,00
25. U. Rovira i Virgili	**1,67**	3,33	18,00	5,00
26. U. del País Vasco/ Euskal Herriko U	**1,67**	1,67	12,00	3,33
27. U. de Murcia	**1,67**	0,83	9,00	2,50
28. U. de Navarra	**1,67**	0,83	9,00	2,50
29. U. de Santiago de Compostela	**1,67**	0,83	9,00	2,50
30. U. de Valladolid	**1,67**	0,83	9,00	2,50
31. U. de Cantabria	**1,67**	0,00	6,00	1,67
32. U. de Castilla-La Mancha	**1,67**	0,00	6,00	1,67
33. U. Pompeu Fabra / Autónoma Barcelona	**1,67**	0,00	6,00	1,67
34. U. Autónoma de Barcelona	**1,39**	1,67	11,00	3,06
35. U. Francisco de Vitoria	**1,39**	0,83	8,00	2,22
36. U. Europea de Madrid	**1,11**	0,83	7,00	1,94

Universidades Españolas de MEDICINA *	% Total créditos asignaturas troncales	% Total créditos asignaturas optativas	Total créditos	% Total Grado
37. U. Internacional de Catalunya	**0,83**	1,11	7,00	1,94
38. U. Jaume I de Castellón	**0,00**	3,33	12,00	3,33
39. U. de Girona	**0,00**	1,39	5,00	1,39
40. U. de Valencia	**0,00**	1,25	4,50	1,25

* Ordenadas de mayor a menor por número de créditos troncales de asignaturas que cumplen los requisitos de estudio. U.: Universidad

Los resultados muestran que hay grandes diferencias, entre los planes de estudio de las diferentes Universidades españolas para una misma titulación universitaria. Existen Facultades que no ofrecen créditos obligatorios en este ámbito como la Universidad Europea del Atlántico en CAFYDE (tabla I) ó las Universidades de Girona, Jaume I de Castellón y Valencia en Medicina (tabla II).

Realizando un análisis específico para cada carrera universitaria, se comprueba cómo, en el grado de Medicina, el porcentaje medio de los créditos de obligado cumplimiento (C. Obligatorios y C. Formación básica) es sólo de 2,38% de 360 créditos totales, mientras que en el grado de CAFYDE, es un 9,87 % del total de 240 créditos que posee la carrera universitaria (tabla III). Con respecto a los créditos optativos, los graduados en Medicina alcanzan un 1,20% frente al 7,92% de los graduados de CAFYDE. Con un porcentaje total de 3,62% de los futuros médicos frente al 17,78% de los futuros profesionales de CAFYDE, tal y como se muestra en la tabla 8 de este documento.

Table 8. Resumen del promedio total de créditos de las Universidades Españolas de los grados de Medicina y CAFYDE que tratan el ejercicio y la actividad física como medida de promoción, prevención o tratamiento de las enfermedades crónicas.

	% C. Asignaturas Troncales (FB + OB) (Media ±SD)	% C. Asignaturas Optativas (OP) (Media ± SD)	% Total (Media ± SD)
Universidades de CAFYDE	9,87± 4,16	7,92± 4,92	17,78± 4,60
Universidades de MEDICINA	2,38 ± 1,29	1,20 ± 1,17	3,62 ± 1,71

CAFD: Ciencias de la actividad física y el deporte
FB: Formación básica
OB: Obligatorios
OP: Optativas
SD: Desviación Estándar

Se ofrecen los datos de todas las asignaturas aceptadas para el objetivo de estudio, y la cuantificación de créditos parciales y totales de todas las asignaturas de los grados de Medicina y CAFYDE de todas las Universidades españolas revisadas (Tablas material suplementario disponible en: http://www.nutricionhospitalaria.org/wp-content/uploads/2017/07/art-730-material-suplementario.pdf).

5.1.1 Discussion

Existe consenso en la bibliografía revisada sobre el déficit de formación de los profesionales sanitarios y de la actividad física en el ámbito de promoción, prevención y el tratamiento de las ECNT a través del ejercicio físico (174). En EEUU, se ha evidenciado que tan sólo entre el 6% (177) y el 13% del currículo de los médicos aborda contenidos relacionados con dicho aspecto (179). Similares resultados se constatan en el Reino Unido (83, 175) y Venezuela (180). Los datos revisados por nosotros para España muestran una situación peor (3,62%). Un estudio previo en Cataluña pone de manifiesto que el conocimiento, actitud y tratamiento que ofrecen los enfermeros y médicos generalistas sobre la promoción de actividad física hacia sus pacientes, es insuficiente y susceptible de ser mejorado (120).

Algo mejor es la situación de los graduados en CAFYDE con casi un 18% de créditos ECTS; pese a ello, hay multitud de evidencia a nivel global que demuestra que los graduados en CAFYDE no poseen un adecuado currículo para dotar de conocimiento especifico en la promoción y ejecución de ejercicio físico específico sobre tratamiento de las enfermedades no transmisibles (181). En países como Corea del Sur, se ha visto una notable mejoría de la formación de los estudiantes de CAFYDE en los últimos 60 años en este aspecto (182). En otros países de Europa se replantean si la formación de los graduados en CAFYDE es la adecuada a la práctica profesional que van a desempeñar con las personas en el ámbito de la salud (183). En España, según los datos ofrecidos en este estudio, ya que no se ha encontrado bibliografía científica que contraste los resultados obtenidos, existe diversidad y diferencias entre las Universidades, que hacen necesario que el futuro estudiante esté bien informado del lugar donde va a recibir sus estudios, ya que de ello va a estar condicionada su formación. Igualmente, los empleadores de los futuros egresados deben ser conscientes de estas diferencias y/o diferenciar a las Universidades por estudios o formar de manera común y consensuada (184) . Distintos autores han propuesto un trabajo interdisciplinar

para los distintos profesionales que se dedican a promover la salud a través de la actividad física y el deporte, potenciando el resultado de la agrupación de sus conocimientos específicos (164). Se ha constatado la eficacia en programas de intervención realizados entre enfermeros, médicos y profesionales de CAFYDE, desarrollados desde centros de atención primaria (143). Aunque el debate parece centrarse más en quienes son las personas que se deben dedicar a ello, que cómo se podría realizar de manera conjunta y eficiente (185). Por cualificación académica y profesional, los médicos especialistas en medicina del deporte son los profesionales más preparados para evaluar la condición física de los pacientes y prescribir programas de ejercicio físico que deberán desarrollar los profesionales de CAFYDE. Las prescripciones individualizadas sobre cada persona con una ECNT deben incluir el tipo, carga y periodicidad de ejercicio físico a realizar, para utilizar el ejercicio físico como instrumento preventivo y de tratamiento y no consejos generalizados para la amplia gama de pacientes que poseen los centros de atención primaria (8). En España, se han desarrollado programas preventivos educacionales para adecuar y aumentar la práctica de ejercicio físico en pacientes con diabetes tipo II, que han tenido resultados satisfactorios (124). También el empleo de una evaluación de diagnostico que indique el nivel de actividad y sedentarismo que ofrece un paciente como marcador de salud (186). Si los profesionales sanitarios no poseen los conocimientos necesarios para utilizar el ejercicio físico, difícilmente el tratamiento va a ser eficaz (19). Incluso, podría ser contraproducente a las necesidades individuales que presenta un paciente, si se proponen ejercicios desaconsejados o con cargas inadecuadas (170). Por este motivo, se deben desarrollar protocolos de actuación para solucionar el problema, a través de cursos de formación complementaria dirigido a los profesionales del área sanitaria. En países como EEUU, ya existen iniciativas de modificación y ampliación de los contenidos a tratar en el currículo educativo de la titulación de medicina (187). Su currículo ha ido adaptándose a las necesidades que demanda la pandemia de ECNT actual, y progresivamente se han añadido créditos y cursos obligatorios para aumentar contenidos relacionados con las ciencias del deporte y comportamentales que han hecho aumentar la formación académica con respecto a la medicina preventiva, para fomentar estilos de vida más sanos, con una adecuada alimentación y aumentando los niveles de actividad física. De la misma forma que ya se hizo anteriormente para tratar adecuadamente sobre el uso del tabaco en los futuros pacientes (177).

Otras iniciativas globales como la de *Exercise is Medicine*, centro avalado por el *American Collage of Sport Medicine* (ACSM) promueven la promoción, prevención y el tratamiento individualizado de las ECNT en los centros de atención primaria, con un trabajo multidisciplinar entre todo el personal sanitario y los profesionales del deporte (4), pautando unas líneas de actuación que ayudarían a disminuir la pandemia de ECNT a causa de la inactividad física y el sedentarismo.

Del presente estudio se pueden considerar como limitaciones, sobrevalorar la cuantificación total de créditos que cada asignatura dedica sobre la promoción, prevención y tratamiento de las ECNT mediante ejercicio físico, al no contabilizar exclusivamente la parte proporcional de contenidos que aborda el plan docente y su proporción específica de créditos en la asignatura.

Además, no se han contabilizado los créditos de la asignatura TFG y Prácticum, en ninguno de los dos grados, como consecuencia de la imposibilidad de controlar si los contenidos abordados en dichas asignaturas, coinciden plenamente con el objetivo del presente estudio en todas las Universidades analizadas. Sin embargo, se han tenido en cuenta para calcular el porcentaje total de créditos.

A pesar de la revisión exhaustiva realizada, no se descarta la posibilidad de alguna omisión o alteración de los datos, como consecuencia de la situación de inactividad o modificación por parte de la Universidades, de las asignaturas que se muestran vigentes en los planes de estudios del BOE analizados durante el primer trimestre del año 2016.

En conclusión, en el presente estudio se ha comprobado que el porcentaje medio total de los créditos ECTS de asignaturas que tratan la actividad y el ejercicio físico como recurso de promoción, prevención o tratamiento de las enfermedades crónicas en el grado de Medicina es del 3,62% (2,38% de créditos obligatorios y 1,20% optativos, sobre un total de 360 créditos) frente al 17,78% (9,87% de créditos obligatorios y 7,92% optativos, sobre un total de 240 créditos) en el grado de CAFYDE. La disparidad observada entre universidades, indica que el conocimiento de los egresados en estas materias no va a ser el mismo. En ambos Grados, los créditos resultan escasos e indican la necesidad de aumentar estos contenidos y/o incluirlos en programas de postgrado y formación continuada.

Conflicto de intereses: Los autores declaran no tener ningún conflicto de interés.

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5.2 ARTICLE 2: PHYSICAL EXERCISE TRAINING IN THE SYLLABUS OF BACHELOR OF SCIENCE IN NURSING DEGREES

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5.2.1 Abstract

Background: Scientific evidence regarding the effectiveness of physical activity (PA) in the prevention and treatment of chronic diseases is increasing. Healthcare systems are trying to increase exercise prescription treatments. However, it is not clear if health professionals are sufficiently trained. *Aim:* to analyze the contents related to PA and exercise in the prevention and treatment of chronic diseases in the syllabus of the Bachelor of Science in Nursing at all Spanish universities. **Methods:** All Spanish universities offering the Bachelor of Science in Nursing were considered for this study. A cross-sectional systematic analysis of all guide programs was performed assessing the European Credit Transfer System (ECTS) related to PA and/or exercise in the prevention or treatment of chronic diseases. ECTS of Practicum and Bachelor thesis were not included in the analysis. **Results:** In the mean, for the 2017-18 academic course, the Bachelor of Science in Nursing dedicated 5.82% (5.01% mandatory and 0.82% voluntary) of a total of 240 ECTS (ranging from 0 to 45 ECTS). The majority of contents were related to PA promotion; in contrast, contents related to exercise prescription are neglectable. Five Spanish universities do not offer any academic teaching to physical activity on prescription (PAP). **Conclusions:** A great disparity between universities was identified. In general, acquired knowledge seems scarce for PA promotion and exercise prescription in PHC staff. Nurses would need additional PAP training to improve PA promotion and exercise prescription knowledge as a coadjutant non-pharmacological treatment for non-communicable chronic diseases at PHC settings.

Key words: Academic Training, Nursing Education research, Physical Activity, Exercise Therapy, Preventive Medicine, Health Promotion, Public Health, Primary Healthcare.

5.2.2 Introduction

Evidence shows that physical inactivity is a risk factor in at least 35 different kind of illness (9). Exercise can be used to prevent at least 26 chronic diseases (10). The hazards of physical inactivity are well known (13). Besides, a high physical activity (PA) behavior attenuates but does not eliminate the increased all-cause mortality risk (188). The disturbance in energy balance in favour of physical inactivity and sedentary behaviors, represent currently a major threat to global health (6, 12, 16, 119). For this reason, different WHO strategies (99, 107) and the medical community are searching for efficient ways to stop this cost-ineffective situation (104, 120, 145).

Current data from OECD Stat has shown that Spanish patients visit PHC (PHC) settings on average 7.6 times per year (OECD Stat, 2018). Last Spanish national statistics (INE) showed that 84.49% of 38960 people, had visited a physician during that year, and only 0.22% had never visited this one in the last 5 years (INE, 2014). Therefore, the healthcare system is a well-considered resource to increase PA among people, and also, because patients trust on healthcare professionals (111). Besides, advices from healthcare professionals about changes for better lifestyles have shown to have a positive effect on patients' health (111).

However, physical activity on prescription (PAP) is scarcely implemented, as healthcare professionals around the world in general have a great unawareness about exercise treatments (27, 112, 189, 190). In fact, only one-third of patients get PA recommendations by healthcare professionals (11). Most of the initiatives propose a multidisciplinary team to encourage physical activity, in which nursing professionals, among others, should be included (4). This is regarded as an important priority by the health promotion service of the Spanish National Healthcare System (103). Insufficient educational opportunities for PHC providers is considered a major contributor to the under-exercise prescription (119). In a previous review about PA promotion and prescription in the syllabus of Spanish medical students we observed this tendency (118). Another study, which analyzed nurses knowledge regarding this topic in some regions of Spain, came to similar results (120). Therefore, the aim of this study has been to analyze the inclusion of PA and exercise for the prevention and treatment of chronic diseases in the syllabus of the Bachelor of Science (BSc.) in Nursing of all Spanish universities.

5.2.3 Material and Methods

The systematic method used in this study has been already described previously (118). A total of 59 universities which offered the BSc. in Nursing according to the R.D 1509/2008, of 12nd of September were identified. We analyzed their syllabus published in the Spanish Official Bulletin (BOE). Curricular guide programs developed for the 2017-18 academic year were downloaded from the website of each Spanish nursing Faculty. When the information did not appear on the website, an e-mail was sent to the contact person of the University, asking about the curricular guide programs of the all subjects of their BSc. in Nursing. All universities except one answered with the properly information. This one university was contacted unsuccessfully several times by telephone and e-mail. In two cases, the information was only given for the current courses developed by the University at that moment, such as is shown in table I.

Curricular guide programs were analyzed in English, Catalan and mainly in Spanish. No guide had to be excluded from the analysis because of the language. All guide programs were reviewed using the following search terms: exercise*, *active*, physical, sport, move*, promotion, prevention, treatment* and *health* with their corresponding translated words in the other reviewed languages (Spanish or Catalan). If the search terms appeared in any of the curricular elements of the guide programs, the relationship to promotion, treatment, assessment of PAL, physical fitness, exercise or sport practices to improve health condition of chronic diseases was analyzed. In these cases, the ECTS were considered for this review. When the search term, for instance, appeared in the introduction, but competences expected to achieve by the students were not properly related with the contents of the subject and the aim of the study, the credits were not considered.

Credits of external practicum and Bachelor thesis were not considered, because topics can differ from the aim of our review; however, these ECTS were considered for the total ECTS quantified in the ratio. No university offered more voluntary ECTS related to the aim of our study, than the *BOE* official programme had published.

Finally, after double-checking, accepted subjects from each University were computed in table III and quantified in the average of total ECTS considered for all Spanish BSc. in Nursing subdividing by mandatory and voluntary credits such as it was shown in their official programme and is explained in table II.

5.2.4 Results

The results indicate that Spanish universities offer an average of 5.82 ± 3.99 % ECTS associated to the promotion and treatment of chronic diseases by PA or exercise in the BSc in Nursing. Most are offered as mandatory ECTS (5.01±3.81%) against the 0.82±1.41% of voluntary ECTS (ranging from 0 to 45 ECTS), mainly in subjects associated with the PA promotion (table 9 and table 10).

Only five Spanish universities do not offer any academic teaching (mandatory and voluntary) related to PA in the prevention or treatment of chronic illness in their BSc in Nursing. In four universities, students can choose an itinerary in which there is not any mandatory credit associated with the aim of this study (see table I). Thirty-eight universities do not offer exercise promotion or treatment in their voluntary credits.

In table 9, all Spanish universities teaching the BSc in Nursing are ranked from highest to lowest number of mandatory ECTS, being 45 ECTS the maximum and the mean 13.82 ± 9.67 ECTS. On average, universities offer 5.82% (5.01% mandatory and 0.82% voluntary) of the total 240 ECTS of contents related to the aim of this study.

In table 10, the list of Subjects considered in each Spanish university which offers the BSc. in Nursing in relation to promotion and prescription of physical activity/exercise to prevent and treat chronic diseases is shown.

Table 9. List of Spanish universities offering Bachelor of Science in Nursing ordered by average of mandatory credits.

Spanish Universities [a]	% Total mandatory credits	% Total voluntary credits	Total credits	% Total degree
1. Universidad Rovira i Virgili	18,75	0,00	45,00	18,75
2. Universidad Francisco de Vitoria	12,50	0,00	30,00	12,50
3. Universidad de Cádiz	11,25	2,50	33,00	13,75
4. Universidad de Granada	11,25	2,50	33,00	13,75
5. Universidad Católica San Antonio	10,00	5,00	36,00	15,00
6. Universidad de Almería	10,00	2,50	30,00	12,50
7. Universidad de Córdoba	10,00	0,00	24,00	10,00
8. Universidad de Jaén	10,00	0,00	24,00	10,00
9. Universidad de Oviedo	8,75	0,00	21,00	8,75
10. Universidad Pública de Navarra	7,50	1,25	21,00	8,75
11. Universidad Autónoma de Barcelona	7,50	0,00	18,00	7,50
12. Universidad Complutense de Madrid	7,50	0,00	18,00	7,50
13. Universidad de León	7,50	0,00	18,00	7,50
14. Universidad de Málaga	7,50	0,00	18,00	7,50
15. Universidad de Navarra	7,50	0,00	18,00	7,50

Spanish Universities [a]	% Total mandatory credits	% Total voluntary credits	Total credits	% Total degree
16. Universidad Europea de Valencia	7,50	0,00	18,00	7,50
17. Universidad Jaume I de Castellón	7,50	0,00	18,00	7,50
18. Universidad Pontificia Comillas	7,50	0,00	18,00	7,50
19. Universidad Rey Juan Carlos	6,88	0,00	16,50	6,88
20. Universidad de Las Palmas de Gran Canaria	5,63	0,00	13,50	5,63
21. Universitat de València (Estudi General)	5,00	1,88	16,50	6,88
22. Universitat Internacional de Catalunya	5,00	1,67	16,00	6,67
23. Universidad de Burgos	5,00	1,25	15,00	6,25
24. Universidad Alfonso X El Sabio	5,00	0,00	12,00	5,00
25. Universidad Autónoma de Madrid	5,00	0,00	12,00	5,00
26. Universidad Católica de Valencia San Vicente Mártir	5,00	0,00	12,00	5,00
27. Universidad de A Coruña	5,00	0,00	12,00	5,00
28. Universidad de Alcalá	5,00	0,00	12,00	5,00
29. Universidad de Cantabria	5,00	0,00	12,00	5,00
30. Universidad de Extremadura	5,00	0,00	12,00	5,00
31. Universidad Fernando Pessoa-Canarias (UFP-C)	5,00	0,00	12,00	5,00
32. Universitat de les Illes Balears	5,00	0,00	12,00	5,00
33. Universidad de Valladolid	4,38	1,25	13,50	5,63
34. Universidad de Murcia	3,75	0,00	9,00	3,75
35. Universidad Pontificia de Salamanca	3,75	0,00	9,00	3,75
36. Universidad de Barcelona	3,75	1,25	3,00	5,00
37. Universidad San Pablo-CEU	3,13	2,50	13,50	5,63
38. Universidad Pompeu Fabra	2,92	6,25	22,00	9,17
39. Universidad de Castilla-La Mancha	2,50	2,50	12,00	5,00
40. Universidad de Sevilla	2,50	2,50	12,00	5,00
41. Universidad San Jorge	2,50	1,25	9,00	3,75
42. Universidad Camilo José Cela	2,50	0,00	6,00	2,50
43. Universidad de Girona	2,50	0,00	6,00	2,50
44. Universidad de Huelva	2,50	0,00	6,00	2,50
45. Universidad de La Laguna	2,50	0,00	6,00	2,50
46. Universidad de Salamanca	2,50	0,00	6,00	2,50
47. Universidad. de Vic-Universidad Central de Catalunya [b]	2,50	0,00	6,00	2,50
48. Universidad de Vigo	1,88	1,88	9,00	3,75
49. Universidad de Santiago de Compostela [c]	1,88	0,00	4,50	1,88
50. Universidad de Lleida	0,00	5,00	12,00	5,00
51. Universidad del País Vasco	0,00	1,88	4,50	1,88
52. Universidad Antonio de Nebrija	0,00	1,25	3,00	1,25
53. Universidad Católica Santa Teresa de Jesús de Ávila	0,00	1,25	3,00	1,25
54. Universidad Cardenal Herrera-CEU	0,00	0,00	0,00	0,00
55. Universidad de Alicante	0,00	0,00	0,00	0,00
56. Universidad de la Rioja	0,00	0,00	0,00	0,00
57. Universidad de Zaragoza	0,00	0,00	0,00	0,00
58. Universidad Ramón Llull	0,00	0,00	0,00	0,00
59. Universidad Europea de Madrid	Not possible access to the information			

[a] Ordered from highest to lowest total percentage of mandatory ECTS per University.
[b] Analysis based only on 1st,2nd and 3rd implanted courses.
[c] Analysis based onlyoin 1st and 2nd implanted courses.

Table 10. List of Subjects considered in each Bachelor of Science in Nursing at Spanish University.

		Mandatory Credits		Voluntary Credits	Total	% Total
University	**Subjects:**	**B**	**M**	**OP**		
Universidad Rovira i Virgili	Childhood and adolescence in the community			3		
	Structure and function of the human body	6				
	Nursing in youth		9			
	In-depth study of complementary techniques in nursing care			3		
	Basic nursing in the life cycle		9			
	Nursing in the adult person		12			
	Nursing in the elderly		9			
	Total		45	0	45	
	% of ECTS		18.75	0.00		18.75
Universidad Francisco de Vitoria	Physiology	6				
	Nutrition and Applied Pharmacology	9				
	Community Nursing II		5			
	Clinical Nursing I		5			
	Clinical Nursing II		5			
	Total		30	0	30	
	% of ECTS		12.50	0.00		12.50
Universidad de Cádiz	Theoretical and methodological bases of nursing care		9			
	Food, nutrition and dietetics	6				
	Applied psychosocial sciences	6				
	Geriatric-geriatric nursing		6			
	Cardiovascular risk factors in children			6		
	Total		27	6	33	
	% of ECTS		11.25	2.50		13.75
Universidad de Granada	Public health		6			
	Adult NursingI		6			
	Adult NursingII		9			
	Nursing of Aging		6			
	Basic fundamentals for the use of Physical Exercise in Health Sciences			6		
	Total		27	6	33	
	% of ECTS		11.25	2.50		13.75
Universidad Católica San Antonio	Community Nursing I		6			
	Clinical Nursing I		6			
	Community Nursing II		6			
	Geriatric and Gerontological Nursing		6			
	Sports Nursing			6		
	Emotional Intelligence in Nursing			6		
	Total		24	12	36	
	% of ECTS		10.00	5.00		15.00
Universidad de Almería	Health Promotion and Safety		6			
	Nursing in Reproductive Health		6		30	

	and Sexual Health				
	Community nursing		6		
	Nursing of Aging		6		
	Complementary Techniques Applied to Nursing Care			6	
	Total		24	6	
	% of ECTS		10.00	2.50	12.50
Universidad de Córdoba	Biochemistry	6			
	Nutrition and diet	6			
	Public health		6		
	Adult Nursing II		6		
	Total		24	0	24
	% of ECTS		10.00	0.00	10.00
Universidad de Jaén	Nurse intervention in health promotion	6			
	Aging nursing		6		
	Complementary care in nursing		6		
	Terminal care nursing		6		
	Total		24	0	24
	% of ECTS		10.00	0.00	10.00
Universidad de Oviedo	Adult and Elderly Nursing		6		
	Community Nursing II		6		
	Pharmacology, Nutrition and Dietetics		9		
	Total		21	0	21
	% of ECTS		8.75	0.00	8.75
Universidad Pública de Navarra	Public health and disease prevention		6		
	Nursing of the adult and the elderly II		6		
	Nursing in school and family health			3	
	Human physiology	6			
	Total		18	3	21
	% of ECTS		7.50	1.25	8.75
Universidad Autónoma de Barcelona	Psychosocial sciences	6			
	Nutrition	6			
	Health Education		6		
	Total		18	0	18
	% of ECTS		7.50	0.00	7.50
Universidad Complutense de Madrid	Methodology of the Nursing Practice		6		
	Clinical Nursing I		6		
	Community Nursing II		6		
	Total		18	0	18
	% of ECTS		7.50	0.00	7.50
Universidad de León	Nutrition and diet	6			
	Public health		6		
	Nursing of childhood and adolescence		6		
	Total		18	0	18
	% of ECTS		7.50	0.00	7.50
Universidad de Málaga	Adult Nursing II		6		
	School Health		6		
	Adult Nursing III		6		18

	Total	18	0		
	% of ECTS	7.50	0.00		7.50
Universidad de Navarra	Nursing care for the person in adulthood I	6			
	Nursing care for the elderly	6			
	Nursing care in childhood and adolescence	6			
	Total	18	0	18	
	% of ECTS	7.50	0.00		7.50
Universidad Europea de Valencia	Nursing Care in Health Alterations II	6			
	Public health	6			
	Processes and basic care	6			
	Total	18	0	18	
	% of ECTS	7.50	0.00		7.50
Universidad Jaume I de Castellón	Biochemistry	6			
	Human anatomy	6			
	Human Nutrition	6			
	Total	18	0	18	
	% of ECTS	7.50	0.00		7.50
Universidad Pontificia Comillas	Fundamentals nursing	18			
	Total	18	0	18	
	% of ECTS	7.50	0.00		7.50
Universidad Rey Juan Carlos	Nursing care for the family and the community	4.5			
	Public health	8			
	Geriatric nursing and gerontology	4			
	Total	16.5	0	16.5	
	% of ECTS	6.88	0.00		6.88
Universidad de Las Palmas de Gran Canaria	Nutrition and diet	6			
	Aging care nursing	7.5			
	Total	13.5	0	13.5	
	% of ECTS	5.63	0.00		5.63
Universitat de València (Estudi General)	Nutrition and dietetics	6			
	Medical-surgical nursing in special situations	6			
	Physical activity and promotion of health in nursing		4.5		
	Total	12	4.5	16.5	
	% of ECTS	5.00	1.88		6.88
Universitat Internacional de Catalunya	Structure and Function of the Human Body I	6			
	Care Methodology	6			
	Health Promotion Activities		4		
	Total	12	4	16	
	% of ECTS	5.00	1.67		6.67
Universidad Alfonso X El Sabio	Basic Nursing Care	6			
	Palliative Care and Applied Ethics	6			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universidad Autónoma de Madrid	Elderly Nursing	6			
	Children and Adolescents Nursing	6			
	Total	12	0	12	

	% of ECTS	5.00	0.00		5.00
Universidad Católica de Valencia San Vicente Mártir	Community Health Care I	6			
	Nursing methodology	6			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universidad de A Coruña	Fundamentals of Nursing	12			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universidad de Alcalá	Basic care for the health of people, family and the group	6			
	Nutrition and diet	6			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universidad de Cantabria	Nutrition and diet	6			
	Education and Health Promotion	6			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universidad de Extremadura	Fundamentals of Nursing II	6			
	Health Education	6			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universidad Fernando Pessoa-Canarias (UFP-C)	Foundations and Procedures in Nursing I	6			
	Family and Community Intervention Nursing	6			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universitat de les Illes Balears	Epidemiology, Public and Community Health	6			
	Nursing in the Senior Person	6			
	Total	12	0	12	
	% of ECTS	5.00	0.00		5.00
Universidad de Valladolid	Human Nutrition	6			
	Immunology in nursing care		3		
	Biochemistry and biophysics	4.5			
	Total	10.5	3	13.5	
	% of ECTS	4.38	1.25		5.63
Universidad de Murcia	Basic fundamentals	3			
	Aging nursing	6			
	Total	9	0	9	
	% of ECTS	3.75	0.00		3.75
Universidad Pontificia de Salamanca	Theoretical and methodological fundamentals of Nursing	9			
	Total	9	0	9	
	% of ECTS	3.75	0.00		3.75
Universidad de Barcelona	Community nursing	9			
	Physical activity, sport and health		3		
	Total	9	3	12	
	% of ECTS	3.75	1.25		5.00
Universidad San Pablo-CEU	Gynecological and Obstetric Nursing	4.5			
	Nursing care processes	3		13.5	

	Sports Nursing		6		
	Total	7.5	6		
	% of ECTS	3.13	2.50		5.63
Universidad Pompeu Fabra	Geriatric nursing	7			
	Advanced knowledge in complementary Natural Therapies		5		
	Functional training for people with neurological disabilities		5		
	Sport and physical activity nursing		5		
	Total	7	15	22	
	% of ECTS	2.92	6.25		9.17
Universidad de Castilla-La Mancha	Physical Exercise, Sports and Health		6		
	Geriatric nursing	6			
	Total	6	6	12	
	% of ECTS	2.50	2.50		5.00
Universidad de Sevilla	Clinical Nursing I	6			
	Principles of Physiotherapy Applied to Nursing		6		
	Total	6	6	12	
	% of ECTS	2.50	2.50		5.00
Universidad San Jorge	Nutrition and human dietetics	6			
	Alternative and complementary therapies		3		
	Total	6	3	9	
	% of ECTS	2.50	1.25		3.75
Universidad Camilo José Cela	Geronto-Geriatric Nursing	6			
	Total	6	0	6	
	% of ECTS	2.50	0.00		2.50
Universidad de Girona	Nutrition, metabolism and biochemistry	6			
	Total	6	0	6	
	% of ECTS	2.50	0.00		2.50
Universidad de Huelva	Nursing and the new challenges in Health	6			
	Total	6	0	6	
	% of ECTS	2.50	0.00		2.50
Universidad de La Laguna	Health Education, Community Nursing and Public Health I	6			
	Total	6	0	6	
	% of ECTS	2.50	0.00		2.50
Universidad de Salamanca	Nutrition and diet	6			
	Total	6	0	6	
	% of ECTS	2.50	0.00		2.50
Universidad de Vic-Universidad Central de Catalunya	Nurse Care to the Family and the Community	6			
	Total	6	0	6	
	% of ECTS	2.50	0.00		2.50
Universidad de Vigo	Nursing of the Life Cycle: Mother-Child I	4.5			
	Basic Physiotherapy Techniques		4.5		
	Total	4.5	4.5	9	
	% of ECTS	1.88	1.88		3.76

Universidad de Santiago de Compostela	Nursing of the Life Cycle: Mother-Child I	4.5			
	Total	4.5	0	4.5	
	% of ECTS	1.88	0.00		1.88
Universidad de Lleida	Healthy Aging		6		
	Chronic pathologies and physical exercise		6		
	Total	0	12	12	
	% of ECTS	0.00	5.00		5.00
Universidad del País Vasco	Valuing the Habits of Life of a Population		4.5		
	Total	0	4.5	4.5	
	% of ECTS	0.00	1.88		1.88
Universidad Antonio de Nebrija	Complementary Therapies		3		
	Total	0	3	3	
	% of ECTS	0.00	1.25		1.25
U. Católica Sª Teresa de Jesús de Ávila	Basic Physiotherapy Techniques		3		
	Total	0	3	3	
	% of ECTS	0.00	1.25	1.25	
U. Cardenal Herrera-CEU	Total	0	0	0	
	% of ECTS	0.00	0.00		0.00
Universidad de Alicante	Total	0	0	0	
	% of ECTS	0.00	0.00		0.00
Universidad de la Rioja	Total	0	0		
	% of ECTS	0.00	0.00		0.00
Universidad de Zaragoza	Total	0	0	0	
	% of ECTS	0.00	0.00		0.00
Universidad Ramón Llull	Total	0	0	0	
	% of ECTS	0.00	0.00		0.00
Universidad Europea de Madrid	No access to the information				
	Total				
	% of ECTS				
			No access to the information		

U: University; PA: Physical activity; S: Sport; B: Basic Credits; M: Mandatory credits; OP: Optative credits.

5.2.5 Discussion

According to Hill et al. (191), healthcare professionals receive very limited training on exercise science. (173). Knowledge offered in the BSc in Nursing at Spanish universities about PA promotion and exercise treatment could be insufficient (120), in the way that has been observed in another studies (174, 175, 191). In Spain, to the best of our knowledge, only one analysis has been done with the staff of Catalonian healthcare professionals in 2005, indicating that nurses and physicians know too little about how PA influences health (120). In our review, around 10% of the BSc. in

Nursing do not offer any ECTS, and more than half do not offer any voluntary credits about PA promotion or exercise prescription.

Unfortunately, in other places of the world, only around 3% of health professionals admit to have ever taken a course related to exercise prescription during their medical school education (180). The ECTS offered by Spanish universities in the BSc in Medicine seem insufficient (3.62% of total credits), such as was assessed by us in 2016 (118) and by other authors in the rest of the world (83, 175, 187, 192-194). According to our review, nursing students have a higher academic offer, but probably not enough for exercise prescription. Competence in prescribing exercise and good awareness is positively correlated with frequency on prescription (117, 119, 195). The lack of specific education in preventive medicine (e.g., physical activity) by 63% of Canadian nurses showed the need to improve the PA promotion and prescription in the curriculum of the BSc. in Nursing in this country (196).

Surprisingly, this is happening in spite of the irrefutable evidence accumulated during the last 60 years (197) regarding the benefits of exercise on human health (9, 76, 180, 198). Even if PA promotion has been a public health priority for many years (97, 99, 100, 196, 199), it is not reflected at least in the Spanish BSc in Nursing curriculum such as has been shown in this study. Nurses play the role to reduce the adverse effects of sedentary behaviors and increasing PAL between PHC patients (12). Exercise training courses together with a remodelling of the curricula plans of healthcare degrees could be a key strategy initiative to improve physical activity referrals in PHC settings (175). Future research should check the improvements in this way.

Limitations: The total of ECTS was included in our review for each subject fulfilling the inclusion criteria, independently of the curricular load developed specifically to the topic.

Impact: After to measure objectively the curricula of Spanish nursing universities, we confirm that there is a lack of physical activity promotion and exercise prescription credits in the curricula of Spanish nursing degrees. PA promotion counseling and exercise prescription knowledge should be improved, at least to be used usefully as a prevention treatment for non-communicable chronic diseases at PHC settings by nurses.

5.2.6 Conclusions

The syllabus about exercise as a resource for prevention and therapy of several chronic diseases is not enough on average in the Bachelor of Science in Nursing offered by Spanish universities.

Training courses on exercise promotion and treatments related to human health should be added to the syllabus of the Bachelor of Science in Nursing, as well as during their professional careers.

Physical activity promotion should be a public health priority policy strategy carried out by a interdisciplinary team including nurses, physicians, sports professionals, among others, in every country.

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5.3 ARTICLE 3: ADHERENCE FACTORS RELATED TO EXERCISE PRESCRIPTIONS IN HEALTHCARE SETTINGS: A CRITICAL APPRAISAL OF SCIENTIFIC LITERATURE.

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5.3.1 Abstract

Purpose: Physical activity on prescription (PAP) is being introduced in healthcare systems around the world. In order to develop a cost-effective PAP strategy, it is important to analyze in the scientific literature, the adherence factors related to PAP according to the multi-dimensional adherence model as a non-pharmacological method used in Healthcare settings. **Methods:** PAP adherence factors in studies published in MEDLINE were reviewed, according to the WHO Five-dimensional adherence model. In a setting of intervention, high-risk factor or chronic disease studies, PAP adherence methods, physical activity (PA) guidelines, patient PA Levels (PAL), and mentioned theories related to changes in active human behavior were analyzed. **Results:** A total of 32 studies reviewed, according to the Five dimensions WHO adherence model showed these total clustered adherence variables: social/economic (n=113), Health system/Healthcare team (n=17), condition-related (n=54), therapy-related (n=17) and patient-related (n=50). PAP adherence has mainly been measured by the number of training sessions attended compared to total PAP sessions scheduled. PAL was measured by ten different methods, mainly by questionnaires. Stage of change model has been the theory most referenced in PAP adherence studies. **Conclusion:** Healthcare system and therapy-related barriers have been less considered, showing a prevalence in the analysis of social/economic and patient-related PAP adherence factors in non-pharmacological prescriptions at healthcare settings. No gold standard method to measure PAP adherence has been identified. The WHO Five-dimensions adherence model could be adopted to analyze PAP adherence as a non-pharmacological prescription done in healthcare settings.

Key words: Physical activity, compliance, concordance, health promotion.

5.3.2 Introduction

The World Health Organization (WHO) defines adherence in healthcare (HC) as “The extent to which a person’s behavior taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a HC provider" (90). Likewise, non-adherence is considered when patients do not follow the recommendations from the HC provider; it is not limited to nonuse but includes underuse, overuse, and inappropriate use (or implementation) of a treatment modality (200). Although the terms adherence and compliance are often used interchangeably, compliance has judgmental overtones, whereas adherence emphasizes collaboration (201). The term “concordance” extends the concept of adherence, emphasizing the therapeutic alliance between patients and health care professionals (202). Irrespective of the term used, all are crucial for a positive outcome of a HC treatment.

Physical activity on prescription (PAP) is an emerging topic of interest (100), as chronic diseases are prevalently increasing in older adults and in parallel, life expectancy is rising worldwide (203). Eighty percent of Primary HC consultations are related to chronic diseases (124). In contrast, positive effects of PAP on many chronic diseases are well known (10) and general practitioners and HC settings have been identified as good resources to promote PA recommendations and prescriptions (111). There are several global and international PAP initiatives that are worthwhile to be mentioned (84). The Dutch "*BeweegKuur*", which combines lifestyle intervention in primary care, to improve physical activity (PA) and dietary behavior in overweight people (204). The “green prescription”, is a cost-effective initiative, widely implemented throughout primary care in New Zealand, Sweden and Norway, offering PA counseling from general practitioners and practice nurses, among others (143). This initiative has shown enhancements in PA levels and quality of life among physically inactive adults patients (142). The denominated PAP initiative is offering written exercise prescription at HC settings of New Zeeland, Australia, Sweden and Finland (205). Also, the "Exercise referral scheme" used, for instance in United Kingdom and Denmark, is the most common model of exercise referral system involving referral from a primary care practitioner and local leisure services (205).

In Spain, during the last years, several PAP initiatives have been developed; for instance, the "*Programa Experimental de Promoción de la Actividad Fisica*" (PEPAF) (149), the "*Pla d'Activitat Física Esport i Salut*" (PAFES) study (150) or the "*Programa*

de Promoción de la Actividad Fisica" (PPAF) programme (152). The Exercise is Medicine-Spain initiative, founded trough an agreement by the Spanish Research Network on PA and health (EXERNET) and the American College of Sports Medicine (ACSM) is also being implemented. This initiative is already working in more than 40 countries of five continents, with the aim to encourage HC providers to include PA activity referral and exercise prescription treatment plans in HC settings or referring their patients to Exercise is Medicine Credentialed Exercise organizations.

Adherence is a key determinant of the effectiveness of all mentioned initiatives, as non-adherence attenuates the effectiveness of any treatment benefit (90). In the literature, there are some discrepancies about the existence of individualized or common patterns towards PA adherence (78) and about which behavioral factors influence in facilitating or maintaining exercise adherence (206). According to the systematic review offered by Picorelli et al., better adherence to PA programmes was observed in people with higher socioeconomic status, better education, living alone, better health status and better physical function. On the contrary, psychological factors such as depression, loneliness, lower scores on the Mini-Mental Status Examination, were associated with poorer adherence (78). In the same way, Martin Borras et al. showed that municipal resources and enhancement of social support and social participation could increase PA levels in older adults (101). Also, Garmendia et al, showed that achieving active livestyles at young ages is the most effective way of ensuring physically-active behaviors throughout life (207). Clearly, human behavior is a complex issue, adherence and non-adherence to PA depends on many factors and is not simply a patient problem.

In order to approach all these factors, WHO proposed in 2003 a Five-dimensions adherence model, which aimed to analyse in an integrated way all factors related to socio-economical, HC system and team, condition, therapy and patient dimensions (90). These are summarized in Table 1. WHO proposes this model to analyse long-term adherence to both pharmacological and non-pharmacological treatments (WHO, 2003). PAP can be considered a non-pharmacological treatment, as WHO recommends that interventions to know individualized PA barriers in patients and avoiding PA non-adherence should become a central component of efforts to improve populations´ health worldwide (90). However, many studies analyze PAP adherence without considering all specific conditions that should be considered in all subcategories of the five dimensions proposed by WHO in 2003 (78, 90).

Therefore, the main aim of this study was to perform a critical appraisal of the scientific literature in order to know main adherence factors to PAP interventions in chronic patients and if these factors have been analysed according to the WHO five-dimension adherence model.

5.3.3 Material and Methods

The electronic database Medical Literature Analysis and Retrieval System Online (MEDLINE; through PubMed: (http://www.ncbi.nlm.nih.gov) was searched for studies published between 1987 and January, 15th 2017. Search terms *"adherence", "concordance", "compliance", "non-adherence", "chronic disease", "exercise treatments", "physical activity" and "physical exercise"* as well as combinations out of these terms were entered in the database and filtered by humans. The inclusion criteria were: adults aged > 18 years (at least in the major proportion of the age range analyzed), both sexes (male/female), design: (Randomized Controlled Trial, Controlled trial, Cross-sectional, Cohort, Prospective cohort, Longitudinal, report of case and Research Support studies), patients in HC settings or people with risk factors (including age > 65 years) or suffering from chronic diseases with PA adherence assessment developed in the study.

Following the methodology proposed by (208), our study selection process was performed by different stages. Firstly, titles and abstracts were screened by a single reviewer excluding the clearly irrelevant ones. Then, full papers of abstracts categorized as potentially eligible for inclusion were screened in a consensus meeting of two reviewers and disagreements were solved in real time by consensus. Finally, data extraction was performed by one reviewer using a standardized data extraction form and checked by the supervisor. Discrepancies were solved by discussions between all authors. Data extracted were: age of participants, setting of intervention, risk factor or chronic disease, PA adherence to the programme, PAP offered by a health professional, Methods to measure PAL, theories named to explain the human behavior about PA adherence, method to register PA adherence, score of PA barriers according to the WHO five-dimensional adherence model (90) and the main subcategories adapted to this study (Table 11). Additionally, demographic data of the population included in the studies reviewed have been considered.

Articles were excluded by these reasons: duplication in the different combined searches, not written in English or Spanish language, participants < 18 years (or without age range in the study), no inclusion of PA or exercise programmes related to PAP, exercise treatments in patients with no risk factors or not suffering at least from one or more chronic diseases in a HC setting, review, systematic review or meta-analysis.

Modified RATS review guidelines were used for this narrative review, with more than five points (10 points Likert-type scale) for the following points: relevance of study question, appropriateness of the method, transparency of procedures and soundness of interpretative approach, were finally chosen.

5.3.4 Results

From a total of 233 articles identified, 32 studies met the inclusion criteria and were included in this critical appraisal of the scientific literature. Descriptive data, methods used for PA measurement and for assessing adherence are shown in Table 12, ordered by year, from the most recent to the oldest one. Within these thirty-two studies, in 15, PA promotion is the PAP method used, referring mainly to national guidelines (i.e. Norway, UK, USA, Korea, etc). Four refer to WHO PA guidelines and two to ACSM guidelines. In 17 of the studies, exercise prescription is the PAP method used, including PA home-based programmes (n=4), community/group-guided exercise programmes (n=9), walking sessions (n=2), and web-based training (n=2).

Different kind of methods were registered in the review to analyze adherence (table 2). Thirteen studies analyzed PA adherence taking into account if participants met or not met national or WHO PA recommendations by questionnaires or accelerometer; Fifteen studies, the percentage and number of classes attended according to sessions scheduled. Four studies used self-reported methods, two telephone calls and one, email follow-ups, two measured if walking programmes were completed and two measured leisure and PA work time levels (Table 12). Two studies used non-adherence methods (assessing adherence in participants with at least 10 weeks of treatment, lapse or readopting the treatment). One study also measured the PAP adherence of the health care provider.

Table 13 summarizes factors related to PA adherence, following the WHO five-dimension adherence model. The following PAP adherence-related factors were

mentioned in the studies: Social/economic factors, considered in 113 times, was the dimension most mentioned in the studies analyzed, followed by condition-related factors (n=54) and patient-related factors (n=50). Therapy-related factors (n=17), and Health system/HCT-factors (n=17) have been less analyzed (Table 13). The factors more cited in social/economic dimension were low socioeconomic status (n=35) and Demographics (n=26). The Condition related-factors more cited were Symptom burden (n=14) and Activity limitation (n=14). The patient-related factors more cited were Beliefs and perceptions (n=13) and Self-efficacy (n=10). The Therapy-related factors more founded were Effective treatment (n=10) and Previous failures with therapy (n=6). Finally, the Health system/HCT-factors more cited were Problems with patient-provider relationships (n=5), inadequate local health services (n=4) and Inadequate support for patient (n=4).

Otherwise, regarding behavior changes theories, the following theoretical frameworks were identified as mentioned theories in the change from physically passive to active behavior in chronic patients: SCM/Transtheoretical Model (SCM/TTM) (n=10), Social cognitive Theory (SCT) (n=5), SDT (n=4), HBM (n=3), Self-efficacy Theory (S-ET) (n=1), TPB (n=1), Social support theory (SST) (n=1), S-RT (n=1), psychological models of Sonstroem (n=1), Religious leaders to promote PA (n=1), Socioecologic model (S-EM) (n=1) and NI theories (n=10) (Table 13).
Studies were carried out in European countries (43.75%), USA (34.38%), Australia (9.38%), Canada (6.25%), and Asia (6.25%) (Table 13).

Table 11. Adherence factors included in the five multi-dimensional adherence model (modified from WHO, 2003).

	Dimensions				
	Social/economic factors:	**Health care System factors**:	**Condition-related factors:**	**Therapy-related factors:**	**Patient-related factors:**
1	Low socioeconomic status	Problems with patient–provider relationships	Symptom burden	Polymedicated	Insufficient knowledge
2	Illiteracy	Inadequate local health services	Frailty	Effective Treatment: (complexity)	Self-efficacy
3	Low educational level	Insufficient PA knowledge and training for health care providers	Activity limitation	Previous failures with therapy	Cognitive ability
4	Unemployment	Lack of incentives and feedback on performance	Other related-treatments	Frequent changes in treatment	Concern over side effects
5	Insufficient social support	Inadequate support for patient	Comorbidities	Lack of perceived beneficial effects	Cosmetic concerns
6	Transportation issues	Insufficient reimbursement from health insurance		Actual side effects	Motivation
7	Excessive medication				Attitude
8	Treatment costs				Psychological issues
9	Environmental factors				Beliefs and perceptions
10	Demographic factors				

Table 12. Descriptive data of the studies included in the review. Material supplementation APENDIX 11

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease /s	PA measured	PA Prescription	PA adherence assessment
(Desveaux, Goldstein, Mathur, & Brooks, 2016)	CS	67	PHCs (both sexes)	35 PHCs	Cardiac rehabilitations	Modified CRBS survey (Shanmugaegaram et al., 2012)	Community based exercise	Measured by CRBS
(Martin-Payo, Suarez-Alvarez, Amieva Fernandez, Duaso, & Alvarez Gomez, 2016)	RCT	18-77	n=230 (57,7, 42,3%)	HC	NCDs	Patients without PA or dietary restriction	WHO, 2010 PA guidelines	Motiva. Diaf. Questionnaire Meeting WHO, 2010. PA guidelines
(Bergh, Lundin Kvalem, Risstad, & Sniehotta, 2016)	C	18-60	n=230 patients (78.3, 21.7%)	Hospital	Morbid Obese	IPAQ-short form. PA and Energy requirements: (MET-min/week).	Norwegian National guidelines	Measured PA Norwegian National guidelines (by IPAQ-short form)
(Chrisman, Daniel, Chow, Wu, & Zhao, 2015)	C	>30-<65	n= 21551 (Both sexes)	HC fairs and clinics.	Obese	CTS survey PAL:(hours/week)	US PA recommendations	US PA recommendations compliance
(Norton, Norton, & Lewis, 2015)	RCT	18-63	n= 871 (Both sexes)	Hospital	NCDs	Sports Medicine Australia screening Physical fitness Pedometer	Group-guided exercise programme	Compliance (%): (Achieved daily targets, Sufficiently active after intervention) Adherence (%): (Completed versus screened and started).

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease /s	PA measured	PA Prescription	PA adherence assessment
(Thomson et al., 2015)	C	44.3±12.2	n= 267, (both sexes)	University	Hypertension	Pedometer CV Fitness measures: (6MW)	Walking group sessions Education sessions	3 markets of adherence: -Completion of homework (Self monitoring PA) -Class attendance -Completion of scheduled telephone calls Adherence indicators:
(Alkerwi et al., 2015)	CS	18-69	n= 3133 (both sexes)	HC System	NCDs	IPAQ	WHO PA guidelines	Compliance to PA guidelines (by IPAQ)
(Kinnafick, Thogersen-Ntoumani, & Duda, 2014)	CS	18-64	n=90 (84,6)	British University-Employees	Physically inactive employees with asthma.	IPAQ (Craig et al, 2003)	Walking intervention	PA adherence or PA Non-adherence (by total weeks intervention).
(Jefferis et al., 2014)	C	70-93	n=6529 (3237, 3292)	PHC	NCDs	Log. Dairy Survey 7d-Accelerometer register	UK PA recommendations	Meeting UK PA recommendations
(Venditti et al., 2014)	RCT	25->65	n=3234. (68, 32%)	27 HC	Obesity and DM2T	N.I.	Published in: http://www.bsc.gwu.edu/dpp/manuals.htmlvdoc.	Percentage ranked of the cohort study

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease /s	PA measured	PA Prescription	PA adherence assessment
(Austin, Qu, & Shewchuk, 2013)	CS	45->64	n=10892 (both sexes)	HC centers for disease control and preven-tion	Arthritis	BRFSS survey	PA guidelines reported at least 30 minutes of physical activity on 5 or more days per week	Yes/no questions - Patients - Healthcare providers
(Garmendia et al., 2013)	RCT	65.0-67.9	n=996 (69.5, 30.5%)	36 PHCs	NCDs	Structured training load	Structured exercise programme	Minimum classes attendance (24 PA classes spread over at least 12 months).
(Bossen, Buskermolen, Veenhof, de Bakker, & Dekker, 2013)	RCT	50-75	n= 100 (60,4)	HC	Osteoar-thritis	Join2move is a self-paced 9-week	PA program web based PA intervention	Number of completed modules / total modules
(Austin, Qu, & Shewchuk, 2012)	RCT	>45	n=33071 (65%, 35%)	HC	Arthritis	BRFSS survey	American College of Rheumatology PA guidelines	Measured by BRFSS questionnaire
(Martin & Woods, 2012)	RCT	50-85	n=24 (9 ,15)	Hospital	Coronary heart disease	Training load.	Community run exercise programmes	Average attendance sessions
(Courneya et al., 2012)	RCT	50-74	n=160 (160,0)	PHCs	Breast cancer	Heart rate monitors (Polar A3) VO2max CV Fitness test	Supervised and unsupervised exercise prescription	Meeting supervised and unsupervised exercise prescription: -Sessions/wk -Min/wk

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease /s	PA measured	PA Prescription	PA adherence assessment
(Evers, Klusmann, Schwarzer, & Heuser, 2012)	RCT	70-93	n=171 (171, 0).	NI	Inactive and Elderly.	Training load (NI)	Standardized training exercise sessions	Number of course units attended in each period.
(Tiedeman n et al., 2012)	Intervention al study	66.7	n=76 (38,38)	11 Physiotherapist centers	Stroke survivors	Training load Pedometer steps/7days Fitness functioning	Home exercise programme	Percentage of classes attended / year
(Rodrigue z-Romo et al., 2011)	CS	25-74	n=1500 (78, 82%)	HC System by phone line	Low self-perceived health (smokers)	Version 2 Global Physical Activity Questionnaire (GPAQv2)	WHO PA recommendations	Adherence PA recommendations (NI method)
(Netz, Goldsmith, Shimony, Ben-Moshe, & Zeev, 2011)	L	>65	n=1536 (both sexes)	HC	NCDs	Israeli national survey (Module of PA)	PA recommendations (ACSM, 2009; AHA, Nelson et al., 2007; USDHHS, 2008):	Meeting PA recommendations according to Israeli national survey
(Yeom, Jung, & Choi, 2011)	CS	65-103	n=2241. (59.6, 40.4%)	Korean National HC System	> 3 NCDs	KNHANES IV Survey WHO's IPAQ KCDC, 2007 Survey	PA guidelines (Korea Ministry of Health and Welfare, 2007):	Percentage (min days/week) Korean PA guidelines.

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease /s	PA measured	PA Prescription	PA adherence assessment
(Leijon et al., 2010)	RCT	18->65	n=2611 (1740, 871)	37 Swedish PHCs	NCDs	7d-PA dairy	Home-based activity Facility-based activity Combination of home-based and facility-based activity	Self-reported PA adherence, 3 and 12 months, (by a yes/no question)
(Smits, Tart, Presnell, Rosenfield, & Otto, 2010)	RCT	19.43	n=92 (51, 41)	College students	Obese	PARQ, (1981) IPAQ (2003)	PA Intervention	PA adherence, after intervention 6 and 12 month (by IPAQ)
(Kallings, Leijon, Kowalski, Hellenius, & Stahle, 2009)	RS	25-78	n=240 (75, 25%)	13 Swedish PHCs	NCDs	Self-reported PAL by FYSS survey.	Counselling based in FYSS project	Self reported adherence by and 6-month follow-up survey
(Gine-Garriga et al., 2009)	RCT	>18	n= 424 (both sexes)	9 Spanish PHCs	NI	International Physical Activity Questionnaire (IPAQ) short form.	PA promotion programme PA guidelines at PHC	Long term adherence at 1 and 3 month (by IPAQ)
(Meseguer, Galan, Herruzo, Zorrilla, & Rodriguez-Artalejo, 2009)	CS	18-64	n=12037 (both sexes)	SIVFRENT study.	Obese	Leisure time Physical activity (LTPA) level by NI method	WHO PA guidelines	LTPA and work PA adherence (NI)
(Bergman, Grjibovski, Hagstromer, Bauman, & Sjostrom, 2008)	CS	18-74	n=1470 (both sexes)	HEPA project	Obese	IPAQ short version METminutes/week^{-1} Accelerometers.	Swedish PA recommendations (HEPA study)	Adherence to PA recommendations (by IPAQ)

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease /s	PA measured	PA Prescription	PA adherence assessment
(Rejeski et al., 2007)	RCT	70-89	n= 684 (471, 213)	Home and HC	NCDs	Training load Functional fitness	Training programme	Follow-up PA adherence.-1y.
(Fielding et al., 2007)	RCT	70-89	n= 424 (both sexes)	4 clinical HC	Sedentary adults (functional limitations)	Training load CHAMPS survey	PA intervention Home-based exercises Health education workshops	Exercise sessions attended of total sessions scheduled
(Heesch, Masse, Dunn, Frankowski, & Mullen, 2003)	RCT	44-75	n= 244 (49, 51%)	The Cooper Institute c preventiv medicine.	Obese	Pedometer Physical Recall (PAP)- 7d	1995 CDC/ACSM physical activity guidelines	Attendance Homework completion Self-monitoring intervention Telephone call completion Mail-delivered intervention. Meeting PA guideline
(Wilbur, Michaels Miller, Chandler, & McDevitt, 2003)	RCT	45-65	n=153 (153, 0)	Nurses practitio-ners in HC	CV disease	HR monitor: Aerobic fitness tests:	Home-based walking programme.	Adherence to walking: by percentage of the expected 96 walks
(White, Croce, Loureiro, & Vroman, 1991)	RCT	>18	n=33 (both sexes)	NI	Sedentary adults.	PA survey (NI)	Exercise Programme	Exercise sessions attended of total sessions scheduled

Note. NI: Not identified; CTS: California Teachers Study; CV: cardiovascular; HR: Heart Rate; PHCs: Primary Health Care's; HC: Healthcare; NCDs: Non-communicable chronic diseases; T2DM: Type 2 Diabetes mellitus; d: days; IPAQ: International Physical Activity Questionnaire, PA: Physical activity; 6MW: 6 Minutes Walk Test; P: Perspective report,; CS: Cross Sectional study; RCT: Randomized Controlled Trial; C: Cohort study; CS: Case Study; L: Longitudinal study; RS: Research Support.

Table 13. Descriptive data related to adherence factors in exercise prescriptions according to the five-dimensions WHO adherence model and mentioned theories related to human behavior included in the review. Material supplementation APENDIX 12

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Healthcare System**	**Condition**	**Therapy**	**Patient**	**Country**
(Desveaux, Goldstein, Mathur, & Brooks, 2016)	SCT	6; 8; 9.	1; 2; 4	1;4; 5.		9	Canada
(Martin-Payo, SuarezAlvarez, Amieva Fernandez, Duaso, & Alvarez Gomez, 2016)	SDT	3; 10.		5.		6; 8.	Spain
(Bergh, Lundin Kvalem, Risstad, & Sniehotta, 2016)	SCM/ TTM	3;10.		5.	2; 3.	2; 3; 5; 6; 7; 8; 9.	Norway
(Chrisman, Daniel, Chow, Wu, & Zhao, 2015)	NI	3; 4; 10.		1; 5.		7.	Mexican and EEUU
(Norton, Norton, & Lewis, 2015)	NI	10.		3; 5.	2.		Australia
(Thomson et al., 2015)	SST SDT SCM/ TTM	1; 3; 10.	5.	5.			EEUU
(Alkerwi et al., 2015)	N.I.	2; 4; 8; 10.		1; 5.		7; 9.	Luxem-bourg
(Kinnafick, Thogersen-Ntoumani, & Duda, 2014)	SDT	5.			2.	2; 6.	Great Britain
(Jefferis et al., 2014)	NI	5; 6; 9; 10.		3; 5.	2.	2; 8; 9.	UK
(Venditti et al., 2014)	SCM/ TTM	1; 3; 4; 5; 10.	3.	1; 5.	2.	1; 6; 8; 9.	EEUU
(Austin, Qu, & Shewchuk, 2013)	HBM	1; 3; 4; 9; 10.	1; 2; 5.	1; 3; 5.			EEUU
(Garmendia et al., 2013)	NI	1; 3; 4; 5; 9; 10.		1; 5.	3; 5.	8.	Australia
(Bossen, Buskermolen, Veenhof, de Bakker, & Dekker, 2013)	SCM/ TTM	3; 5; 10.	2.	1; 3; 5.		2; 6; 8.	Nether-lands

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Healthcare System**	**Condition**	**Therapy**	**Patient**	**Country**
(Austin, Qu, & Shewchuk, 2012)	HBM	1; 3; 4; 5; 10.	1, 6.	1; 3; 5.			EEUU
(Martin & Woods, 2012)	S-RT S-ET SCM/ TTM	5; 10.	2; 5.	5.	2.	2; 9.	Ireland
(Courneya et al., 2012)	TPB	3; 4; 5; 9; 10.		3.	2; 3.	2; 6; 7; 9.	Canada
(Evers, Klusmann, Schwarzer, & Heuser, 2012)	HBM	1.			2.	2; 7.	Germany
(Tiedemann et al., 2012)	NI	10.		1; 3.	3.	3.	Australia
(Rodriguez-Romo et al., 2011)	S-EM	3; 4; 10.		1.		9.	Spain
(Netz, Goldsmith, Shimony, Ben-Moshe, & Zeev, 2011)	Religion	1, 3; 10.		1; 3; 5.			Israeli
(Yeom, Jung, & Choi, 2011)	NI	1; 3; 9; 10.		5.			Korean
(Leijon et al., 2010)	SCM/ TTM	5; 10.	1.	3; 5.	2.		Sweden
(Smits, Tart, Presnell, Rosenfield, & Otto, 2010)	SCT SCM/ TTM	10.		3, 5.		2; 7; 8.	EEUU
(Kallings, Leijon, Kowalski, Hellenius, & Stahle, 2009)	SCM/ TTM	3; 4; 10.	1; 3; 5.	5.	3.	5, 6; 9.	Sweden
(Gine-Garriga et al., 2009)	SCM/ TTM	5.		3; 5.		9.	Spain
(Meseguer, Galan, Herruzo, Zorrilla, & Rodriguez-Artalejo, 2009)	N.I.	3; 4; 10.		5.			Spain
(Bergman, Grjibovski, Hagstromer, Bauman, & Sjostrom, 2008)	N.I.	1; 4; 9; 10.		1.		9.	Sweden
(Rejeski et al., 2007)	**SCT**	3, 10.		1; 3; 4; 5.		2; 5; 9.	EEUU

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Healthcare System**	**Condition**	**Therapy**	**Patient**	**Country**
(Fielding et al., 2007)	NI			1; 3.		9.	EEUU
(Heesch, Masse, Dunn, Frankowski, & Mullen, 2003)	SCT SCM/ TTM	10.		3; 4; 5.			EEUU
(Wilbur, Michaels Miller, Chandler, & McDevitt, 2003)	SDT	3; 4; 5; 10.			3.	2; 6.	EEUU
(White, Croce, Loureiro, & Vroman, 1991)	Sonstr oem model				2.		EEUU

Note. NI: Not identified; BMI: Body mass index; OA: osteoarthritis; PA: Physical Activity; MVPA. Moderate-Vigorous Physical Activity, SCM/TTM: Stage of Change Model/Transtheoretical Model; SCT: Social cognitive Theory; SDT: Self-Determination Theory; HBM: health Behavior Model; S-ET: Self-efficacy Theory; TPB: Theory of Planned Behavior, SST: Social Support Theory; S-RT: Self-Regulation Theory; S-EM: Socioecologic model. **Social/economic factors**: 1: Low socioeconomic status; 2: Illiteracy; 3: Low educational level; 4: Unemployment; 5: Insufficient social support; 6: Transportation issues; 7: Excessive medication, 8: Treatment costs; 9: Environmental factors; 10: Demographics factors. **Health care System factors**: 1: Problems with patient–provider relationships; 2: Inadequate local health services, 3: Insufficient PA knowledge and training for health care providers; 4: Lack of incentives and feedback on performance; 5: Inadequate support for patient; 6: Insufficient reimbursement from health insurance. **Condition-related factors:** 1: Symptom burden; 2: Frailty; 3: Activity limitation; 4. Other related- treatments; 5: Comorbidities. **Therapy-related factors:** 1: Polymedicated; 2: Effective Treatment: (complexity); 3. Previous failures with therapy, 4: Frequent changes in treatment, 5: Lack of perceived beneficial effects; 6: Actual side effects. **Patient-related factors:** 1: Insufficient knowledge; 2: Self-efficacy; 3: Cognitive ability; 4: Concern over side effects; 5: Cosmetic concerns; 6: Motivation; 7: Attitude; 8: Psychological issues; 9: Beliefs and perceptions.

5.3.5 Discussion

Some authors have suggested that the term "compliance" should be used for epidemiological studies when there is interaction between patient and health professional; whereas the term "adherence" should be used for non-human interaction studies (210). Nonetheless, in the reviewed literature, the term “adherence” has been used more frequently than the term “compliance”. Adherence rates for exercise programmes and prescriptions have been estimated to range from 50-80% during the first six months and to fall to less than 50% after one year (210-212), similar as adherence to pharmacological and other treatments of chronic diseases (213). Although it must be stated, that the magnitude of adherence depends on the methods of assessment used (and the inclusion or not of dropouts) (211). In fact, we have registered a huge variability of methods used to evaluate PA adherence. Percentage or number of exercise classes attended per total sessions scheduled has been the main registered method. Some studies have used non-validated questionnaires to investigate adherence

to PA intervention for chronic patients (89, 207). Currently, the percent attendance/participation in prescribed PA guidelines is considered the gold standard measure (89); however, there is not a robust consensus for measuring PAP adherence factors by the lack of unified findings and the interaction of these factors (89). According to Martin-Borras et al. 2018, studies have not yet overcome the most relevant barriers to PA adherence (101). In their intervention study, the main barriers were poor health (57.5%), lack of company (43%) and lack of interest (36.7%). Other authors have identified illness, having not enough time, not being suitable, type of PA and lack of motivation (205). Type of exercise, mainly frequency, intensity and duration, have been also identified as a barrier (210). Desveaux et al. propose cost, travel time, and severity of physical symptoms as top three barriers, and lack of guidance regarding appropriate exercises and the lack of availability of a nearby facility to make possible exercise programme participation as secondary ones (214). These authors, interestingly, observed discrepancies between the barriers perceived by patients and by HC providers. In our review, the most cited factors are a low socioeconomic status (n=35), Demographics (n=26), Symptom burden (n=14), Activity limitation (n=14), Beliefs and perceptions (n=13), Self-efficacy (n=10), Effective treatment (n=10), Previous failures with therapy (n=6), Problems with patient-provider relationships (n=5), inadequate local health services (n=4) and Inadequate support for patient (n=4). In our opinion, to overcome these barriers, it is fundamental to categorize them properly and to analyse them not only individually as in most of the studies, but in combination, like in the proposed model from WHO, in order to be able to establish successful protocols and follow-ups over time.

This WHO multidimensional adherence model has been mainly used in medical settings to measure adherence to pharmacological treatments (114, 115, 215). From our point of view, it could be also used for non-pharmacological treatments such as PAP done in HC settings or sport centers, according to the initiative proposed by WHO in therapeutic PA behaviors (90). Our proposal is not completely new. Blackstock et al. proposed to use the WHO model to measure non-adherence to both pharmacological and non-pharmacological treatments in Chronic Obstructive Pulmonary Disease patients (90, 200). Recently, Venegas, et al. used the model to analyze the influencing factors in long-term adherence to physical therapy for women with urinary incontinence (216). These authors have developed a questionnaire to facilitate data acquisition and follow-

up. Additionally, Desveaux et al. have proposed a questionnaire to find out adherence facilitators and barriers to a community-based exercise program from both perspectives, the one of the patient and the one of the HC provider (214). These questionnaires could be used to propose a new one for PAP in HC settings considering all dimensions and their respective factors.

It is often presupposed that patients are the unique responsible for the capacity to adhere to their treatment (217). In fact, patient-related factors are one of the most considered in the reviewed studies. Interestingly, lack of time, one of the most frequently cited reasons for PA non-adherence (85) is not included in any of the 5 WHO adherence model dimensions for patients. In our review, the "lack of time" barrier has been included in the socioeconomic dimension (such as insufficient social support by familiar or job burden), transportation issues (travel time) or in the personal dimension (in the subcategory of belief and perceptions), depending on the context. In our opinion, lack of time should be included as a separated factor, specifically if the model is used for PAP adherence.

Relatively little research has been conducted on the effects of the HC team and the full health-related system regarding PAP; but both have been identified as crucial for the effectiveness of PAP treatment and adherence fulfillment (152, 207). This is also the case in our review, were Health system/HCT-factors are less considered. WHO already mentioned this missing data in 2003; quite an effort should be done. In any case, we think that any change on PAP adherence and patient behavior will depend of the inter-management of the variables considered in the multi-dimensional adherence model. HC systems should consider all variables of this model to help and give support to improve PA adherence in HC settings.

In our opinion, a consensus in the use of the same method to analyze PAP adherence would be necessary to compare data and improvements. PAP is considered a feasible cost-effective resource and should be easily practicable to increase PA and quality of life in routine primary HC patients (218). While it is well known that high PAL improves health, the implementation of methods to analyze and increase PA in the HC system is still being developed. Non-adherence to medical treatment is of significant public health concern, and can result in poorer treatment outcomes, decreased cost-effectiveness of the HC system, and increased morbidity and mortality. Evidence to date suggests that if providers are asked whether or not patients are adhering to treatment,

they tend to overestimate adherence (217). A small increase of PA is necessary to achieve better levels of health and quality of life, and it might reduce the costs of the public HC system. Health providers and health promotion responsibles in the HC system should realize current realities of health and medicine (200). Interventions for removing barriers to adherence must become a central component of efforts to improve population´s health worldwide (81, 90). A good adherence requires a continuous and dynamic process (90). According to the behavior change model of the transtheoretical theory, this one is a process involving progression throughout a series of stages (81). However, there is little evidence regarding the main factors influencing PA behavior change maintenance (206). In order to achieve the main causes to facilitate the exercise interventions and to maintain the physical active behavior stage for a long term-time, especially in chronic patients (81). PAP adherence is a key determinant of the effectiveness of HC treatments, because non-adherence attenuates optimal clinical benefit in some chronic diseases (90). As there is currently no gold standard method for measuring PAP adherence, the WHO multi-dimensional model could be used to assess facilitators and barriers on PAP at HC centers. Understanding the variables that influence adherence to exercise among adults is very important for HC professionals who prescribe exercise or promote PA (78).

5.3.6 Conclusion

In the reviewed articles, social cognitive theories are mostly used to explain behavioral changes in relation to PA adherence. The factors related to PAP adherence within the Health system/HCT-factors together with therapy-related factors have received limited attention in scientific research. Patient-related features and social/economic factors are the most studied. This could be improved if a consensus, such as the WHO five-dimensions adherence model, is established in HC settings for measuring adherence to PAP.

Future researches are needed to check the relationship between PA barriers and effective PAP to increase general adherence and effectiveness of treatments in chronic patients in HC settings. We need to know whether getting and processing information of barriers and facilitators related to PAP in the HC settings leads to increase PAP adherence levels and subsequent better patient health status.

What Does This Article Add?

There is no gold standard method to analyze PA adherence barriers in HC settings and we propose the WHO adherence model as gold standard method.

This review of the existing scientific literature towards exercise prescription according to the WHO five-dimensional adherence model, provides information about how PA adherence is being considered in long term therapies in HC settings.

The management of the facilitators and barriers on PAP adherence and changes towards active human behaviors in HC patients, would reduce physical inactivity behaviors in HC patients, considering active behaviors and exercise programme training as useful and adjuvant resources to many chronic diseases.

5.4 ARTICLE 4: PHYSICAL EXERCISE BARRIERS RELATED TO A MULTIVARIABLE ADHERENCE MODEL IN CHRONIC ADULT KIDNEY PATIENTS

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5.4.1 Abstract

Introduction: Dialysis patients have been considered with a negative clinical status, with structural and functional changes in the musculoskeletal system due partly to sedentary lifestyle. Physical activity (PA) adherence is related to multi-dimensional factors without a probed cause or relationship between them. This study analyzed the association between some of the most influencing exercise adherence factors in chronic kidney patients.

Methods and materials: 67 subjects (32.5% women) completed the two 14 weeks periods of intervention in 3 dialysis centers in Madrid (Spain). Socioeconomic, condition, therapy and personal-related dimensions of WHO multi-dimensional adherence model were analyzed by a binary logistic regression model. Establishing exercise adherence as dependent variable according to the number of training sessions attended per total sessions scheduled (cut point 75%).

Results: Socioeconomic dimension is not significantly associated with the rest of the WHO multi-dimensions in the dialysis context analyzed. Actual side effects and depression levels are negatively associated, but on the other hand, emotional well-being and state-anxiety levels are positively associated to predict significantly in more than 30% the fulfilment of 75% sessions scheduled to dialysis patients analyzed.

Conclusion: Exercise adherence is complex, interconnecting multi-dimensional factors without a clear relationship to each other. Human behavior toward exercise prescription could be partly predicted and better managed in dialysis healthcare settings.

Key words: patient compliance, adherence, chronic disease, kidney diseases, physical activity, exercise therapy, exercise training.

5.4.2 Introduction

Physical inactivity has been identified as the fourth risk factor of all death causes (158). Sedentary behavior produces negative metabolic effects and is considered an independent health risk factor (12, 13). Physical activity levels (PAL) attenuate, but do not eliminate the risk associated with sedentary long-term times (188, 219). Chronic Kidney Patients (CKP) spend long-term sedentary periods during dialysis treatments showing a faster loss of physical conditions in a short-term time (220). Dialysis patients are considered with a negative clinical status, with structural and functional changes in the musculoskeletal system due in part to inactive lifestyle (221). A well-planned exercise programme during dialysis sessions could improve their health and quality of life (221-223).

Recent health promotion strategies consider health care settings as a good resource to promote physical activity on prescription (PAP) (12, 104, 107, 111, 138). However, there is uncertainty about using and awareness by health care professionals and the effectiveness of the health care settings (111). Health professionals assume that patients uniformly will follow their prescriptions (200). Nevertheless, unwillingness and inability in CKP to follow the pharmacological and non-pharmacological guidelines could decrease the compliance and effectiveness of the treatment (224). Adherence in healthcare treatments, is defined by the World Health Organization (WHO), as "The extent to which a person's behavior-taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health-care provider" (90). And it should be considered as important to apply a successful treatment as to know if the patient is able to follow-up it (78-80). Estimated data suggests that around 40% of patients do not adhere to pharmacological treatments, with the prevalence rate rising up to 70% on lifestyle treatments (81). Studies of exercise training programmes report dropout rates of 20-50% in the first 3-6 months (82). Recently, a meta-analysis by Rao et al. (225) showed that the dropout rate of patients on exercise and pharmacological treatments were rather similar, with a 17.9% and 12% mean dropout rate, respectively (116). And another meta-analysis by Rowley et al. showed that training periods longer than 20 weeks improve adherence to PAP training programmes (226). Otherwise, non-adherence to PAP is a common and serious problem such as it is with other kind of healthcare treatments (227). Following the multi-

dimensional adherence model, exercise adherence, is related to social/economic, healthcare system, therapy, condition and personal-related adherence factors (200).

There is no consensus about what determines human behavior and much less is known about active behavior change in patients, being well known the complexity of health-related human behavior changes (80). Although some studies identified differences on individual characteristics (78, 89, 210), other ones have shown that the extent and nature of the adherence problems are similar across diseases, regimens, and age groups (210, 228). Many studies analyze PA adherence not considering all specific subcategories of the WHO's adherence model (78, 88, 90). The last Systematic review published in 2019 about exercise referral schemes had been only related to psychosocial adherence factors (144). However, in other cases, patient adherence to PAP is considered as a multi-dimensional adherence system such as proposed by WHO in 2003 (115). In any case, studies had not yet overcome the most relevant PA barriers to PA adherence (101). A strict follow-up to improve adherence to non-pharmacological treatments, such as in exercise prescriptions, should be done (229).

Many theories are trying to describe the main factors related to human behavior (80, 230) and possible barriers to increase PA adherence levels (90). A systematic review of Murray et al, in 2018 has demonstrated that there were distinct mediators of PA behavior change during initiation and maintenance phase according to the stages behavior change of the transtheoretical model (206, 231). Until now, no institution recognizes to find a well established, efficient, and sustainable way to promote PA changing from sedentary or inactive behavior to active lifestyle in a long-term time (232) and consequently, little is known about what causes the behavior to be maintained (206). To develop behavior changes according to transtheoretical model interventions and adjusting WHO´s PA adherence dimensions, managing the interaction between factors need to be demonstrated (233). In this study, the aim was to analyze the association of four multi-dimensional factors related to exercise training adherence in CKP, considering adherence according to the number of training sessions attended in the total sessions of a specific exercise training programme scheduled.

5.4.3 Materials and Methods

In this secondary study analysis a total of 67 patients (23.9% women), aged 55-86 years from 3 dialysis centers of the *"Íñigo Álvarez de Toledo"* Kidney Foundation (FRIAT) in the Region of Madrid (Spain) participated in the study. Exclusion criteria: unstable angina, brain-vascular disease or a high risk for recurrence, cardiac ejection fraction <45%, myocardial infarction 6 weeks before to the start of the exercise training programme, uncontrolled hypertension, peripheral vascular disease, musculoskeletal or respiratory alterations, osteoporosis, active liver disease, blood hemoglobin concentration <10 g/dL, or problematic vascular access (immature arterial venous fistulas, high risk for extravasations). All participants had the procedures explained and accepted by signing the written informed consent. The study was performed according to the principles established in the Declaration of Helsinki and approved by the Ethical Committee of the University Hospital Foundation of Alcorcon (Madrid, Spain). The interventional study design was developed in 2 periods of 14 weeks. The first one with a non-exercise intervention period (T1-T2) and the next one with a concurrent exercise programme (defined as simultaneously incorporating both resistance and endurance exercise within a periodized training regime) (T2-T3). We took data at three points (T1,T2 and T3). In the general study data were registered at T1,T2.T3. For this study only data from T2 and T3 were considered.

Exercise training program:

Sessions were supervised by an experimented and qualified exercise trainer. Each session was performed individually with a first warm up, with exercises of joint mobility (neck, shoulders, elbows, hips, knees and ankles) and different kinds of breathing exercises targeting cardiovascular and musculoskeletal fitness adaptations in the main part of the session.

The 14 weeks of exercise training intervention was planned as three month-cycles of 5, 4 and 5 week-cycles, respectively. Training load was progressively adapted to patients.

In the first month-cycle (5 weeks), three week-cycles of resistance exercises were firstly developed with 1 set from 8-10 to 10-12 repetitions (rep), in a correct progressive way of intensity to each exercise and patient. The next week, an increased to 2 series for each exercise was made. Endurance exercise was performed in this time period after one

and half week, by 15-20 minutes of continuous leg-cycloergometer exercise according to fitness patient capacities.

In the following month-cycles (for 4 and 5 weeks each one) an exercise training programme was developed, combining alternatively in three sessions/week, two strength training sessions of 1-2 set of 10-12 rep. (for 4 weeks), 2-3 sets of 8-12 rep. (for next 2 weeks) and 2-3 set of 10-12 rep. (during the last 3 weeks), combined with one session of 15-20min. (for 4 weeks), 25-30 min. (in the next 2 weeks) and 30 min. (during the last 3 weeks) by a continuous leg-cycloergometer exercise training. Starting from two strength sessions and one endurance session/week to one strength session and two endurance sessions next week, following this way in the progression remarked above until the end of the exercise training programme.

Endurance sessions were done by a dual leg-cycloergometer (magic®, Spain) and resistance ones by the following structure of exercises: 1. Combined flexion-extension hip and knee: (1.Position: hip flexion, 2.Position: knee extension, 3.Position: knee flexion, 4.Position: hip extension) with an elastic band (Therabands™). 2. Flexion-plantar and ankle extension with a range resistance from 0.5 to 2.0 kg weighted ankle (ADWT-12227 adidas®, India) and 3. Hip abdution-addution exercise developed with the red 12 inch size professional elastic band (Therabands™, EEUU) and a foam ball (REF:8501323 Domyos, Spain), used to each movement respectively.

Intensity of all exercises was measured through the Borg Rating of Perceived Exertion Scale (Borg 6-20 RPE scale) (234),by perceived values between 12 - 14.

Finally, all sessions were always concluded with stretching exercise in the main muscle groups.

No motivation strategies and adverse events occurred during the 14 weeks of the exercise training programme.

The exercise programme designed complies with CERT rules (65).

Exercise adherence:

Adherence to the clinical exercise training programme was analyzed considering the attendance to scheduled exercise training programme. It was calculated by dividing the number of training sessions attended by the number of training sessions scheduled (sessions attended/sessions scheduled). The exercise programme consisted of a maximum of 40 sessions. A total of 40 sessions were developed for each participant.

Reasons for non-attendance were classified according to the WHO multidimensional adherence model and are shown in table 14.

Table 14. Total number of non-attendance to exercise sessions according to WHO multidimensional PA adherence model.

Dimension	Category	Non-attendance sessions
Social/economic-related	Low socioeconomic status	0
	Illiteracy	0
	Low educational level	0
	Unemployment	0
	Iinsufficient social support	1
	Transportation issues	0
	Treatment costs	0
	Environmental factors (holidays)	40
	Demographics factors	0
Health care system-related	Problems with patient–provider relationships	2
	Inadequate local health services (no exercise class)	6
	Insufficient PA knowledge and training for health care providers	0
	Lack of incentives and feedback on performance	0
	Inadequate support for patient (no fitness instructor)	8
	Insufficient reimbursement from health insurance	0
Condition-related	Symptom burden (different symptoms)	82
	Frailty	0
	Activity limitation (post surgery treatment-related)	14
	Co-morbidities (mandatory medical prescription)	187
Therapy-related	Polymedicated	0
	Effective Treatment: (inadequate exercise program)	34*
	Previous failures with therapy	0
	Frequent changes in treatment	0
	Lack of perceived beneficial effects	0
	Actual side effects (patient self perception)	53
Patient-related	Insufficient knowledge	0
	Self-efficacy (related to fitness and motor skills)	0
	Cognitive ability	0
	Concern over side effects	0
	Cosmetic concerns	0
	Motivation	1
	Psychological issues	0
	Psychological issues (state mental issues)	32
	Beliefs and perceptions (no well being feelings)	203
Total sessions not attended		663
Ratio (sessions no attended/sessions scheduled)		0.29

* results of one patient

This model is divided into four dimensions (90) (Figure 5).

Socioeconomic dimension was determined by three categories: a) Socioeconomic status, measured by the range salary per month (<600€/month; 600-900€/month; >900€/€/month); b) Educational level, by a dichotomy cutoff point (more or less/equal secondary level study); and c) demographic factors based on age. All of them were measured by the general questions of EXERNET questionnaire (235). Condition-related dimension was assessed by three categories: a) Symptom burden, b) activity limitation, based on their respective dimensions of Kidney Disease and Quality of Life™ (KDQOL™-36) (236) (Table 9). The final results to analyze were obtained from the KDQOL™-36 Scoring Program (v 1.0). c) Co-morbidity category was represented by the total points achieved for each patient in the Beck Depression Inventory survey (90), establishing this disease as one of the most related to this kind of patients and their symptoms associated (222). We decided to analyze co-morbidity category by depression status because it is one of the most prevalent diseases associated to others comorbidities related to functional life (222) and WHO's systems model for adherence in a long-term time proposed to integrate depression as a condition-related factor (90). Therapy-related dimension of exercise adherence was assessed by another three categories (one of them repeat twice by different methods): a) Polypharmacy, based on cheeked by question 11 of Oviedo sleep quality questionnaire (SQQ) (237, 238), establishing to this study a personal cutoff point when the patient intake at least 4days/week any sleep inducers in the last month and b) actual side effects, based on KDQOL™-36, b.1) effects of kidney disease and b.2) symptoms/ problems dimensions.

Finally, Patient-related dimension according to a) Self-efficacy was determined by a Z-score mean process of these fitness skills ((6-min walk test (6MWT) (239), 10-repetition sit to stand (STS-10rep) (240, 241), 30 and 60 seconds sit to stand (STS-30sec) (239) (STS-60sec) (240, 241), and right and left handgrip strength tests) (242). b) State-Trait Anxiety Inventory survey (243) was used to assess psychological issues category. We considered about the total of 20 items, (90), according to this equation: A/E= 30 + (3,4,6,7,9,12,13,14,17,18 questions) - (1,2,5,8,10,11,15,16,19,20 questions), where if more than three questions were not answered, the total result was not considered for the patient. Following WHO's systems model for adherence this category was integrated in the patient-related dimension (90).

c) Beliefs and perceptions, was assessed by KDQOL™-36 emotional well-being dimension (Table 15).

Table 15. Descriptive analysis of the sample according to exercise training adherence.

Dimension	Category	Sub-category	Survey used	≤ 75% adherence		> 75% adherence	
				n	Percentage or Mean±SD (Min.-Max.)	n	Mean±SD (Min.-Max.)
Social/ economic	Low socioeconomic status	< 600€/month	EXERNET survey	2	8.70%	3	9.10%
		600-900€/month		7	30.40%	8	24.20%
		> 900€/€/month		14	60.90%	21	63.60%
	Educational level	< secondary educational level	EXERNET survey	12	52.20%	20	60.60%
		≥ secondary educational level		11	47.80%	13	39.40%
	Demographics factors	Male Sex	EXERNET survey	20	87.00%	24	72.70%
		Female Sex		3	13.00%	9	27.30%
		Age	EXERNET survey	23	72.34 ± 8.91 (56.00- 86.00)	33	70.96 ± 9.46 (56.00- 86.00)
Condition-related	Symptom burden	Symptom burden	KDQOL™-36	23	64.40 ± 26.67 (12.50- 100.00)	33	41.72 ± 23.04 (00.00- 87.50)
	Activity limitation	Physical functioning	KDQOL™-36	23	34.78 ± 41.10 (00.00- 100.00)	33	46.96 ± 43.19 (00.00- 100.00)
	Co-morbidity	Depression illness	Beck Depression Inventory survey	21	16.14 ± 11.15 (02.00- 36.00)	32	12.21 ± 09.52 (00.00- 45.00)
Therapy-related	Polymedicated	<4 days sleep helps intake /week	Oviedo sleep quality questionnaire	12	52.20%	25	75.80%
		≥4 days sleep helps intake /week		11	47.80%	8	24.20%
	Actual side effects	Symptoms/problems	KDQOL™-36	22	84.46 ± 11.90 (60.42- 100.00)	33	78.66 ± 17.36 (41.67- 100.00)
		Effects of kidney disease	KDQOL™-36	22	69.46 ± 22.57 (15.63- 100.00)	32	66.11 ± 21.03 (31.25- 100.00)
Patient-related	Self-efficacy	Fitness skills (Zscore)	Physical fitness tests	21	- 0.55 ± 0.51 (- 01.75- +01.24)	30	- 0.16 ± 0.78 (- 01.51- +01.63)
	Psychological issues	Anxiety levels	State-Trait Anxiety Inventory survey	23	17.13 ± 11.15 (05.00- 55.00)	33	17.27 ± 9.99 (01.00- 43.00)
	Beliefs and perceptions	Emotional well-being	KDQOL™-36	23	62.17 ± 26.96 (00.00- 100.00)	33	71.51 ± 19.38 (40.00- 100.00)

*SD = standard deviation.

Statistic analysis:

Binary Logistic Regression (LR) was employed. Assuming normal distribution by the Central Limit Theorem (n>50), homoscedasticity by Levene's test (sig or sig 2 tailed > 0.5) and multicolineality, assessed by Spearman correlation (cutoff point (rho > 0.60) of the data checked before of the RL statistical treatment. Nagelkerke R Square, was used as predictive value of the model.

Dependent variable was considered by the percentage of exercise sessions attendance ≤75% (n=23) or >75% (n=33) of the total classes scheduled.

All statistical analyses were performed using the Statistical Package for Social Science software (SPSS, version 21.0; SPSS, Chicago, IL, USA). Values of $p<0.05$ were considered statistically significant (OR; 95%CI).

5.4.4 Results

Of all four dimensions analyzed, all except the socioeconomic one, presented significant associations in the final model or this one shows significant association when is associated with the rest. Descriptive values of the sample are shown in Table 9. Within condition-related dimension, represented as co-morbidity and assessed by Beck depression inventory survey showed a significant negative association (B= -0.126) to attend exercise training program in our model (OR: 0.882: 95%CI [0.788, 0.987]) (Table 3), showing for each point of increasing in this variable, the CKP could achieve 12% not complete more than 75% of exercise adherence programme. In our study. Therapy dimension assessed by actual side effects through KDQOL™-36 symptoms/problems was definitely introduced in the LR model (OR: 0.925: 95%CI [0.871, 0.983]), with another significant negative association to exercise adherence (B= -0.078), showing that for each point of increase in this variable, the patient has a 7.5% probability to not complete more than 75% of the exercise training programme scheduled (208). With patient-related dimension, only two of three aspect analyzed were associated significantly. Psychological issues assessed by State-Trait Anxiety Inventory survey (OR: 1.122: 95%CI [1.007, 1.250]) offering a significant positive association (B= 0.115), showing to each increase of one unit of this variable an increase of 12.2% of adherence in the exercise programme. The last one of this dimension, beliefs and perceptions factor, registered by KDQOL™-36 emotional well being dimension showed significant association (OR: 1.046: 95%CI [1.001, 1.094]) with a

positive relationship to exercise training sessions attended (B= 0.048), showing to each unit value of increase in this variable an 4.6% the probability to complete more than 75% of training sessions in the exercise programme. All the variables above mentioned were integrated in the LR (Table 16).

Table 16. Statistical descriptions of independent variables introduced in the binary regression logistic model.

				95% C.I.	
	B	**O.R**	**p**	**Lower**	**Upper**
Therapy-related: Actual side effects Symptoms/problems	- 0.078	0.925	0.012	0.871	0.983
Patient-related: Beliefs and perceptions	0.045	1.046	0.048	1.001	1.094
Condition-related: Co-morbidities	- 0.126	0.882	0.028	0.788	0.987
Patient-related: Psychological issues	0.115	1.122	0.036	1.007	1.250

O.R: Odds Ratios for logistic regression. Results are statistically significant ($p < 0.05$).

Nevertheless, self-efficacy variable based on the average of Z-score fitness status was not significantly associated with the rest of variables in the LR model.

The final LR model predicts a 33.20% (ρ= 0.33) with the four independent variables integrated, according to the following equation to exercise attended classes in the sample analyzed:

Exercise adherence ($\leq/>$ 75% sessions attended/sessions scheduled) = 3.501 - 0.126 x condition-related (co-morbidity) - 0.078 x therapy-related (actual side effects) + 0.115 x patient-related (Psychological issues) + 0.045 x patient-related (beliefs and perceptions).

5.4.5 Discussion

Exercise adherence depends on many interrelated multi-dimensional factors (115), and the relationship among them is not clear (101). In our study, we have analyzed four of the five dimensions included in the WHO multidimensional adherence model and observed the complexity of exercise adherence in dialysis patients. Changes from sedentary into active behavior in human being seem not to be easy, being recently more and higher the interest of PA promotion by health institutions (107, 138, 230).

When analysed individually, social/economic factors are significantly associated to exercise adherence level. Interestingly, when they are analysed together with the rest of dimensions in our model, this significance disappears. In many studies, mainly social/economic factors are considered (108, 207, 244). This lack of an integral multidimensional analysis could be leading to wrong conclusions. Condition-related dimension, offered a negative significant association in co-morbidity, measured by Beck depression. It shows that higher level of depression in CKP would offer a significant negative association to the attendance of more than 75% of the exercise training program. Data are in agreement with other studies (245, 246). We could have used other survey such as Charlson Comorbidity Index to measure co-morbidity, but it does not predict functional limitations or quality of life (247). Besides, CKD is a significant risk factor for cognitive impairment (248) and WHO proposed to integrate depression as a condition-related factor (90).

Therapy-related dimension based on actual side effects (by symtoms/problems dimension of KDQOL™-36) was significantly associated with the rest of independent variables of our model, showing that CKP with higher levels in this variable (better KDQOL status), reduce the exercise training adherence levels. There are not references in this sense in the scientific literature, but perhaps, when dialysis patients feel better they refuse the non-pharmacological exercise treatment. In contrast, other studies had shown, that best general levels of quality of life are related to higher adherence levels in dialysis treatments (249-251).

Patient-related dimension, measured by psychological issues based on state-anxiety levels, above described, had a positive association in our model to predict exercise adherence. Better levels of state anxiety offer an increased of likelihood to attend more than 75% of an exercise training scheduled, helping to reduce the anxiety levels when the exercise training programme is followed and correctly executed (245).

Perceptions in patient-related dimension, assessed by KDQOL™-36 emotional well-being, showed significant associated values to exercise adherence in our model. Exercise in routine dialysis provides the key to enhance the emotional well-being status of older patients (252) being associated to exercise adherence levels in dialysis patients (253, 254).

A high fitness level provides benefits in health status and is being nowadays widely accepted (9, 10). An optimal exercise stimulus during dialysis treatments could return

the negative musculoskeletal conditions of CKP (255). The negative clinical status of CKP should be improved, using exercise prescriptions in all dialysis centers (256). This short-long time exercise training programme of 14 weeks, was able to improve physical fitness levels and their related functional skills (257). In this study it was tried to measure whether self-efficacy, based on a Z-score index fitness, before to start exercise training programme (T2) could be associated to enhance exercise training adherence. However, no significant association was appreciated independently of the variables chosen in the LR model.

The high anxiety status of CKP is well known (222). State-Trait Anxiety Inventory survey was used to measure psychological issues category. A significant association in our LR model was observed which could indicate that high levels of state anxiety are a barrier to attend exercise training programmes in dialysis patients. The improvements in anxiety and depression levels by exercise prescriptions could be considered an effective non-invasive treatment, which should be as effective as other treatments or at least contribute to CKP (258). Adherence to exercise training prescriptions during the dialysis treatment would improve health and quality of life in CKP (245, 246, 255).

Adherence factors have been perceived as an issue of the patient, and not of the healthcare providers or the Healthcare System. There is evidence that Healthcare System factors have an important impact on adherence of their patients (115).

In this study, we have not been able to assess the Healthcare System dimension as a dimension related to PA adherence. We considered that the patients went everyday to the centers to receive their dialysis treatments and that they would do the programmed exercise sessions. According to Rowley et al., exercise training programmes over 20 weeks should improve adherence rates (226), but this has not been the case in some CKP included in our study. For that reason, this dimension should be considered in future studies, which assesses exercise prescription adherence, independently of healthcare setting and context.

Much more efforts would be necessary to find the relationship between facilitators and barriers to PA adherence in CKP to increase the compliance to offer an efficient and individualized exercise prescription in dialysis centers.

5.4.6 Conclusions

PA adherence is a multi-dimensional phenomenon in which factors like patients, healthcare system, therapy, conditions related to disease in a socio-economic context have to be considered.

When analysed individually, socio/economic factors are significantly associated to exercise adherence level. Interestingly, when they are analysed together with the rest of dimensions in our model, this significance disappears. Only considering socio/economic factors in an isolated way and not an integral multidimensional analysis could be leading to wrong conclusions.

The 75% of exercise training programme adherence of KCP was 33.20% predicted with our model when considering the dimensions together. In fact, the increase in one unit of the Therapy-related dimension (measured by symptoms/problems, KDQOL™-36 test) increases 7.8% of non-adherence. The increase in one unit of the Condition-related dimension (measured by BECK depression test) increases the probability of non-adherence in 11.8%. The increase in one unit of the Patient-related dimension (measured by Emotional well-being, KDQOL™-36 test) increases 4.6% of adherence. Finally, an increase in one unit of the Patient-related dimension (measured by Self-perceived State-Anxiety, STAI test) increases the probability of adherence in 12.2%. This is to our knowledge the first time to provide detailed data about how to measure exercise adherence by a binary LR model according to the 5 dimensions adherence model.

Hemodialysis patients seem be more influenced by emotional and cognitive factors to develop a good exercise training adherence while receiving their treatments.

More studies should be done to analyze the influence of WHO multi-dimensional adherence factors to chronic therapies in healthcare settings.

Limitations: This study has been performed in a small group of chronic kidney patients. As a future research line could be interesting to know the facilitators and barriers of other chronic patients in all ages and considering the health care team and system dimension.

Strengths: This study has analyzed 4 of 5 dimensions related to PA adherence in long-term therapies. An instrument to measure satisfaction of CKP with healthcare

professionals (259) should be used to assess the health care team-system care dimension.

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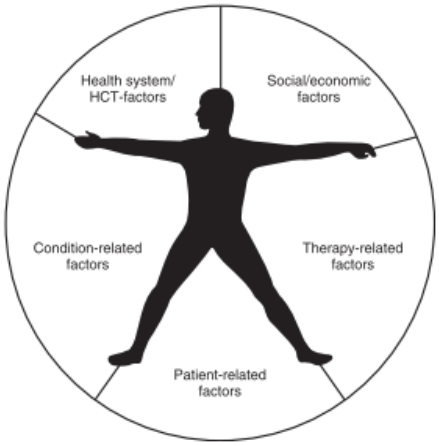

HCT: health care team.

Figure 5. The five dimensions affecting adherence in the general population, as outlined by the World Health Organization. Translated with permission of the publisher from WHO. Adherence to long-term therapies: Evidence for action. Chapter V. pag 27.ISBN 92 4 154599 2 (NLM classification: W 85) (2003). Available from: apps.who.int/iris/bitstream/10665/42682/1/9241545992.pdf.

5.5 ARTICLE 5: FOCUS GROUP SESSIONS OF PHYSICAL ACTIVITY ON PRESCRIPTION WITH GENERAL PRACTITIONERS AND NURSES OF MADRID PRIMARY HEALTHCARES.

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This article has not been submitted yet.

5.5.1 Abstract

Introduction: European health strategies are trying to introduce physical activity (PA) in healthcare settings. The whole health benefits of PA are well known; however, only one-third of Primary healthcare (PHC) professionals use it with their patients. The aim of this study was to analyse in depth the self-perceived barriers and facilitators opinion of nurses and general practitioners (GPs) towards a future implementation of PAP in their PHC settings.

Methods and materials: Two focus group sessions were performed separately with five GPs and nurses working of PHC in the region of Madrid. An expert psychologist guided each semi-structured session. The interviews were verbatim transcribed and consensually analyzed by two reviewers using qualitative content analysis.

Results: Self-perception PA pattern of PHC staff could facilitate the use of PAP with PHC patients, PAP acknowledge could be related to the of no use at PHC consultations, however both are interested in exercise prescription training courses. In addition, both PHC professional have predisposition to leadership and collaborate in PAP. Some of the PAP barriers showed in all focus group sessions were the tool to measure PA levels as a health vital sign, the lack of external policies relationships, time in consultation, spaces, material and economic resources at PHC settings.

Conclusion: This study provides further insight into analysis of self-perceived facilitator and barriers by PHC professionals. Results will be used to design a questionnaire as a first-step procedure.

Key words: Exercise Therapy, Focus Groups, Health Promotion, Public Health, Physicians.

5.5.2 Introduction

In 1986, the WHO Ottawa Charter proposed reorienting health promotion initiatives to enhance physical, mental and social health (260). Unfortunately, physical inactivity and sedentary behavior have been steadily increasing (16). Data registered from 2001 to 2016 and based on 1.9 million participants of 168 countries, established a 27.5% of global age-standardized prevalence of physical inactivity (3). Physical inactivity behaviors are highly related to many NCDs (9). In spite of the well-known health benefits of physical exercise prescriptions (10), even as an excellent cost-effective resource to be used in healthcare settings (100, 261). However, more than 30 years after this first meeting, physical activity on prescription (PAP) is not well implemented in the world (100, 104).

Policy actions to get people more active in multiple settings have been launched by WHO, as the recently PA strategy for the European Regions 2016–2025, which, includes in the priority area 3: "Promoting PA for all adults as part of daily life, including during transport, leisure time, at the workplace and through the health-care system" (138). Healthcare settings seem to be a potential well-considered resource to increase PAL in patients (100, 104). In general, it is estimated that up to 80% of adults visit their general practitioner (GP) at least once a year and patients trust healthcare professionals (104). In Spain, PHC centers are spread throughout the Regions, attending an average of 4.84 patient visit/year in Madrid and 5.20 patient visit/year as average of the rest of Regions according to the last statistic data of the Spanish Healthcare System. Besides, there is enough evidence to confirm that PAP is an effective resource to use in Healthcare settings (100, 111, 262) even better than pharmacological treatments for some NCDs (116, 225).

Many countries are implementing strategies to introduce PAP at PHC such as the Canadian Healthcare System (199) and the USA healthcare centers (263), both of them, following the Exercise is Medicine® initiative launched by the American College of Sports Medicine (4, 8). EIM has presence in 39 countries and Exercise is Medicine® Regional Centers are established in North and South America, Southeast Asia, China, Australasia, Africa and Europe (4). In 2015, the European Initiative for Exercise is Medicine® was founded with the aim of helping to promote widespread implementation of PAP in healthcare settings (4). One year later, this initiative was launched in Spain, where a well-functioning, universal and free healthcare system managed by the regional

governments exists. For the efficient and sustainable implementation of PAP, apart from policy markers, the collaboration of GPs and nurses is essential. Thus, the aim of this study, was to ask GPs and nurses working about feasibility of PAP and their self-perceived barriers and facilitators in Madrid PHC centers.

5.5.3 Materials and Methods

Five GPs and five nurses working at Madrid PHC System, were randomly selected and invited to participate in two focus group sessions. The selection included males and females of different ages, with accredited PHC experience, representing both urban and rural areas at the Region of Madrid. According to Morgan, this heterogeneity of the group, generates a richer conversation and viewpoints from the lively collective interaction, facilitating more spontaneous expressive emotional opinions than an individual interview (111). No economic incentive was given for participation. Each group attended separately two sessions of 2 hours duration, one week apart. An expert psychologist guided all semi-structured sessions, regarding to the main PAP facilitators and barriers found in the scientific literature (19, 104, 111, 196, 264) (Table 17). The protocol was approved by the Central Commission for research of the Region of Madrid and the Ethical committee of the Alcorcon Hospital, Madrid (Spain).

Table 17. Guided topics in the unstructured interview of focus group sessions with nurses and physicians.

Focus group sessions	Semi-structured guide topics
1st Session	Project presentation Participant presentation and sign of informed consent Self perception physical activity pattern and relationship with health and exercise promotion Self perception and possibilities to implement exercise promotion and prescription in their professional group and health care centers Knowledge to promote physical activity and prescribe exercise Chronic illness and exercise prescription Exercise training courses: Types, methodologies, preferences, necessities. Professional, academic and economic incentives in the health care system
2nd Session	Review of the last session Main issues of the health care center and system. Main issues related to space, material, management, time, personal resources, assessment, etc..

	Facilitators and barriers to promote physical activity and prescribe exercise in Madrid primary health care centers. Interrelationship with other professionals: Sport Sciences and Sport Medicine professionals Specific areas of physical activity- exercise intervention inside of the health care centers Relationship with other resources: Town hall, public sport centers, etc.. Free comments

At the beginning of the first session, a brief explanation of the study was done and written informed consent was obtained from the participants.

The experienced moderator guided the focus group discussion, making sure that all topics were covered, and that all group members had the chance to speak. At the end of the second session, participants were invited to add any comment or question that they thought had not been covered and should be discussed. Both sessions were recorded by a H2next handy recorder, Zoom Corporation, ITOHPIA Iwamotocho 2chome Bldg. 2F, 2-11-2, Iwamoto-cho, Chiyoda-ku, Tokyo 101-0032, Japan, and verbatim transcribed by the assistant guide. The transcriptions were peer-reviewed using a qualitative content analysis method. All information obtained during the focus group sessions was coded to guarantee confidentiality. The meaning units were identified as a first stage and were then condensed and coded as had been expressed by the participants according to the proposal of the Swedish PPAF study (265) (111). On the basis of the codes, categories were used as an intermediate stage to develop final subcategories. Finally, it was consensually compared between the two reviewers and the discrepancies decided by five experts in Delphi rounds sessions.

5.5.4 Results

Answers and comments, organized by categories and subcategories, are shown in table 18. Both groups shared similar points of view in the focus group sessions.

Table 18. Categories and subcategories related to the offered comments of nurses and physicians in focus group sessions.

Category	Subcategory	Nurses/physician assistants*	GPs*
Self-perception	Self-perception	Approximately 50% are considered physically active.	60% are considered physically active.
PA pattern of PHC staff	PA behavior of PHC professionals	The sedentary nurses think are as healthy as if they are active.	The sedentary physicians think are as healthy as if they are active
PAP background	Promotion use and knowledge	Awareness and self-perception to promote PA	Awareness and self-perception to supervise the PA promotion
	Prescription use and knowledge	Self-perception in the lack of Knowledge for exercise prescription.	Self-perception in the lack of Knowledge for exercise prescription.
PHC staff position to PAP	Leadership to PA promotion	They should assume the leading in promotion.	They think the promotion should be done outside of the healthcare centers. The patient is ill when she/he visits us.
	Leadership to exercise prescription	It is not clear the leading in prescription.	They demand help by other specialists to individualized and effective PA treatments.
	Collaborative PA promotion	They assume the main role.	They need help by staff inside and outside of PHC settings.
	Collaborative exercise prescription	They demand help by specialists in patients with co-morbidities or specific pathologies.	They demand help by specialists physicians, mainly in some specific patients.
PAP training courses	PAP training courses	Need of facilities offered by the manager staff and the system.	Mandatory and priority to the training courses by different methods (online, face to face, etc.…
		Kind of training courses: Motivational interview, Asses PA and fitness patterns, time management.	Kind of training courses: Motivational interview, time management.
PAP as preventive and rehabilitation resource	PAP awareness by PHC Staff	Lack of academic training in some PHC professionals.	To transfer some similar strategies used with smoking, obesity, treatments in PHC settings
	PAP Awareness by patients	Lack of awareness and education on PA benefits in some kind of patients	Lack of information in some kind of patients and awareness for any kind of health professionals.
PAP barriers	PAP anamnesis vital sign tool	Need to change the tool to asses PA/ sedentary behavior and fitness as a vital sign to patient.	Inefficacy tool and no relationship with informatics staff to assess PA patterns and fitness."
	Improving consultation time management	Lack of time in consultation.	Lack of time. Elevated ratio patients attended by physicians daily.
	External policies relationships in PAP	Lack of knowledge about external PA resources.	Lack of knowledge about external PA resources.
		Lack of individualized treatments and following to change bad lifestyles behaviors in patients.	Doubts about how PA promotion and prescription is considered by the rest of physicians.
	Lack of space resources	Space should be reorganized	Space should be reorganized and clarify the tasks
	Lack of Material-economic	Lack of material to assess PA patterns and fitness .	Lack of material to assess PA patterns and fitness.

	resources	Professional, academic and economic incentives are not always according to professional category	
PAP solutions	Modify PAP vital sign tool	Improve relationship with informatics staff with a face to face week to know exactly the problems with it"	The app should be improved and optimized for the health professionals
	News space resources	Space resources management in each healthcare center. Use of external spaces or manage the actual ones.	Space resources management in each healthcare center. Use of external spaces or manage the actual ones.
	To create PAP networking	To maintain Spanish PHC philosophy: no specify professional task and multitraining among nurses." Use of network team and public resources outside the healthcare center: Sport medicine physicians and inside with psychologists and physiotherapists. Helps by specialists in patients with co-morbidities or specific pathologies. Send patient to Public sport Centers by economic offers by healthcare prescription."	To maintain Spanish PHC philosophy: no specified professional task and multitraining among physicians. Network team and public system relationship: Community and Town hall. Use of nursing as a physician assistant to PA promotion and prescription. Helps by specialists in patients with co-morbidities or specific pathologies.
	To offer PAP Training courses	Modified the actual training course rules, offering more facilities to the professionals. Training courses in coaching, leading and time management.	Training courses to everybody and different modalities.
	PA advisement policies	Use of mass media to the awareness of PA benefits and PAP at healthcare settings	Use of population awareness to implant PA promotion in healthcare centers.
	Progressive PAP implementation in PHC	Need of a Pilot study to establish PAP in PHC settings	Use of common protocol to PA promotion and prescription. Improve relationships inside and outside of the healthcare centers.
	To enhance material and economic resources for PAP	Increase economic resources to buy materials and RRHH. Weight machine, handgrip and differents materials to measure fitness level of patients.	Increase economic resources to buy materials and RRHH. Improve material and economic conditions to the adhered professionals to PAP.
	PAP leadership units at PHC	Increase RRHH to improve quality of treatments. To work with health professional inside of the System as physiotherapist and specialist physicians ." Mandatory relationship nurse-family physician.	Mandatory and priority to the training courses by different methods (online, face to face, etc…. They demand help by other specialists to individualized and effective PA treatments.
	Use of first consultation (nursering)	Use of first consultation by nursing.	Nurse consultation the first resource to the promotion and prescription of PA in the actual system.
	Use of external PHC resources	Mandatory relationship nurse - exercise professional of public sport centers.	Improving relationship with public institutions.

	Improving relationship between Town Hall and healthcare services.	Use of external resources: sports centers, town hall, and Sport medicine schools.
To increase PAP consultation time	To decrease the ratio patients attended by nurses daily or increase nurse staff	To decrease the ratio patients attended by physicians daily

* Translated from Spanish to English. PA: Physical activity. RRHH: human resources

Self-perception PA pattern of PHC staff:

More than 40% of the participants indicated to be physically active. Active subjects recognized the whole health benefits related to a better fitness status. The physically inactive ones, said to be as healthy as the physically active ones, according to the last blood tests done.

One nurse commented: "I believe that sports habits are very related to the vital stage of your life. It is not the same when you are a young person without familiar responsibilities than if you are a person who has just been mother or have familiar support to give ".

Another nurse said: "At some moments in your life you do not have time enough to do many things, but for instance in the Sports center that I go, you have the baby-sitter service to care your child while you are doing your exercise class"

Cultural and educational aspects were adduced by many focus group assistants in both PHC groups to justify the insufficient PA levels (PAL). For instance one assistant said "Men are more PA conscious and more physically active than women".

PAP background:

The awareness of both PHC professionals about the importance to promote PA was evident, although GPs would prefer nurses to do it. However, they indicated not to have enough knowledge to prescribe exercise, managing correctly the training loads in the long-term and with specific patients. Only one PHC professional recognized to be prepared to do it, because he had been riding on a bike since childhood at elite levels.

There was a common agreement related to the difficulties in behavior changes in spite of the social awareness of physical exercise benefits.

"The key is to adapt the guidelines regarding to the preferences of patients"

PHC staff position to PAP

The leadership in PA promotion by nurses is assumed; however, some GP said "PA preventive strategies should be done outside PHC settings, because patients come to PHC when they are already ill". Regarding exercise prescription leadership, nurses showed insecurity to do it and GPs demand a team work with other specialists. Collaboration with other health professionals seem to be clearly accepted in PAP at PHC settings.

A GP said: "Actually, a lot of people practice running, and the Sport awareness is rising and health benefits-related; however, not many people know the dangers of an excessive practice of physical exercise and we receive many patients injured for this reason".

According to the many doubts in PAP for both professionals it was considered necessary to treat more in depth the next point.

PAP training courses

Both PHC professionals indicated the mandatory and priority necessity to increase PAP training courses or workshops with disagreement about the best methodology (online, personal, mixed), although both agreed that it should be at work-time and with special benefits offered to the PHC staff by the Healthcare System.

The following training courses were proposed: Motivational interview, PA patterns and fitness status assessment, training in time management.

PAP as a preventive and rehabilitation resource

Recently, the patient and PHC staff on PAP awareness is rising.

There is a lack of information about Local Sports resources and availability. This produces an ineffective synergy between them, in contrast of cost-effectiveness for the Government and the health status of patients.

The GPs group proposed to establish some similar strategies as used with smoking or obesity at PHC settings. Specifically they said:

"We had a main responsible for smoking cessation strategy done in PHC setting years ago. They received the training courses that then will be transferred to the rest of PHC staff, in the same way that PHC system idiosyncrasy; however, if we want that it works, some professionals and PHC should assume the responsibility and it will be not rewarded by the System"

PAP barriers and some solutions proposed

The main common barriers commented by the professionals were related to space, materials and economic resources to assess physical activity and fitness status of patients. A high patient ratio in a short consultation time, staff and synergies with other public resources. Themselves proposed some solutions to these barriers.

The results are presented in eleven categories with the subsequent subcategories (table 18).

5.5.5 Discussion

Within a broader strategy to implement Exercise is Medicine® in PHC in Spain, this study explored the previous situation by focus groups sessions about PAP in Madrid PHC settings similar as was done in the Netherlands to implement PAP in healthcare settings (266). Personal and professional data were considered necessary for post-analysis of obtained results. Following the trend of other projects to analyze the PA stage of change in patients (19, 111, 196), we checked the stage change on PAP behavior in healthcare staff, considering healthcare professionals behavior as important as patient ones in relationship with the healthy lifestyle medicine (81).Besides, PAP Knowledge should be measured in the PHC staff because the respondents indicated lack of knowledge and need for training about PAP such as has been shown by other authors (111, 112, 118). In the last section, where we introduced the main points of the focus group results, we realized that there are similar opinions between nurses and physicians related to PAP barriers such as lack of PAP knowledge, lack of time in consultations, of space to asses physical fitness and of institutional support to collaborate with internal-external public resources such as has been shown in other studies (4, 87, 111, 112), However, there are some differences related to who should assume the main role of PAP in the healthcare centers. Nurses, in spite of exhibiting lack of time in their consultations, were considered by themselves as the main staff in the center to PAP in contrast of some barriers found in the literature for this reason (111). Both considered necessary more training courses about counseling and motivational interviews, PAP and time management, some of them in concordance with other studies (87, 111, 120, 260).

Another of the main findings related to PAP was not fully integrated into daily consultation routines by nurses and GPs, besides both of them are critical with the PA anamnesis tool used to classify sedentary and PA patterns (267, 268).

Many assistants showed disagreement with the recently anamnesis toll to measure PA and sedentary levels. An assistant said " IT programmers should be in consultation with us during a whole week to modify the tool regarding to the necessities". In this sense, it is necessary to establish a cost-effective method to do it as objective and quickly as possible. Sally B. Rose et al, proposed to measure PAL by a one question survey (269). Other studies propose to use mobile phones apps or by wearable technology that could present a simpler method for clinicians to assess sedentary and active behaviors in primary care (19, 131, 270). In the UK, a national database will be used to implement efficiently their exercise referral schemes in healthcare settings to have a correct follow up with the patient and healthcare team (271). in any case, sedentary behavior should be considered as important as PA, because they have interdependent risks each other on human health (13).

In our first focus group session, around 50% of all participants in both groups identified themselves as physically active. We will have to check if this self-perception has a relationship with the rest of PAP variables analyzed. Discussion was raised whether or not being active had an influence on PAP for patients (120) and in this way we will ask this question in the future questionnaire. In both groups, all of them considered necessary the predisposition of the patient to receive PA counseling and were very confident about the use of exercise as a preventive and rehabilitation medicine such as is concerned by the Exercise is Medicine® strategy (4, 272). According to Exercise is Medicine® strategy, both groups will be interesting to create a networking with other professionals and institutions with the aim to increase efficiency in PAP (199), so we can avoid the dangers of delivering health-related advices beyond scope of practice, such as have shown McKean et al. comparing nutritional advice knowledge between nutritionist and exercise professionals in Australia (273). Besides, they indicated to have a poor knowledge of the sports facilities and resources close to their PHC.

Material, economic and staff support to implement PAP efficiently was very important to them and we want check with the rest of the nurses and physicians of the Madrid PHC centers if some of the solutions commented in the focus group sessions are considered necessary for them such as has been shown in other studies (17, 104, 111).

Create an interdisciplinary network group inside or outside of the PHC settings should be an effective and cost-benefice resource in Madrid health care system. Awareness by the patients, professionals, PHC systems and local and national health policies are

needed to reduce physical inactivity levels in 10-15% to the year 2025-30 such as is proposed by the WHO European strategies (97, 136, 274).

5.5.6 Conclusions

Focus groups sessions have served to identify the main facilitators and barriers to implement PAP in PHC in the Region of Madrid. Health professionals of Primary care interviewed have indicated about the need to introduce PAP and their willingness to participate, but that currently both material and human resources are not sufficient. Results will be used to create a questionnaire in order to reach all professionals working at PHC in the Region of Madrid, as a next-step procedure.

Acknowledgements: We would like to thank the nurses and physicians of Primary care system of Madrid who gave their time and shared their opinions with us, especially to the 10 professionals who went to the focus group sessions.

5.6 ARTICLE 6: DESIGN AND VALIDITY OF A CHOICE-MODELING QUESTIONNAIRE TO ANALYZE PHYSICAL ACTIVITY ON PRESCRIPTION WITH GENERAL PRACTITIONER AND NURSES OF MADRID PRIMARY HEALTHCARE SETTINGS.

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This article has not been submitted yet.

5.6.1 Abstract

Introduction: Worldwide health policies are trying to promote physical activity (PA) at healthcare settings. However, in spite of many strategies nowadays, no highlighted results had improved physical inactivity levels. The aim of this study was to validate two questionnaires to assess the self-perception of nurses and general practitioners to implement physical activity on prescription (PAP) at Primary Healthcare (PHC) settings.

Methods and materials: A thirty questions choice-modelling Google-form questionnaire, was sent to 11 nurses and 11 expert sports medicine physicians, previously designed according to the results of focus group discussions.. Experts had to evaluate each question in a 1-5 points Likert-type scale according to their expertise. Aiken's V coefficient values >0.75 was used to validate separately each question using the Visual Basic 6.0 software.

Results: A total 10 sports medicine physicians and 10 nurses experts with 28.40±5.10y. and 16.3±11.8y. of PAP experience, respectively, validated the questionnaire. One expert in each group was not considered for offering 3±SD answers in ≥2 questions respect to the mean of the rest of experts. Final Aiken's V coefficient values were 0.89 (0.77-1.00) for nurses and 0.84 (0.77-0.95) for physicians questionnaire.

Conclusion: The on-line questionnaires had been designed and validated to assess the self-perception on PAP of PHC nurses and GPs.

This questionnaire can be used in other regional PHC settings to asses and manage PAP implementation trough the self-perception facilitators and barriers of PHC staff.

Key words: Exercise Therapy, Preventive medicine, Health Promotion, Public Health, Physicians.

5.6.2 Introduction

The global age-standardized prevalence of physical inactivity is around 25% in the world (3). Physical inactivity and sedentary behavior represent currently a leading risk factor for NCDs (9). Since in 2015 Saltin et al. established that exercise prescriptions could treat at least 26 differents NCDs (10). PA has represented a cornerstone in the prevention of 35 chronic conditions (9) and recently, has been published than more of 40 NCDs could be prevented and treated by exercise prescriptions as a precision medicine (66). In spite of health benefits of exercise prescriptions are well-known (19) and also, much several approaches are trying to promote physical activity levels (PAL) in Healthcare settings such as the WHO European Region 2016–2025 (138). There are still few positive effects founded about physical activity on prescription (PAP) at PHC settings (100).

Nonetheless, PHC settings are a well-considered resource to promote PA in patients (100, 104) although only one third of patients receive PAP as a non-pharmacological usual care by their PHC professionals (117, 195). More than 80% of adults visit PHC settings at least once a year (104) and PAP has been established as a cost-effective resource in PHC settings (100, 111, 134, 262), helping to reduce the use of medicine drugs on patients (22, 132, 133), improving integral health status (11, 275) and quality of life of patients (276).

Different worldwide strategies, such as the Exercise is Medicine® initiative, are trying to implement PAP in healthcare settings (4, 199, 263). Based on the strength of existing evidence, regular PA should be the first line of preventive and rehabilitation medicine; however, insufficient progress is being developed about the implementation of a model to increase PAP in healthcare settings (100, 102, 108).

Interest in PAP implementation has increased during last years, and adherence to non-pharmacological treatments had been traditionally focused by patient-related factors (113). In contrast, some studies had shown the lack of public resources in the Healthcare System (90, 111, 122) and healthcare team (90, 200), lack of exercise prescription training knowledge (83, 118, 174, 191), time in their PHC consultations (117), awareness with exercises prescription (117, 195), etc.

To identify all the main barriers and facilitators that influence PAP in healthcare settings should be a priority (100, 111). In this sense, we wanted to design and validate

two questionnaires to assess the self-perception barriers and facilitators of nurses and general practitioners (GPs) for implementation of PAP at PHC settings.

5.6.3 Materials and Methods

Based on the results of a previous study performed by our research group (Calonge et al. article 5), two choice-modeling, Google-form questionnaires were designed. Briefly, 5 GPs and 5 nurses commented during four hours of focus groups sessions about their opinions, barriers and facilitators to implement PAP in PHC. Answers were categorized and organized in a structured 30-question questionnaire (Table 19).

Table 19. Summarized and justified structure of questionnaire related to each category obtained by focus groups sessions

QUESTIONNAIRE				
Section	**Category**	**Subcategory**	**Nº Question**	**Observations**
1.	Brief explanation			Summarized questionnaire presentation
2.	Personal and professional date			Personal and professional information
3.	Knowledge about PA benefits		1,4	Objective basic knowledge about PAP to be considered accurate their following answers.
4.	Stage of change on PAP		5	Stage change on PAP behavior in PHC by nurses and physicians
5.	Self-perception PA pattern of PHC staff	Self-perception PA behavior of PHC professionals	6	To check the possibly influence in PAP an active behavior
	PAP background	PAP knowledge and use	7, 8, 9, 10	Knowledge and use about PAP by nurses and primary physicians
	PHC staff position to PAP	Leadership to PA promotion	11, 12	Leader position in a PA promotion networking
		Leadership to exercise prescription	14, 15	Leader position in exercise prescription networking
		Collaborative PA promotion	13, 17, 18	Collaborative PA promotion networking
		Collaborative exercise prescription	16, 17, 18	Collaborative exercise prescription networking
	PAP training courses	PAP training courses status and necessities	19, 20, 21, 22, 23, 24, 25, 26	PAP training courses status and resource necessities in nurses and physicians of primary health care
	PAP as preventive and rehabilitation	PAP awareness by PHC Staff	8, 29.2	Use of PAP in the prevention and treatment of chronic diseases in PHC settings

QUESTIONNAIRE				
Section	**Category**	**Subcategory**	**Nº Question**	**Observations**
	resource	PAP Awareness by patients	29.6	Mass media advices to the patient by Health care System
	PAP barriers	PAP anamnesis vital sign tool	27, 28	PA as vital sign in the Health tool
		Improving consultation time management	29.3	Time to PAP in PHC consultation
		External policies relationships in PAP	29.5	PAP action plan by the Health care system and external institutional relationship
		Lack of space resources	29.1	Lack of space to measure fitness and PA/sedentary levels
		Lack of Material-economic resources	29.4	Lack of economic and material resources
	PAP solutions	Modify PAP vital sign tool	30.1	Add an improved PA vital sign tool
		New space resources	30.2	Add an space to measure fitness and PA and possible PA training programs
		To create PAP networking	30.3	Develop a PAP networking
		To offer PAP Training courses	30.4	PAP Training courses to health care professionals
		PA advisement policies	30.5	PA advisement strategies in mass media
		Progressive PAP implementation in PHC	30.6	Progressive implantation of PAP in primary health care system
		To enhance material and economic resources for PAP	30.7	Add economic resources
		PAP leadership units at PHC	30.8	PAP leader position and structure in the PHC system
		Use of first consultation (nursering)	30.9	Use of first nurse consultation to measure physical fitness, PA levels or something related to PAP
		Use of external PHC resources	30.10	Use of space outside PHC settings. i.e: walking routes, Sports centers, etc..
		To increase PAP consultation time	30.11	Increase PAP consultation time because now is insufficient

In order to validate the questionnaires by the expert methods, 11 nurses and 11 GPs were selected. Inclusion criteria to be considered as an expert were: age ≥35y.; >3y. of PAP career experience and/or ≥20y. of academic background related to sports medicine, general practitioner medicine, nursing, public health promotion and recent or previous relationship with a national public health or PHC system. Descriptive data of the experts are shown in Tables 20 and 21.

Table 20. Descriptive of Sports Medicine Physicians experts in physical activity on prescription (PAP).

Expert	Range age	Sex	PAP experience	Academic Background	Last University studies finished (year)	Career experience (years)
1	51-55	Woman	Researcher, University professor	PhD	1985	20
2	51-55	Woman	University professor, Healthcare professional	PhD	1988	25
11*	56-60	Man	Researcher, University professor, Healthcare professional	PhD	1983	36
4	56-60	Man	Healthcare professional	PhD	1982	31
5	> 60	Woman	Healthcare professional, Public Health promoter	PhD	1977	36
6	56-60	Man	Researcher, University professor, Healthcare professional	PhD	1986	30
7	> 60	Man	University professor, Healthcare professional	Master degree, Bachelor's degree	1984	30
8	> 60	Woman	Healthcare professional	PhD	1981	25
9	> 60	Man	Researcher, University professor	PhD	1981	25
10	51-55	Woman	Researcher, University professor	PhD	1989	26
	Total	50% males				28.4 ±5.1

* Expert exchanged

Table 21. Descriptive of nurses experts in physical activity on prescription (PAP).

Expert	Range age	Sex	PAP experience	Academic Background	Last University studies finished (year)	Career experience (years)
1	56-60	Woman	Healthcare professional	Bachelor's degree, degree	1983	35
2	46-50	Man	Researcher, University professor, Healthcare professional	Bachelor's degree, degree	1982	28
3	41-45	Woman	Researcher, University professor	PhD	2005	19
4	36-40	Woman	University professor	PhD	2003	10

Expert	Range age	Sex	PAP experience	Academic Background	Last University studies finished (year)	Career experience (years)
5	41-45	Man	Healthcare professional	Master degree, Bachelor's degree, degree	1995	20
6	41-45	Woman	Healthcare professional	Bachelor's degree	1995	3
11*	36-40	Woman	Healthcare professional	Master degree	2004	4
8	46-50	Woman	Healthcare professional, Public Health promoter	Master degree	2010	9
9	36-40	Man	Healthcare professional	Bachelor's degree, degree	2002	5
10	51-55	Woman	Healthcare professional	Master degree	1982	30
	Total	30% males				16.3 ±11.8

* Expert exchanged

Link to the questionnaires (nurses: https://forms.gle/CmJDQAjR5Pt1zLp36; sports medicine physicians https://forms.gle/coQttEgtBPYgH7Qj7) was sent via email, previous consent to participate. Experts had to indicate below each question their degree of agreement (1-5 points in the Likert-type scale, where 5 points indicate the highest agreement and 1 the lowest agreement). When an expert's opinion in two or more questions was ≥3±SD different from the mean of the other 9 experts, these values were not considered valid because of the discordance with the rest of experts. The coefficient of content validation for the final 10 experts was calculated using Aiken's V coefficient (95% CI) (277). This coefficient and the lower and upper confidence intervals were calculated using the free software Visual Basic 6.0 (table 5) (277). A minimum Aiken's V coefficient score of ≥ 0.75 was needed for each question to be validated (278).

This study was approved by the Central Commission for research of the region of Madrid and the Ethical committee of the Alcorcon Hospital.

5.6.4 Results

A total 10 sports medicine physicians and 10 nurses experts with 28.40±5.10y. and 16.3±11.8y. in PAP experience, respectively, were finally considered for the validation

of the questionnaires. One expert in each group was not considered for offering 3±SD answers in ≥2 questions respect the mean of the rest experts (table 22 and 23).

Table 22. Values offered by the expert sports medicine physicians in the items validation of the questionnaire.

	Sports Medicine Physicians Questionnaire Validation										
	Expert 1	**Expert 2**	**Expert 11***	**Expert 4**	**Expert 5**	**Expert 6**	**Expert 7**	**Expert 8**	**Expert 9**	**Expert 10**	**Expert 3***
Item 1	5	5	5	4	4	5	5	5	5	5	5
Item 2	5	5	4	2	4	5	5	5	5	4	5
Item 3	5	4	3	4	3	5	5	5	5	3	3
Item 4	5	5	4	5	3	4	5	5	5	5	4
Item 5	4	5	5	5	3	5	5	5	5	5	5
Item 6	5	5	3	4	4	5	5	4	5	5	4
Item 7	4	5	5	4	4	3	5	5	5	5	5
Item 8	4	5	5	4	4	5	5	5	5	5	3
Item 9	3	4	3	3	4	5	5	4	5	5	4
Item 10	3	4	3	3	4	5	5	5	5	5	4
Item 11	4	3	3	4	4	4	5	4	5	5	4
Item 12	4	3	4	3	4	5	5	5	5	4	1**
Item 13	3	4	5	5	4	5	5	5	5	5	3
Item 14	4	3	5	5	4	5	5	4	5	4	4
Item 15	3	3	5	5	4	5	5	5	5	4	1**
Item 16	3	3	5	5	4	5	5	5	5	5	3
Item 17	3	4	4	5	4	5	5	5	5	5	4
Item 18	3	4	3	5	4	5	5	4	5	5	3
Item 19	3	4	5	5	4	5	5	5	5	5	5
Item 20	3	4	5	4	4	5	5	5	5	5	3
Item 21	4	3	3	4	4	5	5	5	5	4	4
Item 22	3	3	4	4	4	5	5	5	5	4	3
Item 23	3	4	3	4	4	5	5	5	5	4	3
Item 24	4	4	3	4	3	5	5	5	5	5	2
Item 25	4	4	3	4	3	5	5	5	5	5	3
Item 26	3	4	3	4	3	5	5	5	5	5	3
Item 27	4	4	5	5	4	5	5	3	5	5	1**
Item 28	3	4	4	4	4	5	5	4	5	5	1**
Item 29	3	5	4	4	4	5	5	5	3	4	2
Item 30	4	4	4	5	4	5	5	5	5	4	4

* Expert exchanged; ** values ≥3±SD of the mean of rest 9 experts

Table 23. Values offered by the expert nurses in the items validation of the questionnaire.

Nurses Questionnaire Validation											
	Expert 1	**Expert 2**	**Expert 3**	**Expert 4**	**Expert 5**	**Expert 6**	**Expert 11***	**Expert 8**	**Expert 9**	**Expert 10**	**Expert 7***
Item 1	5	4	5	4	4	5	4	5	5	5	2
Item 2	5	4	3	3	4	5	4	4	4	5	1**
Item 3	5	5	3	5	4	5	4	5	3	5	5
Item 4	4	5	4	4	4	5	4	5	5	5	4
Item 5	5	4	5	5	5	5	4	4	4	5	1**
Item 6	5	4	3	4	4	5	3	5	5	5	4
Item 7	5	4	4	5	4	5	4	3	5	5	4
Item 8	5	4	5	5	5	5	3	4	5	5	3
Item 9	5	4	4	5	5	5	3	5	5	5	5
Item 10	5	4	4	5	4	5	4	4	3	5	5
Item 11	5	4	5	4	5	5	4	5	5	5	4
Item 12	4	4	4	5	5	5	3	5	3	4	2
Item 13	4	5	5	5	5	5	3	5	5	5	4
Item 14	5	5	4	5	5	5	4	5	5	5	2
Item 15	5	5	4	5	5	5	3	5	4	4	2
Item 16	5	5	5	5	5	5	3	5	4	5	4
Item 17	5	5	5	4	5	5	4	5	5	5	5
Item 18	5	5	5	5	5	5	4	5	5	5	5
Item 19	2	5	5	5	5	5	4	5	5	5	5
Item 20	5	5	5	5	5	5	4	5	5	5	5
Item 21	4	5	4	5	5	5	4	5	5	5	5
Item 22	5	5	5	5	5	5	5	5	5	5	5
Item 23	5	5	5	5	5	5	4	5	5	5	5
Item 24	2	4	4	4	5	5	3	5	4	5	5
Item 25	5	5	4	5	5	5	4	5	5	5	5
Item 26	2	5	2	4	5	5	3	5	4	5	5
Item 27	3	5	2	4	5	5	4	1	5	5	3
Item 28	5	5	3	4	5	5	4	2	5	5	4
Item 29	4	4	5	5	5	5	4	5	5	5	5
Item 30	5	5	5	5	5	5	4	5	5	5	5

* Expert exchanged; ** values ≥3±SD of the mean of rest 9 experts

Aiken's V coefficient values were 0.89 (0.77- 1.00) for nurses and 0.84 (0.77-0.95) for the physicians questionnaire (table 24).

Table 24. The mean and Aiken's V coefficient score for all the thirty items offered for the ten experts.

	GPs Questionnaire							Nurses Questionnaire						
Item	**1**	**2**	**3**	**4**	**5**	**Mean**	**Aiken's V (95% CI*) Value (range)**	**1**	**2**	**3**	**4**	**5**	**Mean**	**Aiken's V (95% CI*) Value (range)**
1	0	0	0	2	8	4.80	0.95 (0.83-0.98)	0	0	0	4	6	4.60	0.90 (0.76-0.96)
2	0	1	0	3	6	4.40	0.85 (0.70-0.92)	0	0	2	5	3	4.10	0.77 (0.62-0.87)
3	0	0	3	2	5	4.20	0.80 (0.65-0.89)	0	0	2	2	6	4.40	0.85 (0.70-0.92)
4	0	0	1	2	7	4.60	0.90 (0.76-0.96)	0	0	0	5	5	4.50	0.87 (0.73-0.94)
5	0	0	1	1	8	4.70	0.92 (0.80-0.97)	0	0	0	4	6	4.60	0.90 (0.76-0.96)
6	0	0	1	3	6	4.50	0.87 (0.73-0.94)	0	0	2	3	5	4.30	0.82 (0.68-0.91)
7	0	0	1	3	6	4.50	0.87 (0.73-0.94)	0	0	1	4	5	4.40	0.85 (0.70-0.92)
8	0	0	0	3	7	4.70	0.92 (0.80-0.97)	0	0	1	2	7	4.60	0.90 (0.76-0.96)
9	0	0	3	3	4	4.10	0.77 (0.62-0.87)	0	0	1	2	7	4.60	0.90 (0.76-0.96)
10	0	0	3	2	5	4.20	0.80 (0.65-0.89)	0	0	1	5	4	4.30	0.82 (0.68-0.91)
11	0	0	2	5	3	4.10	0.77 (0.62-0.87)	0	0	0	3	7	4.70	0.92 (0.80-0.97)
12	0	0	2	4	4	4.20	0.80 (0.65-0.89)	0	0	2	4	4	4.20	0.80 (0.65-0.89)
13	0	0	1	2	7	4.60	0.90 (0.76-0.96)	0	0	1	1	8	4.70	0.92 (0.80-0.97)
14	0	0	1	4	5	4.40	0.85 (0.70-0.92)	0	0	0	2	8	4.80	0.95 (0.83-0.98)
15	0	0	2	2	6	4.40	0.85 (0.70-0.92)	0	0	0	3	6	4.50	0.87 (0.73-0.94)
16	0	0	2	1	7	4.50	0.87 (0.73-0.94)	0	0	1	1	8	4.70	0.92 (0.80-0.97)
17	0	0	1	3	6	4.50	0.87 (0.73-0.94)	0	0	0	2	8	4.80	0.95 (0.83-0.98)
18	0	0	2	3	5	4.30	0.82 (0.68-0.91)	0	0	0	1	9	4.90	0.97 (0.87-0.99)
19	0	0	1	2	7	4.60	0.90 (0.76-0.96)	0	1	0	1	8	4.60	0.90 (0.76-0.96)
20	0	0	1	3	6	4.5	0.87 (0.73-0.94)	0	0	0	1	9	4.90	0.97 (0.87-0.99)
21	0	0	2	4	4	4.20	0.80 (0.65-0.89)	0	0	0	3	7	4.70	0.92 (0.80-0.97)
22	0	0	2	4	4	4.20	0.80 (0.65-0.89)	0	0	0	0	10	5.00	1.00 (0.91-1.00)
23	0	0	2	4	4	4.20	0.80 (0.65-0.89)	0	0	0	1	9	4.90	0.97 (0.87-0.99)
24	0	0	2	3	5	4.30	0.82 (0.68-0.91)	0	1	1	4	4	4.10	0.77 (0.62-0.87)
25	0	0	2	3	5	4.30	0.82 (0.68-0.91)	0	0	0	2	8	4.80	0.95 (0.83-0.98)
26	0	0	2	4	4	4.20	0.80 (0.65-0.89)	0	1	2	2	5	4.10	0.77 (0.62-0.87)
27	0	0	1	3	6	4.50	0.87 (0.73-0.94)	0	1	2	2	5	4.10	0.77 (0.62-0.87)
28	0	0	1	5	4	4.30	0.82 (0.68-0.91)	0	1	1	2	6	4.30	0.82 (0.68-0.91)
29	0	0	2	4	4	4.20	0.80 (0.65-0.89)	0	0	0	3	7	4.70	0.92 (0.80-0.97)
30	0	0	0	5	5	4.50	0.87 (0.73-0.94)	0	0	0	0	1	4.90	0.97 (0.87-0.99)
Total							0.84 (SD±0.04)							0.89 (SD±0.06)

The Likert scale varied from 1 to 5, where the minimum (1) value is according to a to a very poor relevance and the maximum (5) to the highest degree of relevance. CI*: confidence intervals. GPs: General practitioners.

All the thirty questions of both questionnaires were validated through a panel of 10 experts. The design of the nurses´ questionnaire: https://forms.gle/p82MmyrnXhy9JeiZ7 and the GPs´ questionnaire: https://forms.gle/jZSzprU8MPqR5kuP9 could be seen in this mentioned links.

5.6.5 Discussion

The both choice-modeling Google-form questionnaire validations about self-perception PAP barriers and facilitators of nurses and physicians at Madrid PHC settings have been

validated after that a previous design following a rigorous method based on a content-analysis processing of two verbatim transcribed focus group sessions previously published (article 5).

The highest (≥0.9) Aiken's V coefficient values for both questionnaires were obtained for the items, number 1, 5, 8, 13, 19 in both questionnaires. Question 1, focused on the preventive health benefits of PA and exercise, could discriminate if healthcare professionals do not promote PA because of the lack of Knowledge about the benefits or for other reasons still not resolved. However, in spite of scientific literature provided clear evidence of benefits of PA in human health (9, 10, 66), PAP interventions in PCH settings have still a reduced evidence and need to be enhanced (104). Previously, Desveaux et al. proposed a questionnaire to find the patient and healthcare Provider facilitators and barriers to a community-based exercise program (214). Now, we would propose a new validated one for PAP in healthcare settings considering all dimensions and their respective integrated factors, according to the WHO 5 dimensions adherence model (90, 216). And proposed by other authors as a coadjutant recommendations given to chronic patients (90, 200, 216, 217)

Item 5 is related to assess the stage of change on PAP behavior for PHC professionals, according to the stage of changes of Transtheoretical model (233). This question was introduced because many studies had evaluated the lifestyle behavior changes in patients or people (206, 232) although to date, is not recognized a efficient strategy in Healthcare settings to produce changes toward positive healthy lifestyles for a long-term time (232). The participants of the focus group sessions (article 5) showed a lack of awareness as the majority of their professional colleagues. Because of this, the item tries to assess PAP behavior, based on the 5 stages of change behavior (Pre-contemplation, contemplation, preparation, action, maintenance) in PHC providers. In a similar way that WHO in 2003 proposed that health professionals need to be trained in non-pharmacological adherence treatments (90). In our opinion as important should be to know what happens with patients as with PHC staff to improve adherence levels in PAP as a non-pharmacological treatment for patients and it seems to be in agreement with the panel of experts who validated the questionnaires. Item 8 of the questionnaire, was designed to assess the awareness on PAP by the health professionals to be a influential provider with their patients (117, 195) and the experts agreed with the relevance of the question to be considered an indicator in the self perception barrier of PHC

professionals in PAP. Item 13, that asked how PHC professionals were willing to collaborate in PA promotion through a multidisciplinary PHC team, showed a higher acceptance by the experts in the same way that had been developed by the Exercise is Medicine initiative in the last years (4, 263). Finally, item 19, based on the interest on PAP training courses of PHC professionals, was in higher agreement collaboration for all experts, being an indicator to enhance the efficient PAP implementation in PHC settings in concordance with previous scientific literature (175, 187, 191). Besides, other training courses demanded by the professionals such as motivational interviews for PAP and managing time workshops were confirmed in both questionnaires as resources needed to establish PAP in PHC settings, in concordance with other authors (87, 120, 260).

Limitations for this study were the equivalence on contents offered in the questions for nurses and physicians, according to the similitude of results in the content analysis of the semi-structured focus group sessions developed with them. However, after analyzing the data of the questionnaire sent to the rest of PHC professionals, a specific questionnaire could be designed in base of specific results obtained to be newly validated.

This study could offer the key point to establish a validated questionnaire to analyse the main barriers of nurses and physicians at PHC settings to use PAP in their consultations. In addition, local and national PHC system could design in effective strategy managing PHC team-related factors to promote PA in PHC settings, according to the health necessities and such as is proposed by recent European initiatives (97, 136, 274).

5.6.6 Conclusions

The two 30 choice-modeling questions of the Google-form questionnaires have been validated by a panel of 10 experts and both are ready to be used in another Spanish PHC system to assess the self-perception of PAP facilitators and barriers of nurses and general practitioners, trying to implement an efficient cost-effective and useful public health strategy.

Acknowledgements: We would like to thank to all experts who offered their help to validate both questionnaires selflessly. The Sports medicine physicians experts were: José Luis Terreros Blanco, Nicolas Terrados Cepeda, Manel González Péris, Pilar

Martín Escudero, Maite Aragonés Clemente, Fernando Novella María-Fernández, Raquel Blasco Redondo, Franchek Drobnic, Miguel Enrique del Valle Soto, Joaquin Guasch Bosch, Maria Jesús del Castillo and nurses experts in PAP were: Cristina Romero Blanco, Albert Guerrero Palmero, María Cristina Alonso Blanco, Sergio Belmonte Sánchez, Diego José Villalvilla Soria, Sonia López Villar, Guillen Artiguez Vives, Lucia Túnez Rodríguez, Gloria Santos González, Lorena López Castañón, María Jesús Rodríguez.

5.7 ARTICLE 7: SELF-PERCEPTION ASSESSMENT IN PHYSICAL ACTIVITY ON PRESCRIPTION BY GENERAL PRACTITIONERS AND NURSES IN MADRID PRIMARY HEALTHCARE SETTINGS.

Sergio Calonge Pascual[1], et al., on behalf of EXERNET Study Group.

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This article has not been submitted yet.

5.7.1 Abstract

Introduction: Primary Healthcare (PHC) staff is usually associated with a PA promotion role. The Exercise is Medicine initiative aims at introducing Physical activity on prescription (PAP) at PHC. The aim of this study was to assess the self-perception of nurses and physicians towards PAP at Madrid PHC settings.

Methods and materials: From a list of 3850 GPs and 3547 nurses, a total of 319 physicians (76.50% females) and 285 nurses (88.40% females) responded to a validated choice-modeling Google-form questionnaire. PHC staff results were analyzed and compared by Chi squared test, categorized by PHC areas sex, age range and professional status.

Results: Almost 100% of PHC professionals are aware of the benefits of PA for health, although, from 24.3% to 37.0% of them, considered it adequates only for some patient´s profiles. Only 14.7% of GPs knew current WHO PA guidelines in contrast to 75.7% of nurses. Approximately 80% of both professionals recognized to be physically active and to maintain their PAP routines since more than 6 months. PHC staff is more confident for PA promotion (70%) than for exercise prescription (40%). A mean of 63.2% of PHC professionals agree to the collaboration with Sports Scientists for PAP. Physicians have more than 98% of probability than nurses to collaborate with all health providers proposed for PA promotion (OR:1.986; $p<0.001$) and also for exercise prescription (OR:1.987; $p<0.001$). Physicians are more willing to collaborate in PAP with public sports centers than nurses (OR:6.140; $p<0.001$). They agree in some common PAP barriers: PHC professional awareness, lack of material and economic resources; lack of PAP awareness in patients, lack of use and collaboration with another public external PAP resources.

Conclusion: PHC professionals are conscious of PA health benefits in spite of the lack of resources to be implemented at PHC. A good awareness to implement efficiently PAP at PHC settings was observed, especially in physicians.

Key words: Exercise, Medicine, Physician, Health Promotion, Public Health, prescriptions.

5.7.2 Introduction

Physical inactivity and sedentary levels are well known predictors of non-communicable diseases (NCDs) (3, 16). However, one-third of the global age-standardized worldwide population possesses insufficient physical activity levels (PAL) (3). These worrying data are currently considered as a serious health threat with bad expectancies (3, 16, 260). In this way, Healthcare Systems are considered a good resource to take an active role in physical activity (PA) promotion (17). European strategies such as the World Health Organization (WHO) global recommendations on PA for health (136) or the WHO Global action plan on PA 2018–2030 (139) are trying to increase PAL among world population. The most recent initiatives have the challenge of promoting PA in the healthcare sector, such as offer the "Live active" programme (107) or Exercise is Medicine initiative in Spain (4, 272). The WHO PA strategy for the European Regions 2016–2025 (138) is offering to incorporate PAP through the Healthcare System in the same sense that another European initiatives (4, 84). PAP could enhance PAL in patients at least to prevent 35 unhealthy conditions (9) and exercise prescriptions to treat from 26 to 40 different NCDs (10, 66) acting as the best medicinal-drug polypill (153) over pharmacological interventions for some NCDs (116). In addition, Healthcare settings should be used to increase PAL (100, 104). Besides, a higher number of patients visit healthcare setting each year (104, 111) and the evidence says that PAP is a cost-effective resource (100, 111, 262). A review done by Blair et al. concluded that a brief exercise training prescription counseling is efficient, effective, and cost-effective (261). In contrast, the current policies are being insufficient to achieve the 10% physical inactivity levels reduction target (3).

Some authors indicate that lack of resources in the Healthcare System is an issue to implement PAP correctly (104, 108, 279). Besides, the lack of knowledge of exercise prescription training Knowledge by the healthcare staff (118, 174, 175, 191), an inefficient supported network team (19), having not enough time (87), the lack of guidelines and unclear objectives in the healthcare system (260) are some of the main barriers mentioned in the scientific literature, and could lead to the reduced PAP in their consultation (196, 280).

In the last years, many different initiatives support introducing PAP at PHC (101, 151, 199, 263). However, the implementation of PAP in healthcare settings is not without difficulties and worldwide problem and worthwhile to enhance (100, 104, 111). PHC

consultations should include PA assessment and exercise prescription as part of their routines with patients (112). A network action of several health providers, especially related to health, should work together to enhance PAL-related health status (100, 155). Previously, Desveaux et al. in 2016, observed discrepancies between the barriers perceived by patients and by PHC providers to a community-based exercise programme measured by a questionnaire(214). In 2016, Short et al. showed that only one-fifth of participants from their survey sample reported receiving PAP recommendation from their physicians (281). The participants that received PAP recommendation were those who scored higher in physical health-related quality of life (281). Few surveys had been designed to assess the attitude of different healthcare providers and analyzing the main barriers for implementing a PAP strategy at Healthcare settings (282-288). However, considering the limited surveys above mentioned, We designed a new reliable and validated one for analyzing PAP in healthcare settings considering all WHO 5 dimensions (90) and their respective factors as well as the main barriers showed by the representative staff of Madrid PHC physicians and nurses in the previous focus group sessions. In this way our study have tried to assess the PAP self-perceptions of nurses and GPs at PHC settings in the region of Madrid.

5.7.3 Materials and Methods

Two validated questionnaires previously designed by our research group were used for this study (article 6) (table 25).

Table 25. GPs and nurses questionnaire structure

Section	Category	Subcategory	Nº Item
1.	Brief explanation		
2.	Personal and professional date		
3.	Knowledge about PA benefits		1,2,3,4
4.	Stage of change on PAP		5
5.	Self-perception PA pattern of PHC staff	Self-perception PA behavior of PHC professionals	6
	PAP background	PAP knowledge and use	7, 8, 9, 10
	PHC staff position to PAP	Leadership to PA promotion	11, 12
		Leadership to exercise prescription	14, 15
		Collaborative PA promotion	13, 17, 18
		Collaborative exercise prescription	16, 17, 18
	PAP training courses	PAP training courses	19, 20, 21, 22, 23, 24, 25, 26

Section	Category	Subcategory	Nº Item
	PAP as preventive and rehabilitation resource	PAP awareness by PHC Staff	8, 29.2
		PAP Awareness by patients	29.6
	PAP Barriers	PAP anamnesis vital sign tool	27, 28
		Improving consultation time management	29.3
		External policies relationships in PAP	29.5
		Lack of space resources	29.1
		Lack of Material-economic resources	29.4
	PAP Solutions	Modify PAP vital sign tool	30.1
		New space resources	30.2
		To create PAP networking	30.3
		To offer PAP Training courses	30.4
		PA advisement policies	30.5
		Progressive PAP implementation in PHC	30.6
		To enhance material and economic resources for PAP	30.7
		PAP leadership units at PHC	30.8
		Use of first consultation (nursering)	30.9
		Use of external PHC resources	30.10
		To increase PAP consultation time	30.11

GPs: General practitioners; PA: Physical Activity; PAP: Physical Activity on prescription; PHC: Primary Health-Cares.

At the moment of the study, 3850 GPs and 3547 nurses were working at PHC in the Region of Madrid.

The link to the online choice-modeling Google-form questionnaires (nurses´ questionnaire: https://forms.gle/p82MmyrnXhy9JeiZ7 and GPs´ questionnaire: https://forms.gle/jZSzprU8MPqR5kuP9) was sent out centrally by the *Conserjería de Sanidad* to the directors of the Seven Health Areas in which the Region of Madrid is divided. These directors sent it to all GPs and nurses of their area.

Data were analysed by age, sex and health area (North, Nort-West, South, South-East, East, West and Center). Differences between both PHC professionals answers were analyzed by a Chi squared test analysis, corrected by Fisher test for the lower frequency rates of answer of question number 13, 16 and 18 of the questionnaires (SPSS, version 20.0).

The representation of the sample should be guaranteed with a 5% error of response and p=q= 0.5 (95% confidence interval), from the whole sample above mentioned, a total of 374 GPs and 373 nurses, being impossible to achieve this sample and getting a total of 319 GPs responses and 285 nurses responses.

PHC staff results were compared by Chi squared test, and odds ratio (O.R) by the risk of the mentioned test (95% confidence interval (CI)). Categorizing the results of some items by PHC areas, sex, age range and professional status.
The protocol was approved by the Madrid Central Commission for research and the Ethical committee of the Alcorcon Hospital, Madrid (Spain).

5.7.4 Results

A total of 319 GPs (76.50% females) and 285 nurses (88.40% females) with 23.68±8.55y and 25.51±10.84y, of PHC career experience, respectively, answered each questionnaire. For GPs, the predominant age range was 51-60y (48.6% of total sample). 87.0% of respondents were permanent staff in their PHC settings. The percentage responses by the seven areas of PHC System in the region of Madrid were: 22.6% Center, 11.9% South-East, 15.4% North, 14.4% Nort-West, 12.2% South, 18.5% East and 5.0%West.

For nurses, the predominant age range was 51-60y (42.1% of total sample). According to the seven areas of Madrid PHC System, the percentage of answers was: 20.4% East, 20.0% Center, 14.0% Nort-West, 13.0% North, 11.6% South, 13.3% South-East, 7.7% West. 66.3% of respondents were permanent category staff.
In both groups, response rate was highest in the Central and East Healthcare area and lowest in the West Healthcare area.
More than 99.0% PHC professionals admitted health preventive benefits related to PA and exercise, although, only the 63.0-75.7% considered it good for all adults independently of age and sex.

Only 14.7% of GPs knew current WHO PA recommendations against 75.7% of nurses. In spite of the lack of PA guidelines knowledge, more than 80.15% (78.1% GPs and 82.8% nurses) recognized to be physically active. Besides, according to the Transtheorical model, more than 79.5% of PHC staff (81.5% GPs and 77.5% nurses) showed to be in the last stage of the change behavior model, maintaining the PAP routine with their patients since more than 6 months.
Both PHC professionals were more confident in the self-perception knowledge to promote PA 70.85%, (71.5% GPs and 70.2% nurses) than to prescribe exercise 39.8%,

(44.2% GPs and 35.4% nurses, p= 0.02), with no significant differences between both professionals for non self-perception knowledge for PAP (55.8% GPs and 64.6% nurses).

All the PHC staff assessed, showed predisposition to lead PAP in their PHC settings (83.4% GPs and 94.0% of nurses); however, there were significant differences for not wanting to lead PA promotion (16.6% GPs and 6.0% of nurses, p<0.001). Otherwise, the first chosen alternative for GPs was nurses staff (62.0%). For nurses, the main alternative chosen was Sports Scientists (33.3%), with significant differences between both groups for all different professionals proposed (p<0.001). The results between PHC nurses and physicians in the collaboration with all these health professionals: physicians, nurses, psychologists, physiotherapists, nutritionists, sports medicine physicians, sports scientists and school teachers about PA promotion had significant differences when the results were categorized by age range and professional status (p<0.001), having the physicians 98.6% (OR: 1.986) more than probability to collaborate with all of them than nurses. Categorized by sex, the physicians have 8.8% (OR: 1.098) more than probability to collaborate with all professionals than nurses. Nonetheless, 62.30% of both PHC professionals showed predisposition to collaborate in PA promotion with sports scientists, among other professionals. Concretely, the 61.1% of GPs and 63.5% of nurses, being the first option chosen for GPs, their colleagues PHC nurses (91.2%) and for nurses, the health professionals Physiotherapists (87.0%).

There are significant differences too for exercise prescription between both PHC professionals, the first chosen alternative for GPs was nurses (32.9%) and for nurses was Sports Scientists (25.3%) (p= 0,003).

There was significant differences between GPs and nurses, Categorized by PHC areas in South-East (p<0.01) and West (p<0.05). The results between both PHC respondents in the collaboration with: physicians, nurses, psychologists, physiotherapists, nutritionists, sports medicine physicians, sports scientists and school teachers for exercise prescription categorizing the results by age range, professional status and sex had significant differences (p< 0.001), having the physicians 98.7% (OR: 1.987) more than probability to collaborate with all them than nurses. In addition, there was consensus in the collaboration for exercise prescriptions with sports scientists (64.25% mean for both), without significant differences between both PHC professionals categorized by sex, PHC area and only in the range age of 41-50 years (p<0.05). Being the best option

to collaborate in exercise prescription Physiotherapy staff, for both PHC professionals, without significant differences for choosing both professionals mentioned (table 19).

In mean, more than 98.0% of both PHC professionals showed total agree to collaborate with another PAP community resources from the PHC System, moreover, there were some discrepancies between both PHC professionals for the community resources proposed (figure 6).

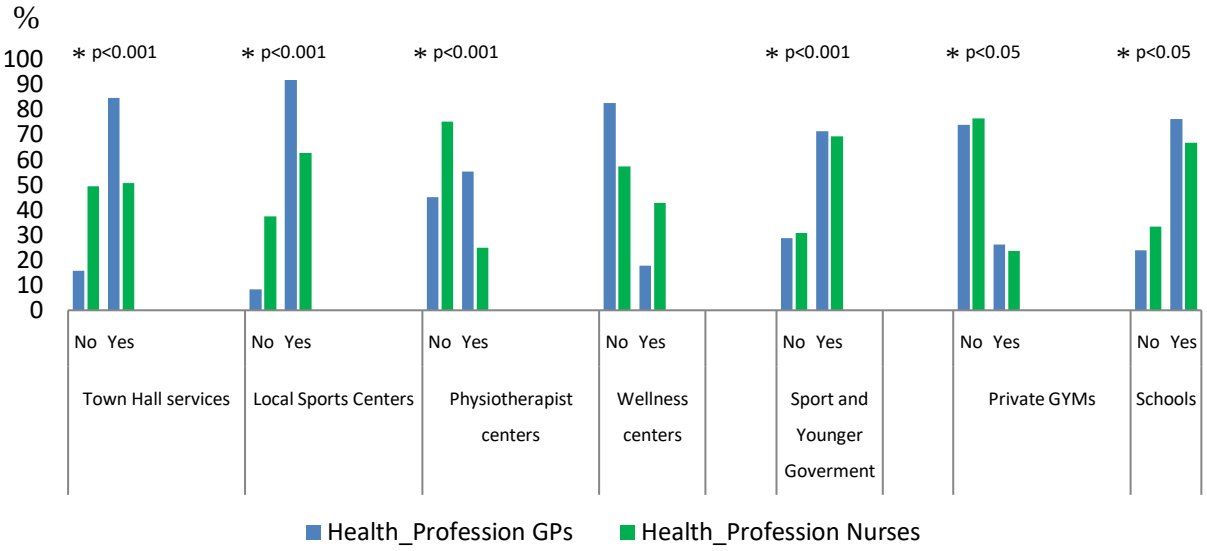


Figure 6. PAP community resources collaboration by healthcare professionals.

Categorized by PHC areas, there are totally agree in Sport and Younger Government, Private Gyms collaboration between both PHC staff and significant differences in the collaboration with Town Hall services ($p<0.001$), Local Sports centers ($p<0.001$), Schools ($p<0.05$), Physiotherapy and Wellness centers ($p<0.001$), in differents ways. The PAP community resources collaboration results categorized by PHC professional category (Figure 7), age range (Figure 8) and sex (Figure 9), the physicians are more willing to collaborate in PA promotion and exercise prescription with public sports centers than nurses (OR: 6.140; $p<0.001$). There was not significant differences in the collaboration with private gyms, not being accepted by the majority of PHC respondents. Categorized the results by age range, the physicians of 31-40 years have more likely to collaborate with all community resources proposed (Item 18, table 25) than nurses for PA promotion (OR: 3.680; $p<0.05$).

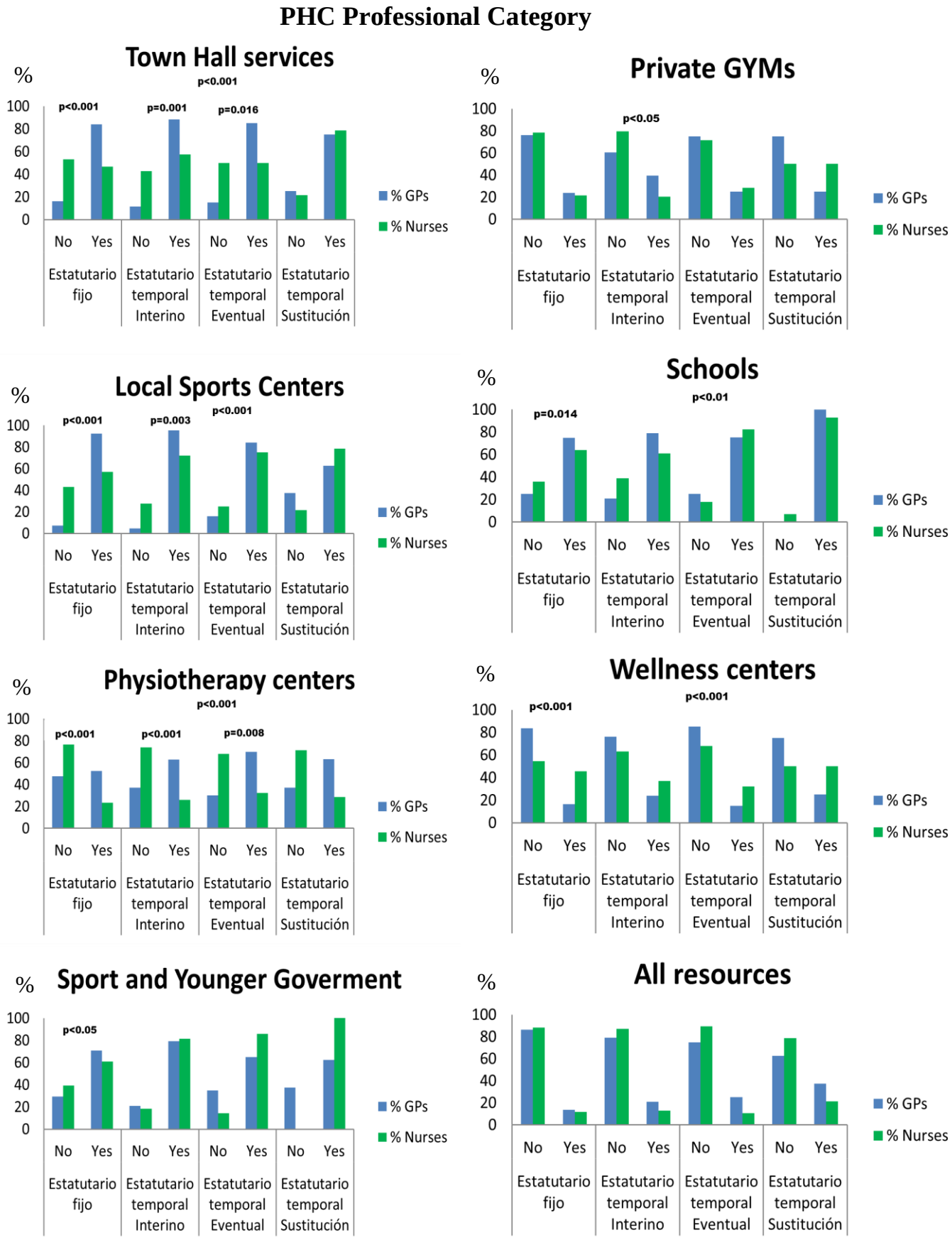


Figure 7. PAP collaboration of GPs and nurses with PAP resources categorized by professional category.

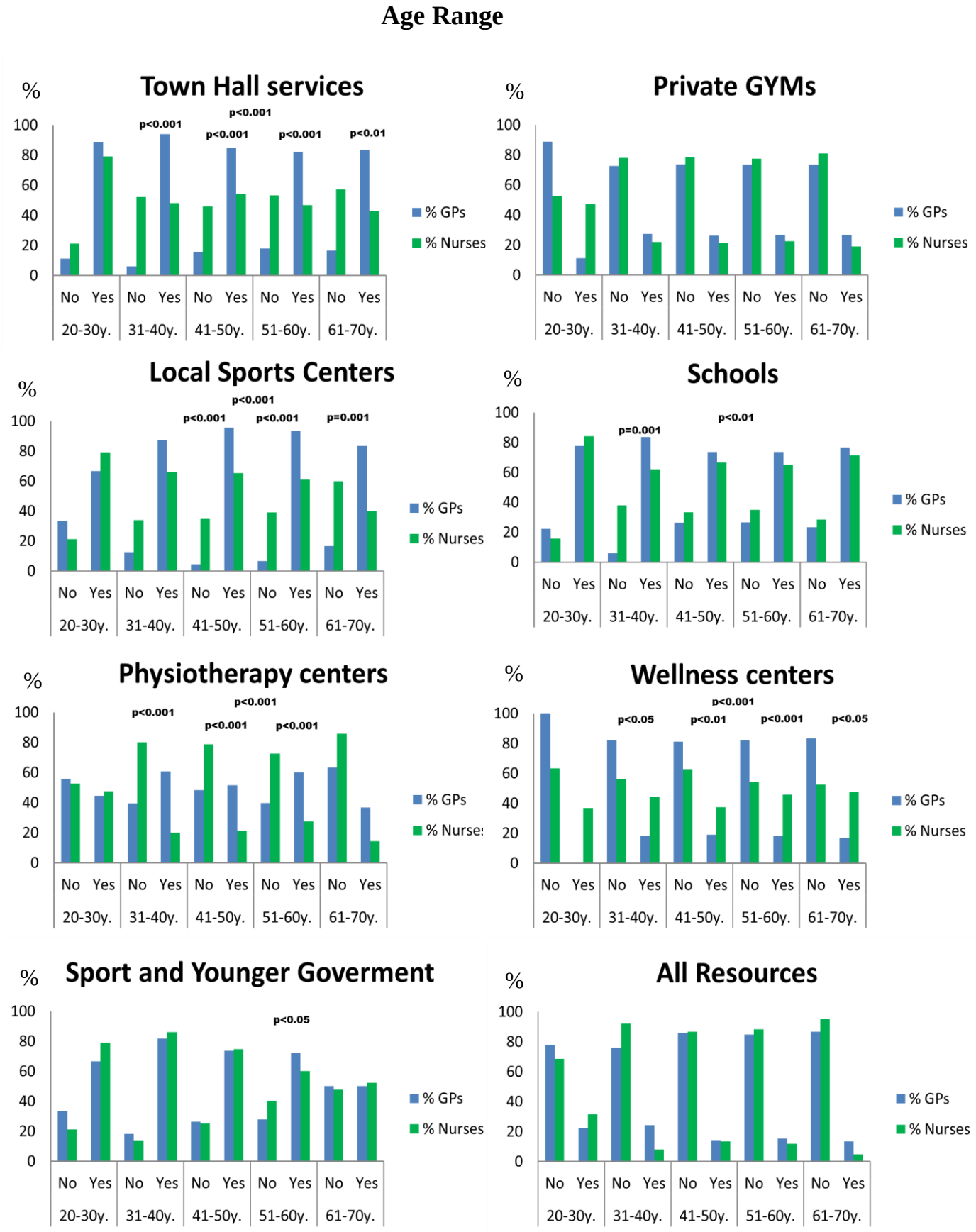


Figure 8. PAP collaboration of GPs and nurses with PAP resources categorized by age range.

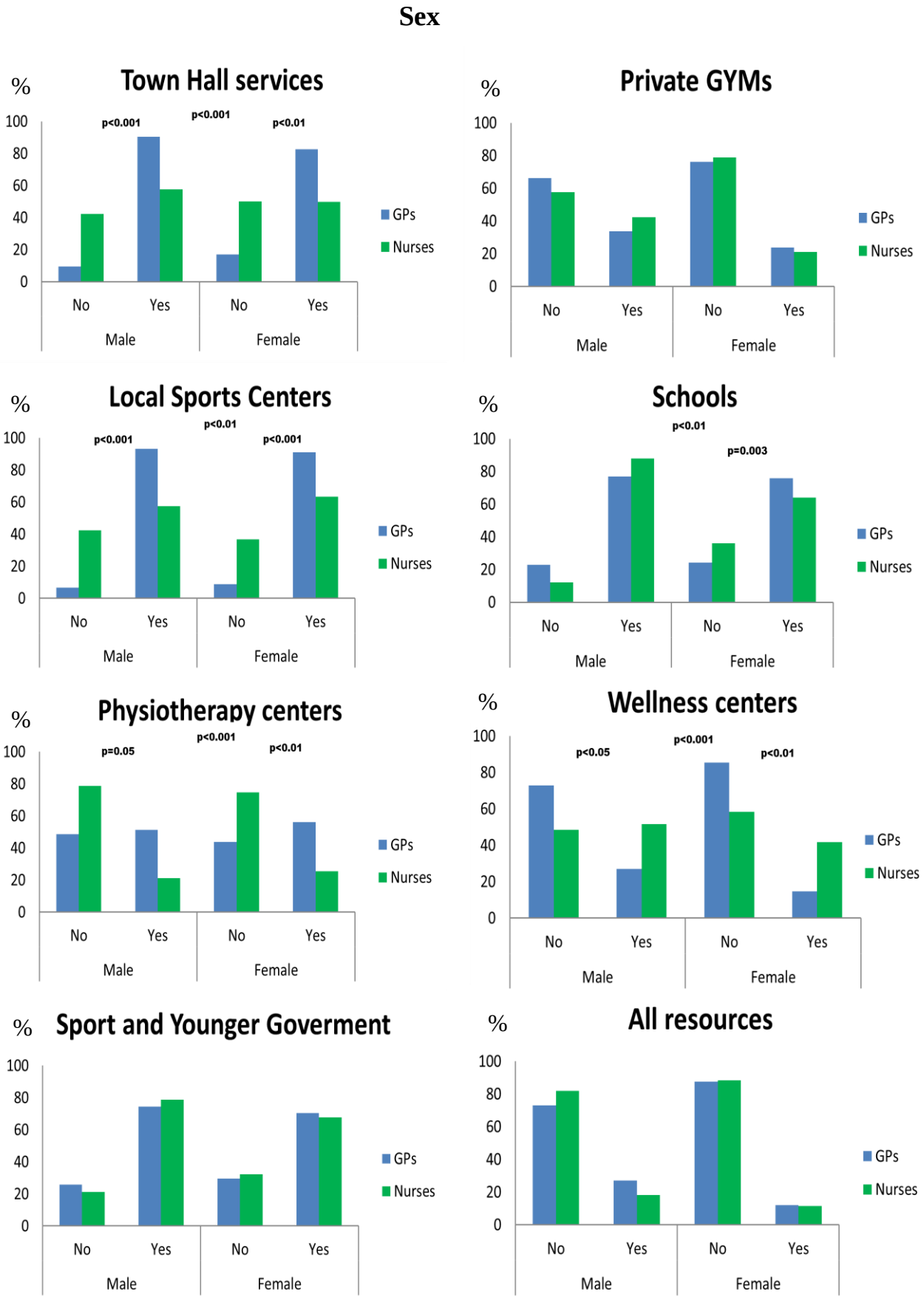
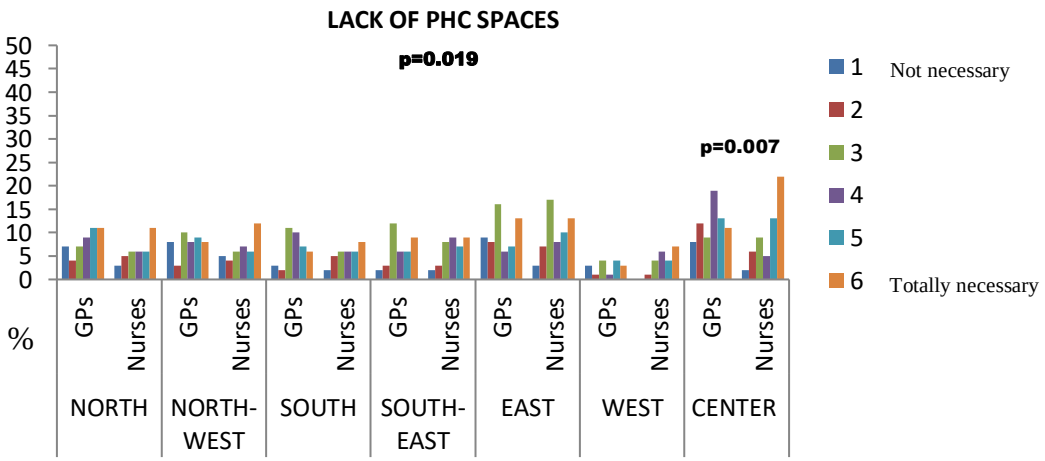
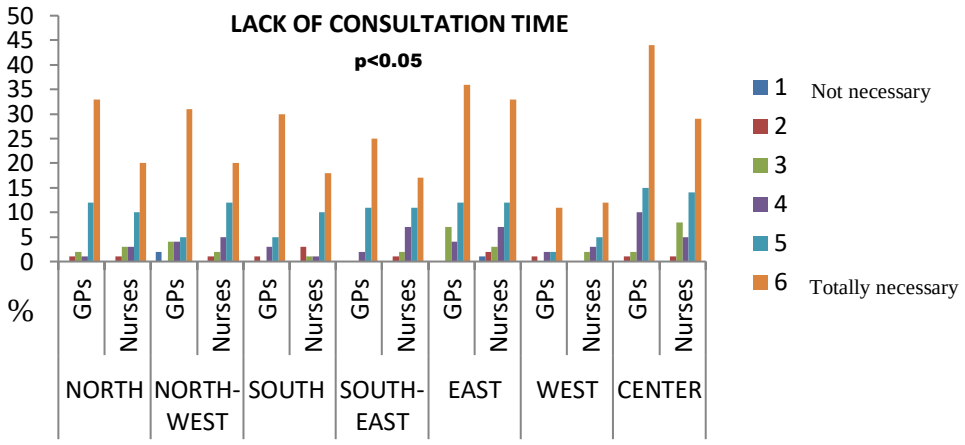


Figure 9. PAP collaboration of GPs and nurses with PAP resources categorized by sex.

The 57.6% of PHC respondents had never done previous PA promotion courses (63.0% GPs and 52.3% nurses, p= 0.006), with a total mean of 1.0±1.8 PA promotion courses for both PHC professionals. Regarding exercise prescription training courses done, 70.4% of all PHC professionals showed no academic training background (72.4% GPs and 68.4% nurses), with a total mean of 0.65±1.5 of exercise prescription courses done for both PHC professionals. In spite, 94.95% of the respondents (93.4% GPs and 96.5% nurses) are interested in PAP training courses and approximately 90% in another training courses. 88.5% in motivational interview (89.0% GPs and 88.0% nurses), 71.0% of PHC professionals in time management (73.7% GPs and 68.3% nurses and only 32.75% (29.2% GPs and 36.3% nurses) in leadership training courses. 22.5% showed satisfaction for all training courses proposed. According to the methodology used in this kind of training courses, 56.9% (54.5% GPs and 59.3% nurses), would prefer mixed methodology than on-line (22.3%) or face to face (19.45%) methodology separately.

According to self-perception barriers to implement PAP in their PHC settings, some differences were observed between both PHC professionals in a choice-modeling 1-6 points Likert scale. For GPs and nurses, respectively, significant differences were observed for the following barriers: lack of space ($p<0.05$); lack of time-management ($p<0.05$) and total agreement for the following barriers: lack of PHC professional awareness, lack of material and economic resources; lack of PAP awareness in patients, lack of use and collaboration with another public external PAP resources. Specifying by areas, is shown in figure 10.




LACK OF CONSULTATION TIME
p<0.05
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GPs
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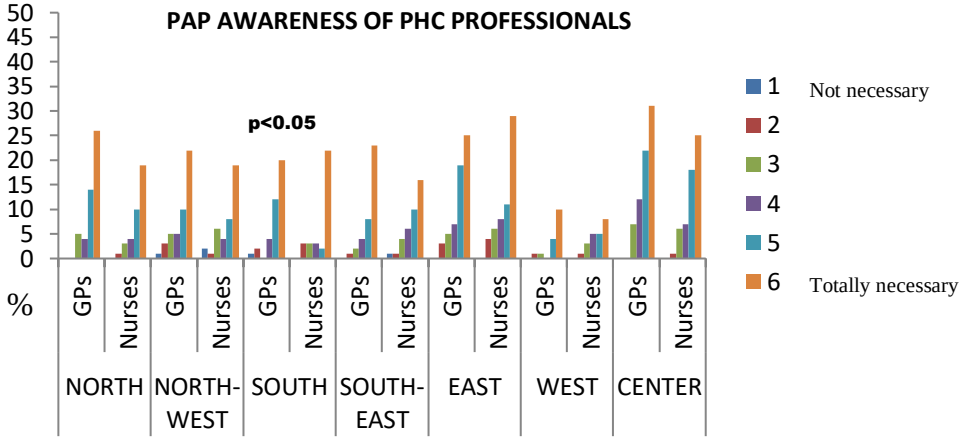
PAP AWARENESS OF PHC PROFESSIONALS
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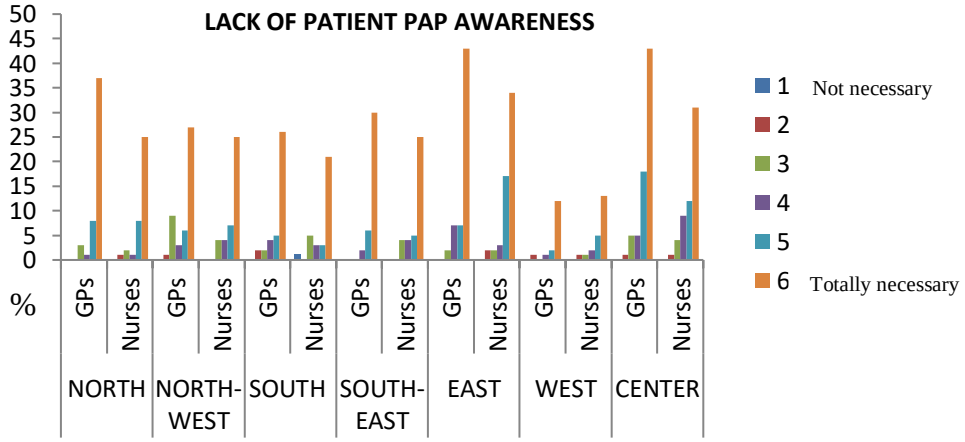
LACK OF PATIENT PAP AWARENESS
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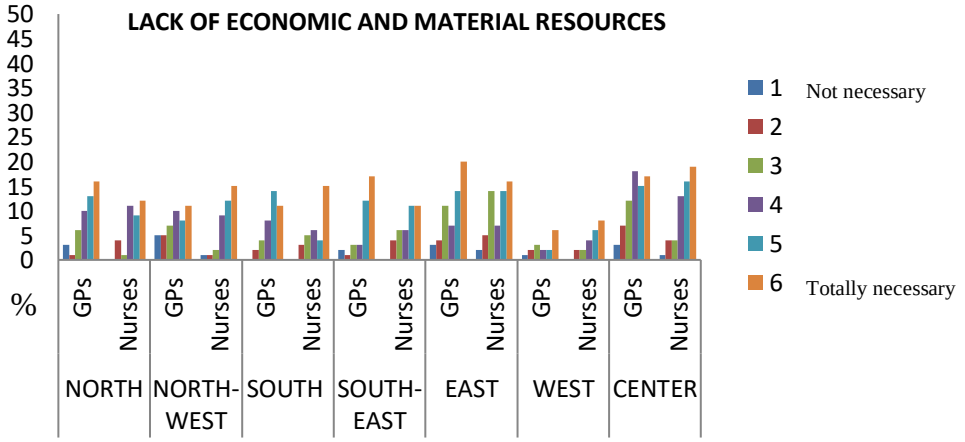
LACK OF ECONOMIC AND MATERIAL RESOURCES
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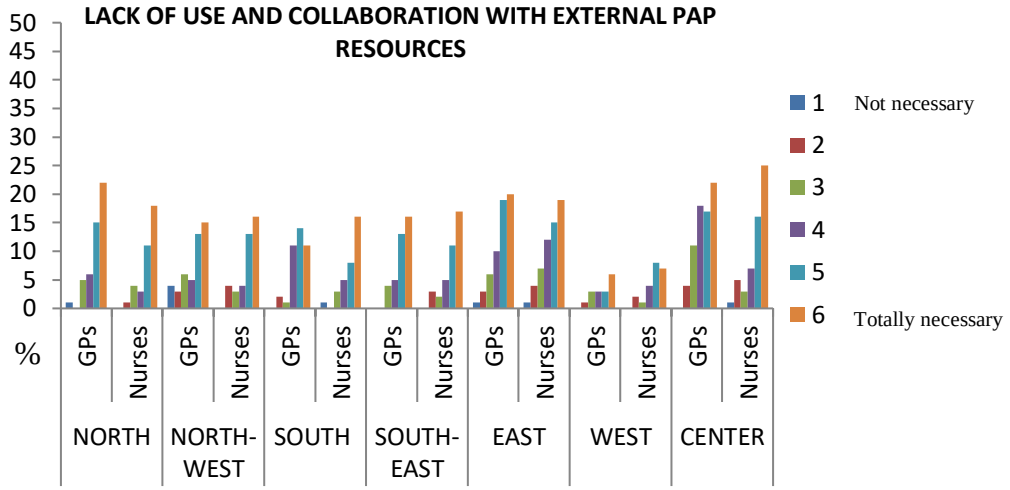
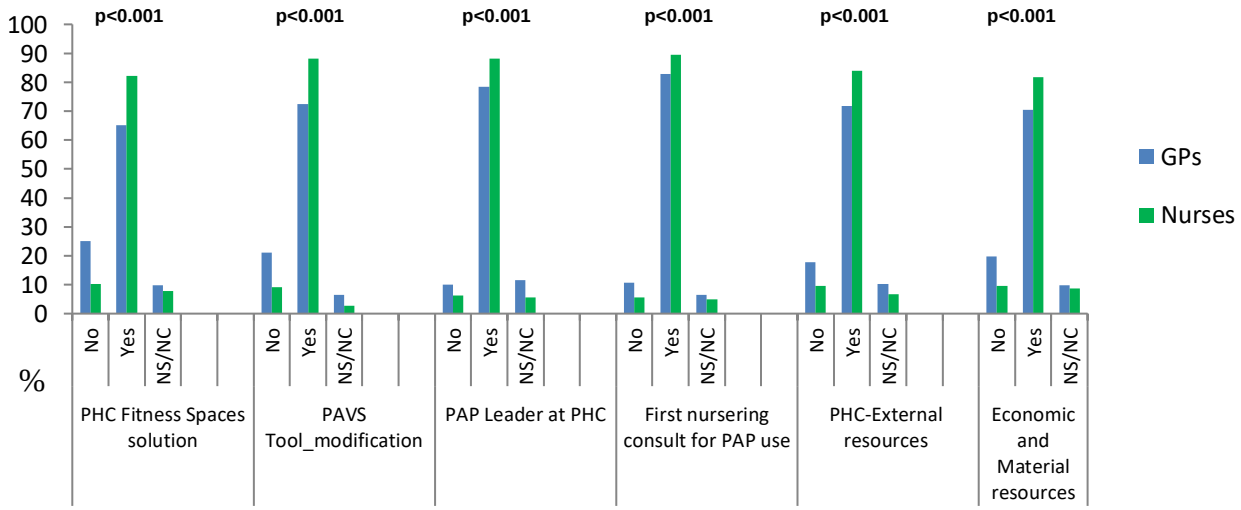


Figure 10. PAP barriers by PHC setting of Madrid.

The selected multi-choice solutions by GPs and nurses, respectively, were: improvement of PAVS tool for anamnesis (Yes: 72.4-88.1%; No: 21.0-9.1%, p<0.001); specific PHC spaces for PAP (Yes: 65.2-82.1%; No: 25.1-10.2%, p<0.001); materials and economic resources improvements (Yes: 70.5-88.1%; No: 21.0-9.1%, p<0.001); PAP leader at PHC (Yes: 78.4-81.8%; No: 10.0-6.3%, p=0.006); PAP use of the first-time visit at PHC (Yes: 82.8-89.5%; No: 10.7-5.6%, p<0.05); collaboration with another public external resources (Yes: 71.8-83.9%; No: 17.9-9.5%, p=0.002). In addition, PAP Networking team, PAP Training courses, PAP Diffusion strategies, Progressive PAP Implantation and to increase Consultation Time are the solutions with maximum consensus among both PHC professionals (more than 90.0% agreement) (figure 11).



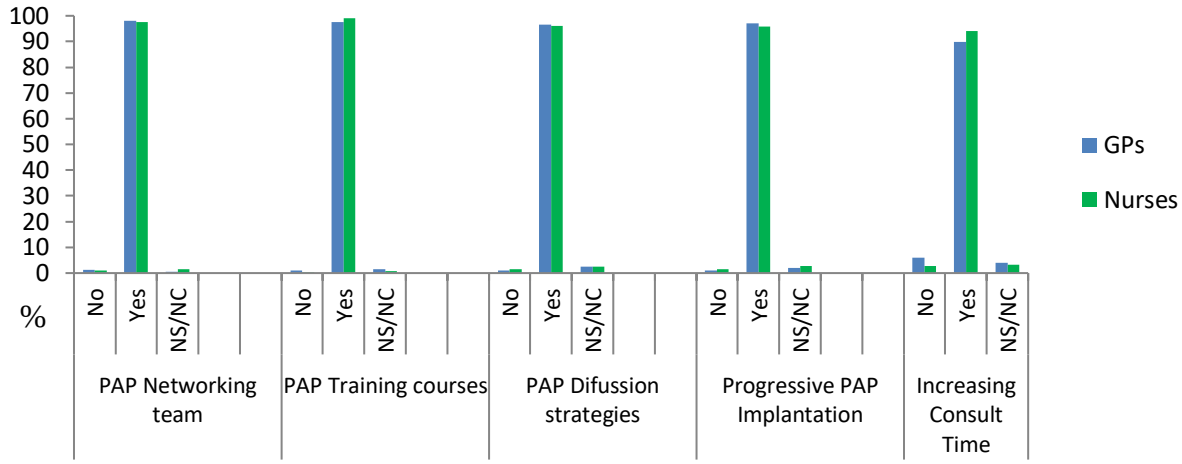


Figure 11. PAP solutions selected by healthcare professionals.

According to α Cronbach test, the reliability for the two choice-modeling, Google-form questionnaires was for GPs 0.84 and 0.87 for nurses.

5.7.5 Discussion

Physical inactivity worldwide has quickly increased in the last years (3, 16, 260) and is considered one of the leading risk factors of morbi-mortality (3-7). Sedentarism is an added health risk, independently of PAL (12, 13). Recent WHO initiatives are focusing to promote of PA at Healthcare settings, implementing PA and exercise as a non-pharmacological prevention and rehabilitation treatment (139). Data published in the literature indicates that less than one-third of physicians are using PAP counseling(112, 117). This results are lower when patients are asked (281). In contrast, the 81.5% PHC physicians analyzed in our study showed that they maintain the PAP counseling with their patients since more than 6 months. These results are in contrast to lower exercise prescription levels shown by other authors (111, 117, 173).

Some studies have tried to analyze the PHC context to implement PAP in PHC settings without positive results (100, 101, 104, 111, 151, 199, 263). In this way, the analysis of PAP self-perception of two of the most important PHC providers done in the Region of Madrid has shown more than 99% agreement with PAP implementation. To the best of our knowledge, this is the first study providing detailed data related to this issue in Spain, such as was done in 2012 in Germany (283).

Physically active behavior was assessed in both professionals, trying to observe if it has some influence for their patients such as has been indicated in the scientific literature

(120). But the data shown by the respondents were not reliable because most of them did not know the recent PA recommendations to be considered physically active or not. Nonetheless, the higher awareness in PA preventive benefits, the use of PAP from more than 6 months ago showed for PHC professionals and the self-reported physically active behavior recognized for PHC staff, in spite of different knowledge of GPs (14.7%) and nurses (75.7%). the lack of current WHO PA guidelines by PHC staff had been shown too in the survey study recently done by Freene et al. in Australia (288).

In addition, both PHC professionals showed a more self-confident attitude to promote PA (70.85%) than to prescribe exercise (39.8%). In contrast, both assume PAP leadership roles (83.4% GPs and 94.0% of nurses) as a potential problem for the future PAP implementation in PHC settings. Otherwise, both of them are interested in enhancing the PAP training skills by training courses in concordance with the necessities shown in other studies (87, 120, 260). The lack of self-confident behavior in exercise prescriptions could be associated with the lack of exercise training knowledge. A mean of 70.4% indicated no exercise training background with a mean of less than 1 exercise prescription course for all PHC professionals during most of the 23 years of mean PHC career experience for the sample analyzed. The exercise training background is not enough such as has been observed by other authors (118, 174, 175, 191). However, all of them showed a good attitude to increase it by training courses.

PHC professionals showed predisposition to collaborate in PA promotion with sports scientists, among other professionals. In spite of Sports Scientists are not officially considered a healthcare professional; however, Sports sciences students seem be more confident prescribing exercise (289) and more aware of and familiar with the exercise is medicine initiative (289) than medical students, perhaps influenced by their degree curriculum such as it was shown in our previous study (118). Some authors indicate about the need of including Sports scientists into PHC System, an aspect also included in the Exercise is Medicine® initiative (4, 263). PHC professionals analyzed in Madrid together regarding to the Exercise is Medicine initiative (4) an open to create a PAP networking team inside and outside PHC settings, but mainly with public resources. In this way, 98.0 % of PHC professionals agreed to the collaboration with another community resources to enhance PAP in the PHC System, even although, both groups were interested in creating a PAP networking with other professionals and institutions with the aim to increase efficiency to prevent NCDs, according to the Exercise is

Medicine initiative (199). Local sports centers were the first option for GPs (94.6%) and nurses (94.7%) in the implementation of PAP with PHC setting, in contrast to 58.8% and 55.2% of nurses that chose Physiotherapist centers, also, Town Hall services (mean of 82.9% for both PHC professionals) and school institutions (mean of 72.6% for both PHC professionals) were another community resources chosen by PHC staff to implement PAP efficiently.

The good predisposition in the collaboration with sports clubs is not only for the physicians of Spain. It has been shown previously in a German survey cohort study developed by Bock et al. (283). Our results show that awareness of physicians in the PAP collaboration with Sports centers is greater than of nurses for a future PAP implementation following the Exercise is medicine key lines.

Regarding the self-perception of PHC staff, all barriers proposed should be considered as a priority, with total consensus in lack of professional awareness, lack of material and economic resources; lack of PAP awareness in patients, lack of use and collaboration with another public external PAP resources such as had been shown by other survey studies in other countries (284, 286, 288).

In any case, all measures commented in the focus group sessions, proposed by the Exercise is Medicine initiative (4, 272) and other authors in the scientific literature should be a priority for the efficient implementation of PAP in the Healthcare System (17, 104, 111). The lack of public resources seems to be a reality according to the results offered by PHC respondents. For that reason, such as the respondents and Exercise is Medicine® initiative propose, an efficient PAP implementation could be done creating an interdisciplinary network team and using of other public and private resources (4, 91, 263, 265). PAP awareness as a preventive and non-pharmacological treatment should be a priority in health policies to reduce physical inactivity levels, including sedentary behaviors, to improve health and the quality of life of the world population (97, 116, 136, 274).

Both choice-modeling Google-form questionnaires are validated by experts and could be used to analyzed healthcare providers barriers and facilitators in Spanish healthcare System in a fullest mode than the questionnaire proposed by Desveaux et al. in 2016 (214) or others developed in Australia (288), Nigeria (284) or Germany (283) with physicians. In our study, in spite of the questionnaire was sent out twice, the response rate was lower than expected, but with a similar sample than other studies (283, 285).

Doctors and nurses are usually associated with PA promotion role, but other professions such as psychologists, physiotherapists, school teachers and sports scientists could have more specific knowledge or attitudes to promote PA or use exercise as a treatment to prevent chronic diseases (111). The idea of integrating a PA health provider staff as an interdisciplinary team such as an internal or external community resource for PHC setting should be achieved in the next future years (4). In this sense, sports scientists could be the more willing and with more PAP knowledge to implement exercise treatments in healthcare settings (118, 287, 289). This study shows the perspectives of PHC nurses and physicians about PAP, giving the opportunity to stimulate the implementation of Exercise is Medicine® initiative at PHC settings.

5.7.6 Conclusions

GPs and nurses are conscious of the benefits of exercise on health in spite of the lack of resources and self-perception barriers observed to implement PAP at PHC settings. The collaboration with other professionals and external public resources are the two main facilitators observed in both PHC professionals, especially in physicians.

Some discrepancies were found between both PHC professionals to implement PAP which indicate the specificity of PHC professionals for a future PAP implementation.

According to our results, it is necessary to improve knowledge of GPs and nurses, design a procedure, identify the professionals who should assume a leader role working with other professionals in a multidisciplinary or interdisciplinary team, creating specific spaces at PHC for implementing Exercise is Medicine® initiative properly in the Region of Madrid.

Additionally, the validated questionnaire developed in this thesis could be used to assess the PAP self-perception barriers of other PHC Systems, as the first dimension assessment in the PAP implementation at PHC settings.

Limitations: It cannot be excluded that PHC staff with more affinity for PAP implementation was more likely to participate in the survey.

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5.8 ARTICLE 8: ASSESSMENT DESIGN OF PHYSICAL ACTIVITY AND SEDENTARY PATTERNS AS A VITAL SIGN ANAMNESIS FOR PRIMARY HEALTHCARE SETTINGS

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This article has not been submitted yet.

5.8.1 Abstract

Introduction: Physical inactivity is a leading risk factor for chronic diseases. Exercise is Medicine® proposes to measure physical activity level (PAL) at Primary Health-Care (PHC) settings by means of the Physical Activity Vital Sign (PAVS) survey. The aim of this pilot study was to compare PAL obtained by PAVS with International Physical Activity questionnaire (IPAQ) questionnaire and accelerometer data.

Material and methods: Study-1: PAL for two people were registered by accelerometer during 7 days. One participant wore a ND-wrist (90Hz and 60 epoch) and two right-hip placement accelerometers (30-90Hz and 15-60 epoch, respectively) and another one, wore two right-hip accelerometers (30-90Hz and 30-60 epoch). Different cut-points were used to measure PAL. Study-2, four cancer patients were monitored during 7 days with a right-hip accelerometer, using the cut-point of Freedson et al., 1998 to compare PAL against the IPAQ and PAVS questionnaires. One factor ANOVA and repeated measures T-test analysis were performed with IBM SPSS statistics software (v24).

Results: In Study-1, the 7day accelerometer period time registered offered a great variability of results, depending of selected cut-points and placement used (wrist/right-hip). The same epoch register showed similar data using Freedson et al., 1998 and Troiano et al., 2008 cut-off points, with different frequencies (90 versus 30 Hz) and rising PAL by Sasaki et al., 2011 cut-off point. In Study-2, the mean time of moderate-vigorous PAL by accelerometer (242 min/week) was a higher than the PAVS questionnaire (207 min/week), and lower than the IPAQ (452 min/week).

Conclusion: Current methodology used misclassifies PAL in patients. There is a need to develop specific methodology to measure PAL at PHC.

Key words: Exercise Therapy, sports medicine, physical activity, sedentary behavior, health promotion, public health.

5.8.2 Introduction

According to WHO, physical inactivity is the fourth leading risk factor for all cause global mortality (136, 157) and associated with a range of non-communicable chronic diseases (NCDs) (2, 102, 157). The benefits of exercise are well established (10, 290). A well-applied physical stimulus contributes to decrease the risk of suffering at least 35 unhealthy conditions (9) and to treat 26 different kinds of NCDs (10), in total, until 40 NCDs could be prevented and treated by physical activity on prescription (PAP) (66).

Otherwise, hospitalized patients on bed rest can lose nearly 1 kg/day of muscle (75). Muscle mass, an endocrine organ in human body, has an important role on health and could be used as preventive resource in chronic diseases (75). However, chronic patients and people in general are getting much more sedentary year after year (3, 16), knowing that physical inactivity per se, independent of energy balance, produces negative metabolic effects (13). Additionally, higher uninterrupted time sitting is related to adverse health conditions and is considered an independent health risk factor (12). Increased physical activity levels (PAL) attenuate, but do not eliminate the risk associated to sedentary time (188, 219). There is a lot of evidence for proposing exercise as a non-pharmacological treatment in the Healthcare sector (76). However, in spite of its cost-effectiveness, it is not being used for disease prevention and treatment in Healthcare settings (66). Besides, only one-third of patients are counselled with PA recommendations by their healthcare professionals (117).

Health promotion policies are trying to promote physical activity, also at Healthcare settings (138), to reduce physical inactivity levels at least 10% by 2020 (137) and 15% for adults and adolescents by 2030 (139). Current analysis of PA and sedentary patterns in Primary Health-Care (PHC) patients cause distrust and unsuccessful utility (19, 104, 122). Nonetheless, PA patterns of patients at PHC settings should be another vital sign to be measured such as blood pressure, glucose levels, heart rate level, among others. This is needed for an effective diagnosis and disease treatment, because PAP effects have been found at least as effective as drugs in controlling blood glucose, blood lipids, blood pressure, and thrombosis diseases (116).

The use of PAL screening tools to identify active or inactive patterns in patients is essential to improve PAP programs at Healthcare settings (122). However, there is not a consensus in the Spanish Healthcare System regarding the method (122) and regarding the accurateness of the measurements (291). Besides, there are doubts about the

usefulness of accelerometers considered as the gold standard method. Some authors have observed that it is not possible to know the prevalence of meeting PA guidelines based on the accelerometer methodology (131). A recent systematic review has shown that few fitness apps have been empirically tested, and among those that have, not all were valid or reliable to measure fitness levels (292). Even although, the methodologies used in this pilot study had been previously validated and accepted, such as the Physical Activity Vital Sign (PAVS) (40, 41, 291) or the International Physical Activity Questionnaire (IPAQ) (293). The aim of this study was to check the accuracy of PAVS questionnaire compared with IPAQ with objectively measured PAL by accelerometer as a pilot study to implement PAL in the anamnesis of PHC settings.

5.8.3 Materials and Methods

A review of the scientific literature for the analysis of Accelerometer Data Collection and processing criteria to assess PA and sedentary behaviors by ActiGraph accelerometer method published previously by Migueles et al., in a systematic review of 2017 (130), was considered for the methodology process of our study. Besides, a previous survey validation of PAVS with a 1 axis- accelerometer in clinical staff was considered for this project, too, (291). Additional literature comparing questionnaires, in similar conditions with a triaxial Actigraph accelerometer (294) was also considered.

A brief explanation of the study was done and written informed consent was obtained from the participants. The anonymity of answers and data were guaranteed according to the Declaration of Helsinki and Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

Two studies were performed. In the first study, two subjects, wore during 7 days a triaxial accelerometer (ActiGraph wGT3X-BT, Pensacola, FL, USA). Subject 1 (male sex, aged 35y and 76 Kg of body weight) wore a ND-wrist (90Hz and 60 epoch) and two right-hip placement accelerometer (30Hz and 15 epoch and 90Hz and 60 epoch, respectively). Subject 2 (male sex, aged 33y and 85 Kg of body weight), wore a two right-hip placement accelerometer (90Hz and 60 epoch and 30Hz and 60 epoch, respectively).

Sedentary time and different intensities of PA (light, moderate and vigorous) were measured by vector magnitude (VMCounts) according to cut-points proposed by Freedson et al., 1998; Troiano et al., 2008 and Sasaki et al., 2011.

In study 2, four survival cancer patients were monitored by 7-d right-hip accelerometer (ActiGraph wGT3X-BT, Pensacola, FL, USA) using the cut-point proposed by Freedson et al., 1998, at 10 seconds epoch and programmed initially to 30 Hz frequency. Subjects answered the PAVS from Exercise is Medicine survey (http://www.exerciseismedicine.org/assets/page_documents/Complete_HCP_Action_Guide.pdf, appendix B and appendix 9 of this Ph.D. Thesis) and the IPAQ Portuguese short version (http://rbafs.org.br/RBAFS/article/download/931/1222/, p. 12-13. appendix 10 of this thesis), the last one, used with cancer survivor patients by a Portuguese native speaker, immediately after the 7-d accelerometer period, in order to standardize the methodology. In both studies, there were not water-based activities registered.

Non-wear time was defined as at least 60 consecutive minutes of 0 counts. At least 2 weekend day and 5 week days, for a minimum of 10 hours per day are needed to register the data. Accelerometer data were downloaded using ActiLife software version 5.7.0 (ActiGraph).

One factor ANOVA and repeated measures T-test analysis was done with the IBM SPSS statistics software (SPSS, version 21.0; SPSS, Chicago, IL, USA). Values of $p<0.05$ were considered statistically significant (95%CI).

5.8.4 Results

In study-1, subject-1, shows in the same 7d accelerometer period time a great variability of results, mainly if the selected cut-point in the non-dominant wrist (ND-Wrist) is compared with right-hip placement (Figure 12).

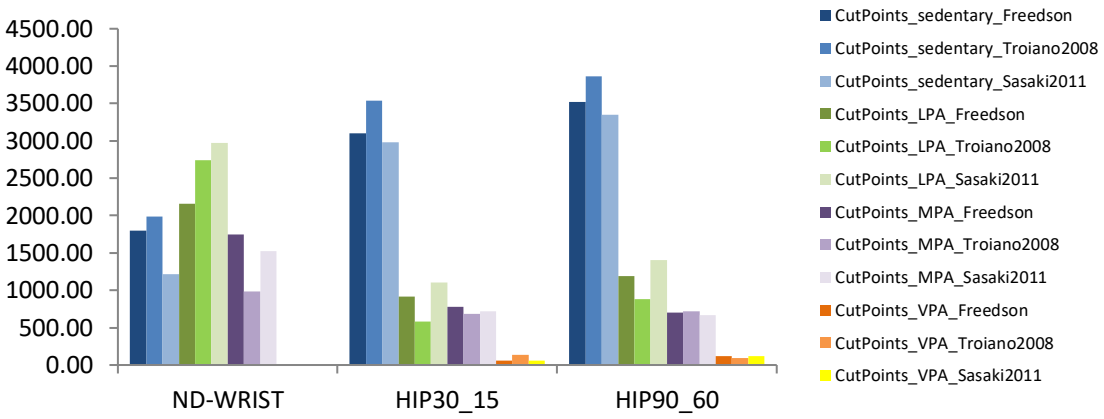

Figure 12. Total minutes per week of physical activity and sedentary time for Subject-1.

LPA: Light Physical Activity; MPA: Moderate Physical Activity; VPA: Vigorous Physical Activity.

The same data registered in subject 2, with the same epoch register, are similar when using cut-off points proposed by Freedson et al., (1998) and Troiano et al., (2008), with opposite frequency register (90 versus 30 Hz). Increasing PAL are observed with cut-off point proposed by Sasaki et al., (2011), especially in light intensity and reduced sedentary levels respect to the other authors (Figure 13).

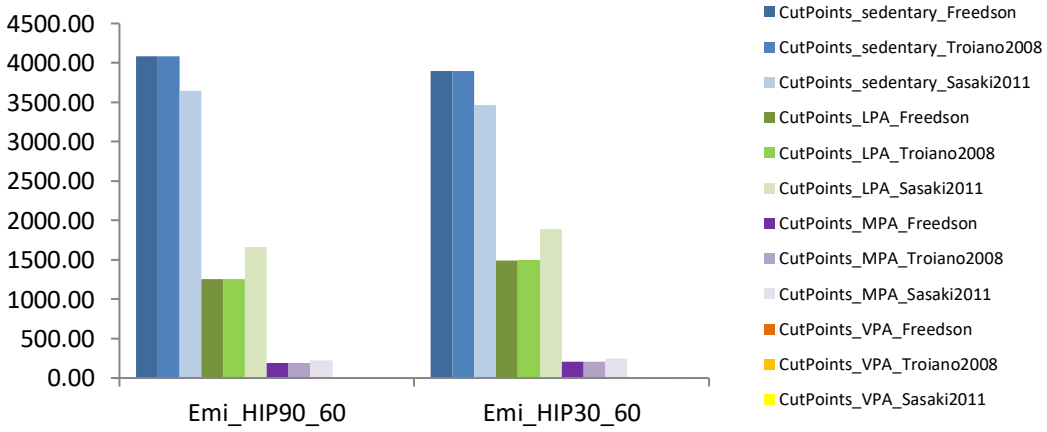

Figure 13. Total minutes per week of physical activity and sedentary time for Subject-2.

LPA: Light Physical Activity; MPA: Moderate Physical Activity; VPA: Vigorous Physical Activity.

Both participant show different PAL per week (Figure 14).

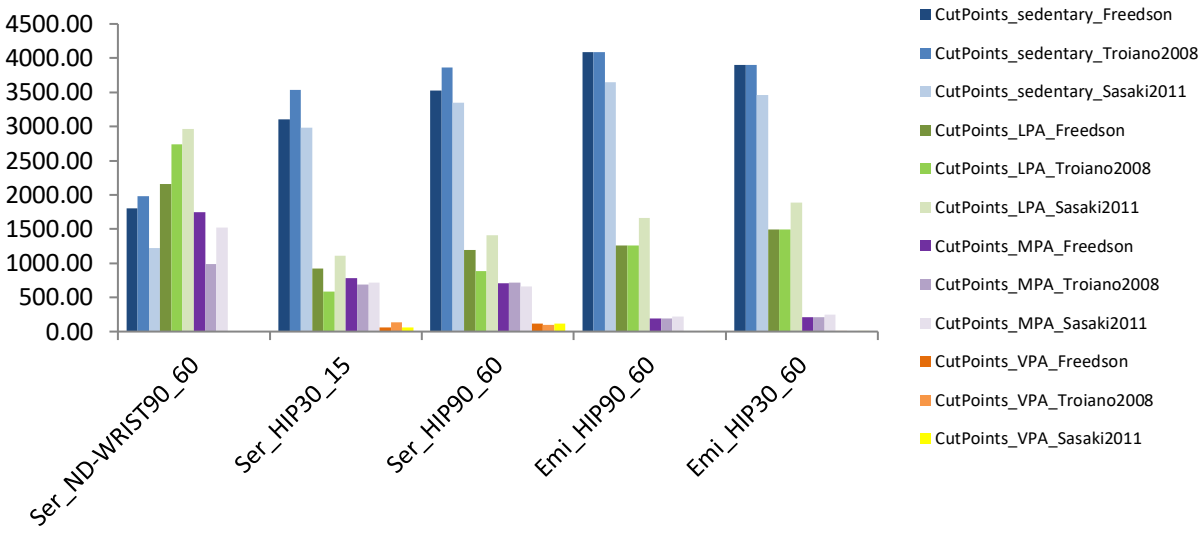

Figure 14. Total minutes per week of physical activity and sedentary time for subject-1 and 2.

Descriptive results of both participants are shown in table 26.

Table 26. Summarized total minutes per week of physical activity and sedentary time for subject 1 and 2.

	Cutoff points											
	Sedentary			Physical Activity								
				LPA			MPA			VPA		
Placement	Freedson et al., 1998	Troiano et al., 2008	Sasaki et al., 2011	Freedson et al., 1998	Troiano et al., 2008	Sasaki et al., 2011	Freedson et al., 1998	Troiano et al., 2008	Sasaki et al., 2011	Freedson et al., 1998	Troiano et al., 2008	Sasaki et al., 2011
Ser_ND-WRIST	1801.0	1983.0	1219.0	2161.0	2738.0	2968.0	1747.0	988.0	1522.0	0.0	0.0	0.0
Ser_HIP 30_15	3104.2	3533.5	2978.0	918.5	582.5	1105.2	777.5	685.5	717.0	57.2	139.5	57.2
Ser_HIP 90_60	3524.0	3860.0	3347.0	1191.0	883.0	1408.0	703.0	718.0	663.0	117.0	96.0	117.0
Emi_HIP 90_60	4087.0	4087.0	3643.0	1255.0	1258.0	1663.0	193.0	190.0	223.0	0.0	0.0	6.0
Emi_HIP 30_60	3898.0	3898.0	3464.0	1494.0	1496.0	1886.0	210.0	210.0	245.0	2.0	0.0	9.0

LPA: Light Physical Activity; MPA: Moderate Physical Activity; VPA: Vigorous Physical Activity. 30_15: 30 Hz/ 15sec epoch; 90_60: 90 Hz/ 60sec epoch; 30_60: 30 Hz/ 60sec epoch.

Comparing PAL using the three authors cut-points above mentioned by two different epoch processing data (15sec. vs. 60 sec.) as comparing variable, there are not significant differences, in spite of the different values registered and neither when the

data was analyzed between frequency (30Hz vs. 90Hz). Mean differences between both participants are shown in table 26.

In study-2, the results for the 4survival cancer patients monitored by 7-d right-hip accelerometer according to the Freedson et al., (1998) cut-point, show that the mean results of MVPA are higher than the PAVS-Exercise is Medicine survey and lower than the IPAQ Portuguese short version, with more than the double value from the lowest to the highest (Table 27).

Table 27. Summarized total minutes per week of different kind of physical activity and sedentary time by three different methods (IPAQ, PAVS and ActiGraph accelerometer).

	IPAQ					PAVS		ActiGraph			
Parti-cipant	Sedentary Time	Walking Time	MPA Time	VPA Time	MVPA Time	MVPA Time	Sedentary Time	Light Time	MPA Time	VPA Time	MVPA Time
1	630.0	240.0	180.0	20.0	200.0	210.0	2578.8	1125.0	291.8	0.3	292.1
2	1260.0	840.0	420.0	140.0	560.0	380.0	4142.5	1100.1	235.0	1.3	236.3
3	1260.0	840.0	0.0	120.0	120.0	120.0	2019.8	664.1	279.8	5.1	285.0
4	1260.0	0.0	900.0	30.0	930.0	120.0	4467.3	1823.0	151.1	6.5	157.6
Mean	1102.5	480.0	375.0	77.5	452.5	207.5	3302.1	1178.0	239.4	3.3	242.7

LPA: Light Physical Activity; MPA: Moderate Physical Activity; VPA: Vigorous Physical Activity.

Comparing the data, there are no significant differences between MVPA by the three methods. On the contrary, significant differences in sedentary behavior were observed comparing the accelerometer data with IPAQ questionnaire (Table 28 y 29).

Table 28. Comparing data of total minutes per week of different kind of physical activity and sedentary time by three different methods (IPAQ, PAVS and ActiGraph accelerometer).

	Sedentary behavior (Mean ±SD)		MVPA Physical Activity behavior (Mean ±SD)			
	IPAQ Vs ACEL.	p	IPAQ Vs PAVS	IPAQ Vs ACEL.	PAVS Vs ACEL.	p
Cancer survive patients (n=4)	-2199.6 ±1098.1	0.028*	245.0 ±386.6	209.7 ±432.4	-35.2 ±130.4	p>0.05

LPA: Light Physical Activity; MPA: Moderate Physical Activity; VPA: Vigorous Physical Activity. Acel.: accelerometer. I.C. confident interval;
***** p<0.05

Table 29. Descriptive data of total minutes per week of different kind of physical activity and sedentary time by three different methods (IPAQ, PAVS and ActiGraph accelerometer).

	Sedentary bahavior (Mean ±SD)		MVPA Physical Activity behavior (Mean ±SD)		
	ACCEL.	IPAQ	IPAQ	PAVS	ACCEL.
Cancer survive patients (n=4)	3302.1 ±1187.6	1102.5 ±315.0	452.5 ±371.4	207.5 ±122.5	242.7 ±61.9

LPA: Light Physical Activity; MPA: Moderate Physical Activity; VPA: Vigorous Physical Activity. ACCEL.: accelerometer.

The mean time to answer PAVS questionnaire was 1.75 minutes against the 3.25 minutes to answer IPAQ questionnaire.

5.8.5 Discussion

The current short PA questionnaire (BFAQ) used in the Spanish PHC System to measure PAL has been analysed and validated but has also been questioned (122). In the scientific literature some validations between PA questionnaires and objectively measured PA by accelerometer have been made independently by uniaxial (291) or triaxial accelerometers (294). In some cases, without specifying the Hz frequency of the register and with low correlation coefficients in a particular variable analyzed (291, 294). Observing the variability of the data according to the process followed, more specificity in the methodology should be considered to analyze PAL and sedentary levels of patients in a PHC screening. Besides, recently, Guo et al. compared PAL between accelerometer and questionnaire in a sample of 78947 UK Biobank participants. They observed a high correlation between PAL measured by accelerometer and body composition (270). The stronger associations between PAL and adiposity with objectively measured PA than with self-reported PA questionnaires should emphasise the need to incorporate objective measures in future clinical studies (270).

The Exercise is Medicine® PAVS survey seems not adequate to measure correctly PAL compared with the accelerometer methodology. This pilot study with a reduced sample,

has checked the variability of the results on sedentarism and PAL with all the methods analyzed. In addition, PAL measured by accelerometer, considered the gold standard method, depends considerably of all variables considered in the previous set up and the method chosen during the software processing data. For that reason, both methods should be actually reviewed before implementing a new PAL screening tool at PHC settings in Spain or at least until having a PHC consensus to choose the same protocol in the healthcare System for a long time.

The mean time calculated to respond PAVS was 1.75 minutes against the < 30 seconds that propose Ball et al. (40); in any case, less than the 3.25 minutes time in the mean to answer IPAQ short Portuguese version, but the accuracy of PAL data obtained would be less reliable than measured objectively by accelerometer (270).

The PAVS should be evaluated further for repeatability with a greater sample and a consensus regarding the accelerometer methodology, to be established in PHC centers, knowing the importance of sedentarism and PAL of patients as a vital health status. In this sense, healthcare providers could offer exercise guidelines and referral to their NCDs patients producing well-known health benefits and better quality of life in their treatments.

In our study we have observed that the sedentary or PA pattern, according to worldwide PA guidelines (295), could be being assessed in an inadequate way due to the previous variables established and the methodological screening tool chosen by the health provider, in concordance with the doubts published by other authors (131, 270).

5.8.6 Conclusions

Analysis of PA and sedentary patterns for patients at PHC settings is quite new and in an initial phase but necessary for further PAP. Physical Activity Vital Sign (PAVS) which includes two questions trying to identify quick and efficiently the physical activity level/pattern in patients could misclassify according to the data obtained. A mobile phone application could be designed to be used by the patient at the same time that PA and sedentary pattern appear in the anamnesis tool of PHC staff. Future researches are needed to propose a consensus for measuring PAL at healthcare settings.

6 INTEGRATIVE DISCUSSION

There is a large evidence about the importance of PA for health, but PAP is still scarcely used by physicians (111). Less than one-third of patients report PAP counseling by their Healthcare professional (117, 195, 281). In contrast, WHO initiatives are trying to increase PA promotion to reduce the physical inactivity levels in the population, focusing the strategies in the Healthcare sector (139). The evidence of health benefits of PA are well known, as a preventive medicine (9, 66) or as a non-pharmacological treatment for at leastl 26 different chronic diseases (10, 76).

In 2011, Pavey et al. showed in their systematic review that health benefits of exercise referral schemes were limited, putting in doubt their value at PHC in PA promotion. However, in their review, they showed much better outcomes when exercise referral schemes were used than usual Primary care (279). In another review done in 2014, Sanchez et al. concluded that several high-quality reviews provided clear evidence of small but positive effects of PAP intervention at PHC settings; however, for a greater effectiveness an implementation improvement is still needed (104). One of the crucial elements for planning and adopting Public Health measures is having precise information available about the health status (296). With these perspectives, we wanted to analyze in this thesis the context of PHC settings to find the main barriers for implementing PAP resources to reduce non-communicable chronic diseases in PHC settings of Region of Madrid.

According to Hill et al. (191), healthcare professionals receive very limited training on exercise science. (173). In this Ph.D. thesis, the PAP knowledge of Spanish Sports Scientists, Nurses and Physicians, counting the total ECTS related to PA promotion and exercise prescription has been objectively measured. Once analyzed, all curriculum degrees seem to be insufficient regarding PAP knowledge, such as has been observed in other studies in the rest of the world (120, 174, 175, 191).

From our point of view, research is focused to find the best strategy to prevent or the best treatment to take care of some chronic diseases but not how to increase healthy lifestyles during our life. Based on physical active lifestyles, adherence rates for exercise programmes and prescriptions have been estimated to range from 50-80% during the first six months and to fall to less than 50% after one year (210). According to Martin-Borras et al. the most relevant barriers to PA adherence have not yet been overcome. However, Eynon et al. published in 2019 a systematic review assessing the

psychosocial factors associated with PAP adherence. They showed that the key factors associated with PAP adherence were intrinsic motivation, psychological need satisfaction, social support, and self-efficacy (144). In the scientific literature, there is a high degree of heterogeneity about how to measure adherence (208) and which factors influence in the total follow-up of PAP counselling. In this Ph.D. thesis, studies that reported adherence to exercise and that were prescribed to chronic patients were reviewed by the 5 dimension adherence model proposed by WHO in 2003 for long-term therapies (90). We thought that the model could get to analyse adherence from a whole and holistic perspective such as in many other studies (114, 115, 200, 216). But according to this model proposed by WHO in 2003 (90), we found that Health system/Healthcare team-factors are less considered in the scientific literature than socioeconomic or personal-related factors. In our opinion, for a good compliance in the treatments prescribed by a Healthcare provider for their patients, a good client-practitioner relationship is necessary such as Carl L. Rogers already showed in 1957 to achieve a constructive personality change in the client (297) and was consistently related to treatment adherence and positive outcomes by Sexton and Whiston in 1994 (298, 299). For that reason, the WHO 5 dimension adherence model could be used to assess the adherence factors related to the PAP treatments proposed at PHC settings to increase the effectiveness of the treatment such as have already proposed Venegas et al. in women with urinary incontinence patients (216). Understanding the variables that influence exercise adherence is one of the most important variables for achieving the effectiveness of exercise treatments at PHC settings.

Predicting factors to PAP adherence have a great variability of considerations to be used at Healthcare settings (205, 217). PA adherence in Healthcare settings is a multidimensional problem without efficient solution until date (206) and probably because it was treated by a reductionist vision. We knew that the 5 dimensions model has been scarcely used for exercise treatments, in contrast, it has been used for pharmacological treatments (114, 115). As we mentioned before and in the same way that Venegas et al in 2018, we wanted to analyse exercise training programmes adherence in dialysis patients according to the 5 dimension adherence model, among others coadjutant recommendations given to chronic patients in healthcare settings (90, 200, 216, 217).

Nevertheless, the use of the 5 dimension adherence model, would help to manage the patient-healthcare professional relationship and could be established to prescribe cost-effective exercise treatments for chronic patients in any Healthcare System. In our binary LR model, socioeconomic-related factors seem not to be associated to exercise adherence levels when these factors are interacting with the rest of factors of the 5 dimensions adherence model. It is different versus previous results shown by other authors treated independently (200, 214, 244). In our binary LR model, the 75% adherence to the exercise training Programme for KCP was 33.20% predicted (ρ= 0.33). The increase of one unit of Therapy-related dimension (measured by symptoms/problems, KDQOL™-36 test) a 7.8% of non-adherence, by one unit of Condition-related dimension (measured by BECK depression test) a 11.8% of non-adherence, and one unit of Patient-related dimension (measured by Emotional well-being, KDQOL™-36 test) the 4.6% of adherence. Finally, for one unit of Patient-related dimension (measured by Self-perceived State-Anxiety, STAI test) a 12.2% of adherence. This was in our knowledge the first time to provide detailed data about how to measure exercise adherence by a binary LR model according to the 5 dimensions adherence model.

Furthermore, this was the first thesis trying to analyse in depth attitudes, self-perception, barriers and facilitators of nurses and physicians towards the implementation of a PAP initiative at PHC settings. For the context development and analysis of this thesis, it had been necessary to develop a rigorous scientific strategy. First of all, focus groups sessions were done in a qualitative study by following semi-structured interviews such as in other countries like Sweden (111) and the Netherlands (265). After that, we analysed the verbatim transcribed sessions by a content analysis system following the recommendations of Persson et al., in the implementation of a Swedish PAP strategy in 2013 (111). By the consensus of the peer-reviewed was designed a choice modelling Google form questionnaire. These ones were sent to a group of 10 experts to be validated with Aiken's V coefficient values higher than 0.75 such as had been shown in previous studies by other authors (277, 278). Finally, the validated questionnaires were sent to all PHC nurses and physicians to get the self-perception about PAP such as had been done in Nigeria (284), Canada (199), Germany (283) or Australia (288) for a future possible implementation of the Exercise is medicine initiative at PHC setting. The results in PA promotion and exercise prescription, comparing the self-perception

between PHC nurses and physicians for a future collaboration within of a interdisciplinary health team integrated by physicians, nurses, psychologists, physiotherapists, nutritionists, sports medicine physicians, sports scientists and school teachers had significant differences when the results were categorized by age range and professional status ($p<0.001$), having the physicians more than 98% of probability to collaborate with all of them than nurses.

Better Physicians predisposition than nurses were shown in the collaboration with other PAP community resources. Categorized by age range, professional status and sex, the physicians are more willing to collaborate in PA promotion and exercise prescription with public sports centers than nurses (OR: 6.140; $p<0.001$). There were not significant differences in the collaboration with private gyms, but it was not accepted by the majority of PHC respondents. These aspects are relevant for a future implementation of the Exercise is Medicine initiative in PHC settings of Madrid. The results of this thesis could be likely similar among other PHC staff and also among the same professionals in other Spanish regions.

Finally, and following this initiative which has our same opinion, PA and sedentary levels should be the two variables measured in the anamnesis of PHC settings as another Vital Sign to design a cost-effective strategy for PAP at Healthcare settings. In this sense, we thought to compare PA and sedentary levels, measured objectively (by accelerometer) or subjectively (by the PAVS-EIM and the IPAQ short version questionnaires), for contributing to the design of a patient anamnesis tool at PHC centers. After the analysis in a small sample, we saw that there is a great variability in the PA and sedentary results obtained, not only comparing the questionnaire data against accelerometer data. The data obtained in the objective accelerometer method has a great variability according to the installing register ordered and according to the raw data processing followed. The variability of our data could be predicted according with the variability in the cut points established in the systematic review of Migueles et al in 2017 (130) or in the study developed one year after showing the different PA and sedentary levels depend on different body-worn attachment sites and acceleration metrics (131). In this way and according to the results of study 8 of this Ph.D. thesis, Future investigation is needed to analyze PA and sedentary levels in patients with the same accuracy and specificity in the methodology process in all PHC patients. After that screening, healthcare providers should promote PA at every consultation with

sedentary and physical inactive patients, to reduce the risk factors related to physical inactivity or sedentary behavior, offering individualized PA guidelines or exercise treatments to PHC patients as a precision medicine resource in the same way that propose other authors (46, 54, 66). The improvement of patients' health and well-being should be achieved through exercise prescriptions and PA counselling from a multidisciplinary or interdisciplinary healthcare team to their patients, inside or outside of PHC settings (4). In this Ph.D. thesis, PHC physicians and nurses do not want to collaborate with private gyms, for that reason, it could be difficult to implement the Exercise is Medicine initiative like in other countries.

Furthermore, such as it has been mentioned in this thesis, lots of projects and studies had designed different PAP characteristics without common conclusions for an effective PAP implementation (145). According to the interdisciplinary PAP initiatives, such as Exercise is Medicine, some health providers have had the same self-perception barriers. For instance, in the last performed study survey with physiotherapists in Canada, they reported a very high level of confidence (90%) providing PAP information and resolving patients doubts about PAP (300). In our study, we obtained the same self-confidence in PAP for Spanish PHC nurses and physicians, despite that in both countries they demand more PAP education and training. Furthermore, healthcare professionals around the world are urged to promote PA to their patients in order to prevent the chronic diseases burden-related to sedentary lifestyles. In Australia, nurses (288), physiotherapists (301) or general practitioners (281) had shown a good willing to get the role of PAP in PHC settings. In Germany, although the majority of all medical respondents felt responsible for PAP and they reported to be involved in PAP counselling with their patients, in the same way that our healthcare respondents in Spain, they showed certain doubts about the effectiveness of PAP counselling to patients (286). In Nigeria, good role disposition and self-confidence to PAP had been shown by physicians (302) and physiotherapists (284) as in Scotland by physicians (303). Swedish PAP model had been showed as a barrier of the lack of education and exercise training among their healthcare staff (111). In all countries, healthcare staff has shown great level of PAP confidence and disposition to keep this role in PHC settings, in spite of the necessity shown for all of them in PAP training. This one, is likely required to offer an effective PAP strategy. All the strategies and surveys had been done with healthcare staff, but in my opinion, the more educated and trained health

professionals in PAP are those with more physical education, teachers and sports scientists. At least in Spain, such as it has been shown with the health professional degrees analysed in this thesis. We can resolve, or at least reduce, the barrier related to the lack of PAP knowledge, by offering PAP counselling through exercise professionals or working in an interdisciplinary team with them. Besides, the role about PA promotion could be developed at schools (91, 304-306), sports centers or PHC settings by sports scientists in an integrated approach of PAP (87, 287, 289).

In our country, regardless the PAP strategy that you choose, the figure of exercise specialist is present, and following the new professional law of sports for the Madrid region: "6/2016, of 24th of November" Fitness instructor (*Preparador Físico*) is responsible of the prevention, advice, planning, design, development and technical-scientific evaluation of physical exercises for improving the quality of life and health of people. In this way, any brief PA advice or exercise referral in the Region of Madrid should be offered or at least participated in the decision by sports scientists. We know, these ones are not healthcare staff, but they could be used in Healthcare settings, Sports Centers or schools as PA promoters or exercise providers included in an interdisciplinary team of health professionals in any PAP inclusive approach (Figure 13).

In America, a recent study has published about how exercise science students have more confidence prescribing exercise than medical students, with significant difference perceived about the Exercise is Medicine initiative between both groups of students (289). Few initiatives had used physical education teachers and sports scientists directly as the main professional to promote PA and much less to prescribe the exercise programme. And possibly, it could reduce some of the perceived barriers shown by the Swedish pioneer European model between PA and primary care sector such as their own issues, lack of time, money, knowledge, suitable PA activities and instructors (266). Other pioneer studies about PAP at PHC such as NICE in the UK, which starts in 1990 (144, 145), or "*Fysisk Aktivitet pa˚ Recept*", in Sweden in 2003 (145, 147) have shown the importance of behavior changes in patients (307) or motivational interview (147) to change from sedentary and physically inactive behavior to another more physically active patient behavior. In our studies, we can see as healthcare professionals in the focus group sessions as well as healthcare respondents in the questionnaires demand motivational interview training to implement an efficient PAP initiative in PHC

settings. Any case, to conclude the discussion of this Ph.D. thesis, we tried to offer the analysis context related to exercise training in some health providers and a multidimensional vision related to adherence that could be applied and used to improve exercise adherence levels in a specific group of chronic patients. The self-perception of nurses and physicians of one region of Spain to implement PAP in PHC settings and the critical vision of how to measure PA and sedentary levels as a vital sign in the anamnesis of patients in PHC settings. This is a first step in the hard process to implement exercise as a coadjutant medicine by a health interdisciplinary team in the Health System, because such as said Robert N. Butler, "If exercise could be packed in a pill, it would be the single most widely prescribed and beneficial medicine in the nation".

PA promotion and exercise prescription in Healthcare settings is a huge challenge that is worthwhile to study for the correct implementation in our country during the next followings years.

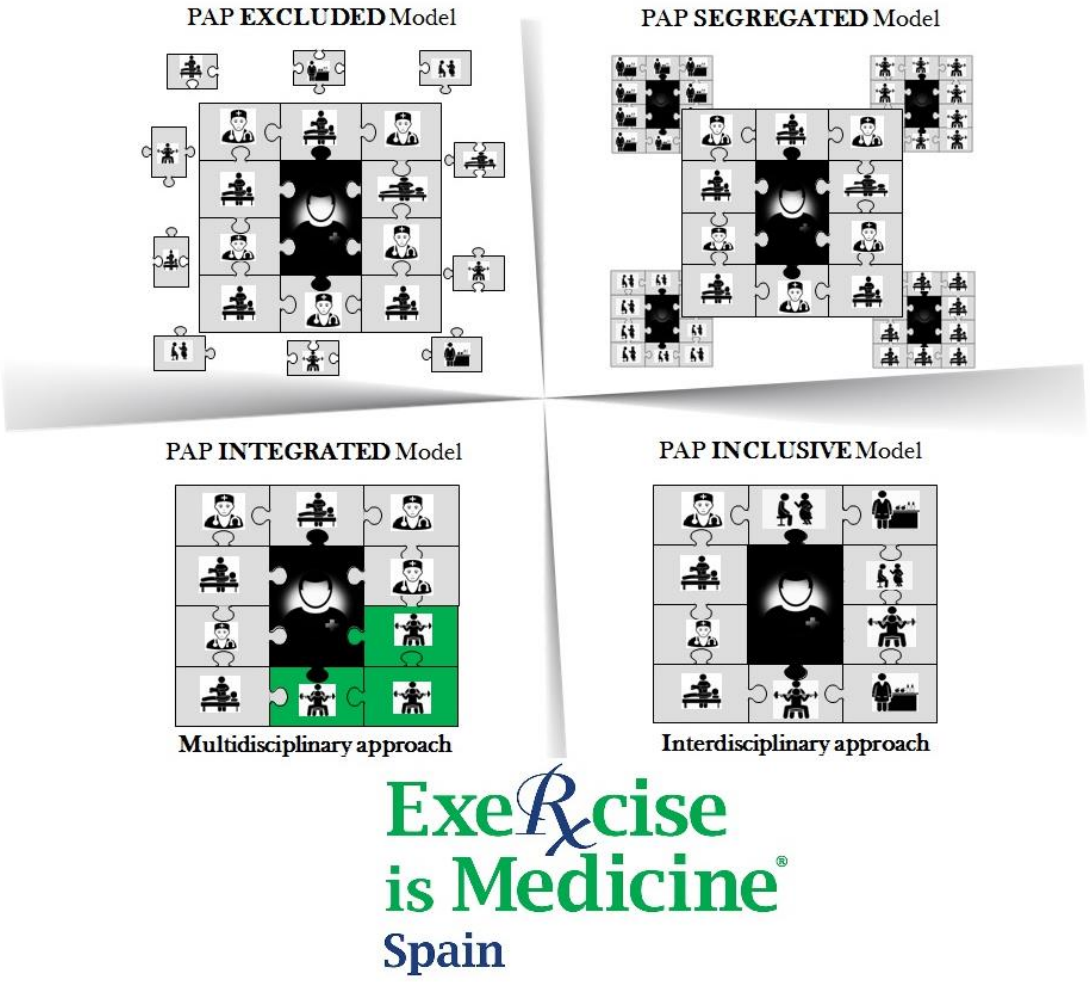

Figure 15. Evolution of Physical activity on Prescription (PAP) strategy according to the Exercise is Medicine-Spain initiative.

Limitations

To summarize the principal limitations of the Ph.D. thesis, I would like to say that the analysis done in nursing, medicine and sports science degrees could be more specific if the total credits related to PAP are considered uniquely by the specific ratio in contents about the total of the subject credits and being considered the practicum and final Degree thesis. Additionally, the critical appraisal review of PAP adherence did not follow PRISMA reporting guidelines to do a Systematic Review. Besides, the article related to predict adherence in chronic kidney patients has not a representative sample and was not possible to analyze the Health care team and System dimension of WHO multidimensional adherence model. PHC respondents in the cohort survey study probably is the staff with more affinity for PAP implementation and the respondents could have had answered questions in a socially desirable way; resulting in higher rates of knowledge and confidence in PAP. So, this could be considered a bias in our results. Finally, the low response rate (less than 10%) is lower than other cohort e-mail-based previous survey studies.

7 CONCLUSIONS

- The European Credit Transfer System related to physical activity promotion and exercise prescription in the Bachelor syllabus of Medicine, Sports Science and Nursing were 3.6±1.7%, 17.7±4.6% and 5.8 ±3.9%, respectively.
- Our critical appraisal narrative review has shown a low treatment of Healthcare system/Healthcare team and therapy-related factors comparing to the rest of dimensions social/economic, condition-related and patient-related factors), according to the 5 dimensions WHO adherence model.
- In our binary LR model, the 75% of exercise training programme adherence of chronic kidney patients was 33.20% predicted, considering four dimensions of the adherence model together. The increase in one unit of the Therapy-related dimension increases 7.8% the probability of non-adherence. The increase in one unit of the Condition-related dimension increases the probability of non-adherence in 11.8%. The increase in one unit of the Patient-related dimension increases 4.6% the probability of adherence. Finally, an increase in one unit of the Patient-related dimension increases the probability of adherence in 12.2%.
- Two choice modelling questionnaires have been designed and validated to assess the self-perception barriers of PHC nurses and physicians of the Region of Madrid, showing in our cohort survey study, that PHC physicians and nurses are conscious of exercise health benefits. They are willing and assume the role to promote and prescribe physical exercise, in spite of the lack of resources and self-perception barriers observed to implement Physical Activity on Prescription at PHC settings. The collaboration with other health professionals such as Sports Scientists and the collaboration with external public resources are the two main facilitators found for both PHC professionals, especially physicians.
- The current analysis of physical activity and sedentary levels by accelerometer processing data analysis (considering different frequency, body-worn attachment site, epoch time and cut-off points) and the registers done by questionnaires such as IPAQ short version or PAVS-EIM offer disparity of results without a consensus to be determinate in the use of PHC anamnesis with properly efficacy.

7.1 **Practical Conclusions**

- Physical Activity on Prescription knowledge should be reinforced in the syllabus of physicians, nurses and sports scientists in order to improve the PA promotion and the use of exercise prescription such as precise and coadjutant non-pharmacological treatment. Alternatively, a Master Degree on Exercise in the Clinical Setting could be created.
- A consensus in the use of WHO adherence model should be established for measuring long-term adherence in Physical Activity on Prescription. This model could be used in chronic patients treated by exercise training treatments.
- Sport Scientists should be included in the Healthcare System to be part of the interdisciplinary team which seems necessary to implement the Exercise is Medicine initiative properly.

7.2 **General Conclusion**

Implementation of physical activity on prescription as a preventive and treatment resource for non-communicable chronic diseases in primary healthcare centers in the Region of Madrid is only partially feasible. Good predisposition and attitude of physicians and nurses are facilitating factors, lack of knowledge, together with a lack of space, time, agreement to classify the main barriers related to physical activity adherence are limiting factors. An interdisciplinary approach, integrating exercise specialists in the Healthcare System could improve feasibility. An action plan should be created based on the results of this PhD Thesis in order to implement Exercise is Medicine successfully.

7.3 **Future Research Lines**

- To replicate the analysis of curricula in other health professionals.
- A new interview and cohort e-mail survey study to analyze the self-perception of patients, policy makers, Healthcare System managers among others, regarding the Exercise is Medicine approach.
- A pilot study of Exercise is Medicine implementation taking into account the results of this Ph.D. thesis.

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APPENDIX

APPENDIX 1

Dirección General de Salud Pública
CONSEJERÍA DE SANIDAD
Comunidad de Madrid

imFine UPM
Grupo de Investigación en Nutrición, Ejercicio y Estilo de Vida Saludable

Your Prescription for Health
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CARTA DE PRESENTACIÓN DEL ESTUDIO:

"ADHERENCIA A LA PROMOCIÓN DE ACTIVIDAD FÍSICA Y MEJORA DEL PATRÓN ACTIVIDAD FÍSICA-SEDENTARISMO EN LA RELACIÓN SISTEMA SANITARIO-PACIENTE DE ATENCIÓN PRIMARIA.

Madrid, Enero de 2018

Ha sido usted invitado/a a participar en una investigación financiada por el grupo de investigación en nutrición, estilo de vida saludable y calidad de vida: IMFINE de la Universidad Politécnica de Madrid, quien colabora con el *"American College of Sport Medicine"* (ACSM) y el centro nacional *"Exercise is Medicine"* y la Consejería de Sanidad de la Comunidad de Madrid, con el interés de realizar un estudio científico para implementar un modelo de promoción y tratamiento de actividad física en los centros de Atención Primaria.

Este estudio se va a llevar a cabo siguiendo escrupulosamente la legislación vigente y con la aprobación del Comité de Ética del Hospital de Alcorcón y la Fundación para la Investigación e Innovación Biomédica de Atención Primaria de la Comunidad de Madrid.
La información y datos recogidos en los diferentes cuestionarios realizados durante este estudio respetarán siempre lo establecido por la Ley Orgánica 15/1999 de Protección de Datos de Carácter Personal, y por tanto cualquier información obtenida de este estudio será confidencial. Los resultados de este estudio pueden ser publicados en foros científicos (revistas y congresos), utilizando únicamente los datos agrupados y respetando el anonimato de los datos.

Los médicos y enfermeros serán seleccionados como profesionales en activo con carga completa en sus jornadas laborales hacia la labor sanitaria, excluyendo de este modo a los profesionales que compatibilicen su labor con actividades de gestión sanitaria, ya que dichas tareas podrían sesgar la realidad laboral en la que se encuentra el grupo profesional al que representan. A ellos, se le pedirá que realicen 2 sesiones de debates presenciales utilizando la técnica *"focus group"* en sesiones de 2h. con el propósito de determinar las limitaciones y potencialidades que puedan modificar el grado de adherencia hacia la promoción y prescripción de actividad y/o ejercicio físico entre ellos, como representantes de su sector profesional. A través de su opinión en las charlas, que serán grabadas en audio con el fin de facilitar el análisis de los datos aportados en las sesiones, se realizará posteriormente un cuestionario "*on line*" para evaluar los facilitadores y barreras, así como el grado de adherencia en la promoción y prescripción de actividad y/o ejercicio físico en los centros de Atención Primaria.

Fdo: Prof. Dra. Mª Marcela González Gross

Dirección General de Salud Pública
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CONSENTIMIENTO INFORMADO DE GRABACIÓN Y DEL ESTUDIO DEL VOLUNTARIO

Los sujetos firmarán un consentimiento informado según la declaración de Helsinki y R.D. 1720/2007, de 21 de diciembre, de protección de datos de carácter personal. Por tanto, le rogamos, **una vez leída la información adjunta**, firme el siguiente consentimiento informado, mostrando su consentimiento.

Yo, ... (nombre y apellidos del voluntario)

Código: | | | | | |

- He recibido información oral y escrita, he leído la carta adjunta.
- He podido hacer preguntas sobre el estudio y resolver mis dudas.
- He recibido suficiente información sobre el estudio.
- He hablado con: Mª Marcela González Gross (nombre del investigador principal)
- Comprendo que mi participación es voluntaria.
- Consiento que mi aportación en las sesiones pueda ser grabada: SÍ | | NO | |
- Comprendo que puedo abandonar el estudio en cualquier momento por decisión propia.

Presto libremente mi conformidad para participar en el estudio.

Madrid, a ..... de Enero de 2018

Firma del voluntario Firma del investigador

D/Dña: _____
con DNI_____ revoco el consentimiento prestado para participar en el estudio.

En _____, a _____ de _____ de 2018

Firma:

APPENDIX 2

UNIVERSIDAD POLITÉCNICA DE MADRID
FACULTAD DE CIENCIAS DE LA ACTIVIDAD FÍSICA Y DEL DEPORTE (INEF)
C/ Martín Fierro, 7 – 28040 Madrid

PROTOCOLO DE ACTUACIÓN:

PROYECTO:

IMPLEMENTACIÓN DE "EXERCISE IS MEDICINE®" EN ESPAÑA: CUESTIONARIO PARA ANALIZAR EL ESTADO DE LOS PROFESIONALES DE MÉDICINA Y ENFERMERÍA DE ATENCIÓN PRIMARIA DE LA COMUNIDAD DE MADRID EN PROMOCIÓN DE ACTIVIDAD FÍSICA Y PRESCRIPCIÓN DE EJERCICIO FÍSICO.

Datos del solicitante:

Persona de contacto: **MARIA MARCELA GONZÁLEZ GROSS**

Institución: Grupo de investigación ImFINE. **UNIVERSIDAD POLITÉCNICA DE MADRID**

Objetivos:

Objetivo general:

Evaluar el estado de los profesionales de medicina y enfermería de Atención Primaria de la Comunidad de Madrid hacia la promoción de actividad física y prescripción de ejercicio físico.

Objetivos específicos:

- Analizar los resultados obtenidos de las 2 sesiones grupales de "focus group" realizadas con los 5 médicos y 5 enfermeros de Atención Primaria de la Comunidad de Madrid.
- Diseñar un cuestionario que permita diagnosticar las potencialidades y barreras que posee el personal sanitario para promocionar y prescribir ejercicio físico.
- Determinar las limitaciones y potencialidades que puedan modificar el grado de adherencia hacia la promoción y prescripción de actividad y/o ejercicio físico entre todos los médicos y enfermeros de Atención Primaria de la Comunidad de Madrid.

Metodología a emplear:

Se analizan los resultados obtenidos de las sesiones de "focus group", creando una serie de preguntas que aporten datos relativos a su perfil personal y profesional. Doce preguntas irán encaminadas a determinar el nivel de conocimientos que los profesionales sanitarios poseen en relación a la actividad física, que serán contrastados mediante la respuesta que ofrezcan a las preguntas 14-18 (enfocadas a evaluar su auto-percepción con respecto a su propio patrón de actividad física-sedentarismo, su conocimiento sobre los beneficios y la promoción/prescripción de actividad y ejercicio físico. Posteriormente, se evaluará el estado de comportamiento de los profesionales hacia la promoción y prescripción de ejercicio física, basados en la teoría de los estados de cambio y una última sección donde se realizan las preguntas relacionadas con las categorías y temas abordados en las sesiones de "focus group", a través

de las preguntas y del análisis de la transcripción de las conversaciones mantenidas en las sesiones, otorgando un total de 12 categorías compartidas para ambos grupos. Para la primera sesión: 1. Patrón físico del profesional, 2. Conocimiento para promocionar/prescribir ejercicio físico, 3.Promoción de actividad física, 4. Prescripción de ejercicio físico, 5. Formación para prescribir, 6. Organización del propio centro, 7. Organigrama de los centros de Atención Primaria, 8. Otros aspectos clave. En la segunda sesión se considerarán las siguientes categorías: 9. Profesionales con los que colaborar, 10. Problemas de recursos, 11. Solución a la problemática de recursos, 12. Medicina preventiva a través de ejercicio físico. Mediante un total de 47 preguntas que determinarán por parte de todas las personas que den contestación al cuestionario los factores que limitan y potencian la promoción y prescripción de actividad y/o ejercicio físico entre los profesionales sanitarios (médicos y enfermeros) de Atención Primaria de la Comunidad de Madrid. La oorganización de todas las preguntas a las categorías establecidas, vendrán determinadas de la siguiente manera:

CUESTIONARIO			
SECCIÓN	CATEGORIA	SUBCATEGORIA	PREGUNTA/S:
6.	Explicación del cuestionario		
7.	Datos personales y profesionales		
8.	Conocimientos generales sobre actividad física		1-12
9.	Estado de comportamiento hacia la promoción y prescripción de AF/EF		13
10.	Categorías obtenidas de la sesión 1		
	1. Patrón físico del profesional		14
	2. Conocimiento para promocionar/prescribir ejercicio físico		15, 16,17,18
	3. Promoción de actividad física	Liderar	19,20
		Colaboración	21
	4. Prescripción de ejercicio físico	Liderar	22,23
		Colaboración	24,
	5. Formación para promocionar/prescribir	Formación	27, 28, 29, 30, 32,33,34,35
		Reconocimiento profesional	31
	6. Organización del propio centro- Sistema de salud	Herramienta diagnóstico	36,37
		Tiempo consultationa	38,39
		Plan estratégico de actuación	41,42
		Otras	43
	7. Organigrama de los centros de Atención Primaria	Reparto de tareas	40, 43
	8.Otros aspectos clave	Publicidad/concienciación del ciudadano-paciente	47
	Categorías obtenidas de la sesión 2		
	9. Profesionales con los que colaborar	Red de trabajo	21,24,25,26
	10. Problemas de recursos	Necesidad de recursos	44
	11. Solución a la problemática de recursos	Soluciones necesarias	45,46
	12. Medicina preventiva a través de ejercicio físico	Concienciación/ utilización del ejercicio físico en consultationa	15,16

Los cuestionarios están diseñados para ser contestados en un rango aproximado de 8-10 minutos de duración. Se realizarán a través de un enlace que se enviará al correo electrónico institucional de cada profesional sanitario. Las direcciones serán facilitadas a través de la propia Consejería de Sanidad de la Comunidad de Madrid.

Además se espera contar con la colaboración de los responsables de las unidades docentes de cada centro de Atención Primaría, que pretendemos que se encarguen de motivar e implicar a todos los profesionales de su centro que formen parte como encuestados de este proyecto a que ayuden a aumentar el volumen esperado de respuesta (aproximadamente del 10-15%).

El Tratamiento estadístico de los datos, se realizará mediante: Análisis descriptivos univariantes, distribuciones de frecuencias, relaciones de dependencia entre parámetros y condiciones de la población basados en frecuencias.

Modelos multivariantes como análisis de correspondencias y técnicas de clasificación y segmentación. Meta análisis, comparación de resultados entre médicos y pacientes.

Aspectos éticos: Los sujetos firmarán un consentimiento informado según la declaración de Helsinki y R.D. 1720/2007, de 21 de diciembre, de protección de datos de carácter personal. El proyecto se realizará bajo el cumplimiento de la LEY 14/2007, de 3 de julio, de Investigación biomédica. Se cuenta con la aprobación del Comité de Ética del Hospital Universitario Fundación Alcorcón. El proyecto está sometido para su aprobación a la Fundación para la Investigación e Innovación Biomédica de Atención Primaria de la Comunidad de Madrid.

Experiencia e idoneidad del grupo de investigación:

Para este grupo de investigación, se han unido investigadores de prestigio reconocido en las áreas de salud pública, promoción de salud, medicina de familia y del deporte, fisiología del ejercicio, actividad física y psicología, configurando un equipo multidisciplinar ad hoc para llevar a cabo el proyecto en España y transferirlo a otros países.

La investigadora principal de esta parte del proyecto es la Doctora Marcela González Gross, Catedrática de la Facultad de Ciencias de la Actividad Física y del Deporte-INEF de la Universidad Politécnica de Madrid, Es la responsable del **Grupo de Investigación en nutrición, ejercicio y estilo de vida saludable** (ImFINE) (http://imfine.es/). La práctica regular de actividad física, su repercusión en el **estado de salud y en el proceso de envejecimiento**, y la forma de evaluación mediante la composición corporal, la condición física y marcadores sanguíneos son uno de los pilares del trabajo investigador del grupo, siendo Marcela la responsable directa de su inclusión y gestión como biomarcadores en los proyectos que ha participado, 20 de ellos como investigadora principal y de los resultados y publicaciones resultantes en sus más de 25 años de trabajo investigador. Es miembro de Centro de Investigación biomédica en red de fisiopatología de la obesidad y nutrición (CIBERobn). Manager científico de Exercise is Medicine Spain. Vicepresidenta de la Sociedad Española de Nutrición. Ha publicado más de 260 trabajos en revistas científicas con factor de impacto, además de otras publicaciones, capítulos de libro, etc. Ha participado en grupos de trabajo de asesoramiento de Organización Mundial de la Salud, de la Conserjería de Sanidad de la Comunidad de Madrid, organismos internacionales de investigación, diversos *Think Tanks* en Bruselas, etc. Dirige el Laboratorio de Bioquímica de la Facultad, que tiene acuerdo con el laboratorio de la Agencia Española para la Protección de la Salud del Deportista (AEPSAD) para el análisis de muestras biológicas.

El resto de expertos que trabajarán en esta parte del proyecto, serán:

Susana Belmonte: Jefe de Servicio de Nutrición y Trastornos Alimentarios de la subdirección de Promoción, Prevención y Educación para la Salud. Dirección General Salud Pública. Consejería de Sanidad. Comunidad de Madrid.
Rosa Ángeles Arnal: Directora asistencial de Enfermería de la dirección asistencial Norte. Consejería de Sanidad. Comunidad de Madrid.
Marisa López: doctora en Medicina, especialista en Medicina Familiar y Comunitaria y profesora asociada en la UEM.
Diego Villalvilla: Enfermero familiar y Comunitario en el Centro de Salud Alcalá de Guadaira (Madrid) de la Comunidad de Madrid.
Francisco Fuentes: Psicólogo deportivo, profesor de la UPM y lleva muchos años analizando la motivación de colectivos de diversas edades hacia la práctica deportiva. Especialista en la dinámica de discusión de grupos dentro del ámbito psicosocial. . Realizará la labor de moderador de los *Focus Group,* con dos de los grupos.
Fernando Novella: Médico especialista en medicina de la educación física y el deporte y profesor asociado en UPM. Tiene una amplia experiencia profesional tanto a nivel de deporte de alto rendimiento como de deporte-salud y prevención de lesiones y médico responsable del centro deportivo de Fuenlabrada.. Realizará la labor de moderador de los *Focus Group*, con uno de los grupos.
Sergio Calonge: Doctorando e investigador de la Universidad Politécnica de Madrid, que lleva a cabo el desarrollo de la tesis doctoral titulada: " Desarrollo e implantación de Exercise is Medicine® como medida de prevención y tratamiento de las enfermedades crónicas no transmisibles en la población española, a través de programas individualizados de ejercicio físico". Realizará la labor de observador, en todas las sesiones de *Focus Group*.

APPENDIX 3

Rafael Manuel Micó Pérez, con NIF 52713252N Secretario General de la Sociedad Española de Médicos de Atención Primaria (SEMERGEN), la cual tiene domicilio fiscal en Madrid, c/ Jorge Juan, 66 - Local, y CIF G-28628402

CERTIFICA

Que la actividad **0032-2019 IMPLEMENTACIÓN DE "EXERCISE IS MEDICINE®" EN ESPAÑA: FASE 2. VALORACIÓN DEL CONOCIMIENTO Y DE LA ADHERENCIA A LA PROMOCIÓN DE ACTIVIDAD FÍSICA Y PRESCRIPCIÓN DE EJERCICIO FÍSICO EN LOS PROFESIONALES SANITARIOS DE ATENCIÓN PRIMARIA,** ha recibido el Aval Institucional de SEMERGEN, según comunicado recibido en esta Secretaría General.

Y para que así conste, a los efectos oportunos, firmo el presente certificado en

Madrid a 5 de marzo de 2019.

Fdo.: Rafael Manuel Micó Pérez
Secretario General Sociedad Española de Médicos de Atención Primaria (SEMERGEN)

Secretaría: C/ Jorge Juan, nº 66-Local.-28009 MADRID- Telfs. 91 500 21 71-Fax: 91 431 06 11
e-mail: secretaria@semergen.es-www.semergen.es

APPENDIX 4

Código Participante: ☐☐☐☐☐

Red de Investigación en ejercicio físico y salud para poblaciones especiales (EXERNET)

ESTUDIO MULTI-CÉNTRICO PARA LA EVALUACIÓN DE LA CONDICIÓN FÍSICA EN PERSONAS MAYORES

CUESTIONARIO GENERAL 3.0

Fecha de la encuesta: _____ Nombre del encuestador: _____

El presente documento constituye la primera parte de una serie de cuestionarios relacionados con la salud y la práctica de actividad física. Las preguntas redactadas a lo largo de las siguientes páginas hacen referencia a aspectos nutricionales, de educación, renta, historia deportiva, satisfacción personal...así como los datos personales. **No rellenar los cuadros sombreados.**

DATOS PERSONALES

1.Nombre y Apellidos_____

Día Mes Año

2.Fecha de Nacimiento: ☐☐ ☐☐ ☐☐☐☐

3.Edad: _____años.

4.Sexo: Hombre ☐ (1) Mujer ☐ (2)

5.Domicilio:_____

6.Localidad:_____**7.Provincia**_____

8.Teléfono/s:_____

9.Nombre Hijo/Hija/Familiar de Contacto:_____

10.Teléfono Hijo/Hija/Familiar de Contacto: _____

11.Estado civil: Soltero/a ☐ (1) Casado/a ☐ (2)
Divorciado/a ☐ (3) Viudo/a ☐ (4)

12.¿Vive sólo? Sí ☐ (1) No ☐ (0)

13.¿Con quién?

Cónyuge ☐ (1) Hijo/a ☐ (2) Hermano/a ☐ (3)
Residencia ☐ (4) Otro ☐ (5) Indique cuál: _____

14.¿En su casa tiene ascensor? Sí ☐ (1) No ☐ (0)

15.¿En qué piso vive? _____ (0=Casa/ bajo /Chalet)

16.¿Qué estudios tiene?

No sabe leer ni escribir ☐ (1) Estudios primario ☐ (2)

Estudios secundarios ☐ (3) Estudios universitarios ☐ (4)

Sabe leer y escribir pero no tiene estudios primarios ☐

17.¿Recibe usted renta propia? Sí ☐ (1) No ☐ (0)

18.¿Cuál es su nivel de renta actual?

Menos de 650 €/mes ☐ (1)

Entre 650 y 900 €/mes ☐ (2)

Más de 900 €/mes ☐ (3)

-(Preguntas 19-24 solo en caso de ser mujer)-

19.Edad de Menopausia: _____

20.Edad de Menarquia (aparición de la primera menstruación):____

21.¿Ha recibido usted alguna vez tratamiento hormonal sustitutivo (terapia estrogénica)?

Sí ☐ (1) No ☐ (0)

22.En caso afirmativo, ¿durante cuánto tiempo?_____

23.Número de embarazos (incluidos posibles abortos):_____

24.Número de partos: _____

ESTILO DE VIDA

25. Actualmente, ¿realiza actividad física de manera organizada (gimnasio, actividades del ayuntamiento, club deportivo...)?

Sí ☐ (1) No ☐ (0)

26. ¿Qué tipo de actividad organizada?

Natación ☐ (1) Acuagym ☐ (2) Gimnasia Mantenimiento ☐ (3)

Yoga ☐ (4) Otra ☐ (5)

Indique cuál:_____

27.¿Cuántas horas a la semana de actividad organizada?_____ horas

28.¿Ha variado su actividad física desde 2011? No, no ha variado (0) ☐

Sí, ha aumentado ☐ (1) Si, ha disminuido ☐ (2)

29.En su juventud, ¿practicó algún tipo deporte o hizo ejercicio físico de manera regular?

Sí ☐ (1) No ☐ (0)

30. ¿Qué tipo de actividad?

Natación ☐ (1) Gimnasia Mantenimiento ☐ (2) Fútbol ☐ (3)

Otro ☐ (4) Indique cuál:_____

31.¿Durante cuánto tiempo (años)?_____

32. ¿A qué nivel?

Élite ☐ (1) Competición ☐ (2) Recreación ☐ (3)

Otro ☐ (4) Indique cuál:_____

33. Respecto a su vida laboral, ¿trabajó fuera del hogar?

Sí ☐ (1) N o ☐ (0)

34. ¿A qué se dedicaba?

*Dirección de empresas y administraciones públicas ☐ (1)

*Técnicos y profesionales científicos e intelectuales ☐ (2)

*Técnicos y profesionales de apoyo ☐ (3)

*Empleados de tipo administrativo ☐ (4)

*Trabajadores de servicio de restauración, personales, protección y Vendedores de comercio ☐ (5)

*Trabajadores cualificados en agricultura y en la pesca ☐ (6)

*Artesanos y trabajadores cualificados de industrias manufactureras, Construcción, y minería, excepto operadores de instalación y Maquinaria ☐ (7)

*Operadores instalaciones y maquinaria, y montadores ☐ (8)

*Trabajadores no cualificados ☐ (9)

*Fuerzas armadas ☐ (10)

*Trabajo en el hogar ☐ (11)

*Desempleado ☐ (12)

*Otra (indicar): _____ ☐)

35. Indique cuánto tiempo dedica al día a cada una de las siguientes actividades:

	Caminar	Estar sentado	Tareas del hogar
Menos de 1 hora (1)	☐	☐	☐
Entre 1 y 2 horas (2)	☐	☐	☐
Entre 2 y 3 horas (3)	☐	☐	☐
Entre 3 y 4 horas (4)	☐	☐	☐
Entre 4 y 5 horas (5)	☐	☐	☐
Más de 5 horas (6)	☐	☐	☐

ASPECTOS RELACIONADOS CON LA SALUD

36. ¿Toma medicación de manera habitual? (en caso de ser necesario, grapar los prospectos a esta hoja)

Sí ☐ No ☐

En caso afirmativo, por favor, indique cuál:

Nombre del medicamento y laboratorio fabricante	Frecuencia de consumo			Dosis (número de pastillas)
	A veces	Todos los meses	A diario	
(añadir más filas si es necesario)				

37. ¿Sufre usted o está en tratamiento de alguna enfermedad?

Sí ☐ (1) No ☐ (0)

38.En caso afirmativo, señale cual…

Diabetes ☐ (1) Hipertensión ☐ (2) Colesterol ☐ (3)

Artritis/artrosis ☐ (4) Depresión ☐ (5) Insomnio ☐ (6)

Osteoporosis ☐ (7) Fibromialgia ☐ (8)

Otros:_____

39.En los últimos 12 meses ¿ha sufrido usted alguna caída? Sí ☐ No ☐ (0)

40.¿Cuántas? _____

41.¿Ha sufrido alguna fractura en los últimos 10 años? Sí ☐ No ☐ (0)

42.¿En qué parte del cuerpo? _____

43.¿Cuántas horas duerme por la noche cada día? _____

44.¿Cuántas horas duerme de siesta al día? _____

45.Respecto al sueño, señale la casilla que mejor describa su situación durante el último mes:

	No me ocurre (0)	Me ocurre 1-3 días (1)	Me ocurre 4-7 días (2)	Me ocurre 8-14 días (3)	Me ocurre 15-21 días (4)	Me ocurre 22-31 días (5)
Dificultad para caer/quedarse dormido/a (iniciar sueño)						
Dificultad para permanecer dormido/a						
Despertarse varias veces por la noche						
Despertarse y sentirse cansado/a y agotado/a después de sueño normal						

46.Durante el último mes, ¿cómo valoraría en conjunto, la calidad de su sueño? (señale un valor en la escala)

muy mala 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 muy buena

47.¿Cuánto tiempo habrá tardado en dormirse, normalmente, las noches del último mes?

Muy poco, 0-1 minutos ☐ (1) Poco, entre 1 y 15 minutos ☐

Algo, 16-30 minutos ☐ (3) Bastante, 31-60 minutos ☐ (4)

Mucho, más de 60 minutos ☐ (5)

48.En la actualidad, ¿fuma? Sí ☐ No ☐ (0)

49.En caso afirmativo, ¿desde cuándo? _____

50.¿Cuántos cigarrillos al día?

Menos de 5 cigarrillos ☐ (1) Entre 5 y 10 cigarrillos ☐ (2)

Entre 10 y 15 cigarrillos ☐ (3) Entre 15 y 20 cigarrillos ☐ (4)

Más de una cajetilla diaria ☐ (5)

51.¿Ha fumado en el pasado?

Sí ☐ (1) No ☐ (0)

52.¿Durante cuantos años fumó en el pasado? _____

53.¿Cuántos cigarrillos al día fumaba en el pasado?

Menos de 5 cigarrillos ☐ (1) Entre 5 y 10 cigarrillos ☐ (2)

Entre 10 y 15 cigarrillos ☐ (3) Entre 15 y 20 cigarrillos ☐ (4)

Más de una cajetilla diaria ☐ (5)

54.¿Hace cuantos años que dejó de fumar? _____

Respecto al estudio de la incontinencia de orina:

55.¿Sufre en alguna ocasión algún escape de orina y/o incontinencia urinaria?

Sí ☐ (1) No ☐ (0)

-(Preguntas 56-60 solo en caso de que la respuesta sea afirmativa)

56.Los posibles escapes de orina que tiene, ¿cuánto afectan su vida diaria? ***(por favor, marque un círculo en un número entre 0 (no me afectan nada) y 10 (me afectan mucho):***

0	1	2	3	4	5	6	7	8	9	10

57.Señale la respuesta a la siguiente cuestión: Me da miedo hacer esfuerzos porque se me escapa la orina:

No, en absoluto 0 - 1 - 2 - 3 - 4 - 5 Mucho

58.¿Con qué frecuencia pierde orina? ***(marque una):***	- Nunca (0) - Una vez a la semana o menos (1) - Dos o tres veces a la semana (2) - Una vez al día (3) - Varias veces al día (4) - Continuamente
59.Cantidad de orina que usted cree que pierde ***habitualmente*** **(tanto si lleva protección como si no)** ***(marque uno):***	- No se me escapa nada (0) - Muy poca cantidad (1) - Una cantidad moderada (2) - Mucha cantidad (3)
60.¿Cuándo pierde orina? ***(señale todo lo que le pasa a usted):***	A-Nunca pierde orina No (0) Si (1) B-Pierde orina antes de llegar al WC No (0) Si (1) C-Pierde orina cuando tose/estornuda No (0) Si (1) D-Pierde orina cuando duerme No (0) Si (1) E-Pierde orina cuando hace esfuerzos físicos/ejercicio No (0) Si (1) F- Pierde orina al acabar de orinar y ya se ha vestido No (0) Si (1) G- Pierde orina sin motivo evidente No (0) Si (1) H- Pierde orina de forma continua No (0) Si (1)

61.Por la noche ¿Cuántas veces se levanta a orinar? _____ veces/noche

62.Hace 5 años ¿Cuántas veces se levantaba a orinar? _____ veces/noche

APPENDIX 5

Su salud
– *y* –
Bienestar

Enfermedad Del Riñón y Calidad De Vida (KDQOL™-36)

Las siguientes preguntas se refieren a lo que usted piensa sobre su salud y bienestar. Esta información permitirá saber cómo se encuentra usted y hasta qué punto es capaz de realizar sus actividades habituales.

¡Gracias por contestar a estas preguntas!

Estudio de calidad de vida para pacientes en diálisis

¿CUÁL ES EL OBJETIVO DEL ESTUDIO?

Este estudio se está realizando en colaboración con los médicos y sus pacientes. El objetivo es conocer la calidad de vida de los pacientes con enfermedad del riñón.

¿QUÉ TENDRÉ QUE HACER?

Nos gustaría que, para este estudio, llenara hoy el cuestionario sobre su salud, sobre cómo se ha sentido durante las últimas 4 semanas. Por favor, marque con una "X" la casilla bajo la respuesta elegida para cada pregunta.

¿ES CONFIDENCIAL LA INFORMACIÓN?

No le preguntamos su nombre. Sus respuestas se mezclarán con las de los demás participantes en el estudio, a la hora de dar los resultados del estudio. Cualquier información que pudiera permitir su identificación será considerada confidencial.

¿ QUÉ BENEFICIOS TENDRÉ POR EL HECHO DE PARTICIPAR?

La información que usted nos facilite nos indicará lo que piensa sobre la atención y nos ayudará a comprender mejor los efectos del tratamiento sobre la salud de los pacientes. Esta información ayudará a valorar la atención médica.

¿ES OBLIGATORIO QUE PARTICIPE?

Usted no tiene la obligación de completar el cuestionario. Además, puede dejar de contestar cualquier pregunta. Su decisión sobre si participa o no, no influirá sobre sus posibilidades a la hora de recibir atención médica.

Su salud

Este cuestionario incluye preguntas muy variadas sobre su salud y sobre su vida. Nos interesa saber cómo se siente en cada uno de estos aspectos.

1. En general, ¿diría que su salud es: [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

Excelente	Muy buena	Buena	Pasable	Mala
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Las siguientes frases se refieren a actividades que usted podría hacer en un día típico. ¿Su estado de salud actual lo limita para hacer estas actividades? Si es así, ¿cuánto? [Marque con una cruz ☒ una casilla en cada línea.]

	Sí, me limita mucho	Sí, me limita un poco	No, no me limita en absoluto
2. Actividades moderadas, tales como mover una mesa, empujar una aspiradora, jugar al bowling o al golf	☐ 1	☐ 2	☐ 3
3. Subir varios pisos por la escalera	☐ 1	☐ 2	☐ 3

Durante las últimas 4 semanas, ¿ha tenido usted alguno de los siguientes problemas con el trabajo u otras actividades diarias regulares a causa de su salud física? [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

	Sí	No
4. Ha logrado hacer menos de lo que le hubiera gustado	☐ 1	☐ 2
5. Ha tenido limitaciones en cuanto al tipo de trabajo u otras actividades	☐ 1	☐ 2

Durante las últimas 4 semanas, ¿ha tenido usted alguno de los siguientes problemas con el trabajo u otras actividades diarias regulares a causa de algún problema emocional (como sentirse deprimido o ansioso)? [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

	Sí	No
6. Ha logrado hacer menos de lo que le hubiera gustado	☐ 1	☐ 2
7. Ha hecho el trabajo u otras actividades con menos cuidado de lo usual	☐ 1	☐ 2

8. Durante las últimas 4 semanas, ¿cuánto ha dificultado el dolor su trabajo normal (incluyendo tanto el trabajo fuera de casa como los quehaceres domésticos)? [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

Nada en absoluto	Un poco	Mediana-mente	Bastante	Extremada-mente
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Estas preguntas se refieren a cómo se siente usted y a cómo le han ido las cosas durante las últimas 4 semanas. Por cada pregunta, por favor dé la respuesta que más se acerca a la manera como se ha sentido usted.

¿Cuánto tiempo durante las últimas 4 semanas…

	Siempre	Casi siempre	Muchas veces	Algunas veces	Casi nunca	Nunca
9. Se ha sentido tranquilo y sosegado?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
10. Ha tenido mucha energía?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
11. Se ha sentido desanimado y triste?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

12. Durante las últimas 4 semanas, ¿cuánto tiempo su salud física o sus problemas emocionales han dificultado sus actividades sociales (como visitar amigos, parientes, etc.)? [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

Siempre	Casi siempre	Algunas veces	Casi nunca	Nunca
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Su enfermedad del riñón

¿En qué medida considera cierta o falsa en su caso cada una de las siguientes afirmaciones? [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

	Totalmente cierto	Bastante cierto	No sé	Bastante falso	Totalmente falso
13. Mi enfermedad del riñón interfiere demasiado en mi vida	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14. Mi enfermedad del riñón me ocupa demasiado tiempo	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
15. Me siento frustrado al tener que ocuparme de mi enfermedad del riñón	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
16. Me siento una carga para la familia	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Durante las cuatro últimas semanas, ¿cuánto le molestó cada una de las siguientes cosas? [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

	Nada	Un poco	Regular	Mucho	Muchísimo
17. ¿Dolores musculares?	☐1	☐2	☐3	☐4	☐5
18. ¿Dolor en el pecho?	☐1	☐2	☐3	☐4	☐5
19. ¿Calambres?	☐1	☐2	☐3	☐4	☐5
20. ¿Picazón en la piel?	☐1	☐2	☐3	☐4	☐5
21. ¿Sequedad de piel?	☐1	☐2	☐3	☐4	☐5
22. ¿Falta de aire?	☐1	☐2	☐3	☐4	☐5
23. ¿Desmayos o mareo?	☐1	☐2	☐3	☐4	☐5
24. ¿Falta de apetito?	☐1	☐2	☐3	☐4	☐5
25. ¿Agotado/a, sin fuerzas?	☐1	☐2	☐3	☐4	☐5
26. ¿Entumecimiento (hormigueo) de manos o pies?	☐1	☐2	☐3	☐4	☐5
27. ¿Náuseas o molestias del estómago?	☐1	☐2	☐3	☐4	☐5
28a. (Sólo para pacientes hemodiálisis) ¿Problemas con la fístula?	☐1	☐2	☐3	☐4	☐5
28b. (Sólo para pacientes en diálisis peritoneal) ¿Problemas con el catéter?	☐1	☐2	☐3	☐4	☐5

EFECTOS DE LA ENFERMEDAD DEL RIÑÓN EN SU VIDA

Los efectos de la enfermedad del riñón molestan a algunas personas en su vida diaria, mientras que a otras no. ¿Cuánto le molesta su enfermedad del riñón en cada una de las siguientes áreas? [Marque con una cruz ☒ la casilla que mejor corresponda con su respuesta.]

	Nada	Un poco	Regular	Mucho	Muchísimo
29. ¿Limitación de líquidos?.....	☐1	☐2	☐3	☐4	☐5
30. ¿Limitaciones en la dieta?	☐1	☐2	☐3	☐4	☐5
31. ¿Su capacidad para trabajar en la casa?	☐1	☐2	☐3	☐4	☐5
32. ¿Su capacidad para viajar?	☐1	☐2	☐3	☐4	☐5
33. ¿Depender de médicos y de otro personal sanitario?	☐1	☐2	☐3	☐4	☐5
34. ¿Tensión nerviosa o preocupaciones causadas por su enfermedad del riñón?	☐1	☐2	☐3	☐4	☐5
35. ¿Su vida sexual?	☐1	☐2	☐3	☐4	☐5
36. ¿Su aspecto físico?	☐1	☐2	☐3	☐4	☐5

¡Gracias por contestar a estas preguntas!

APPENDIX 6

TEST DE DEPRESIÓN DE BECK

Instrucciones para el entrevistador para la aplicación del Cuestionario de Depresión de Beck

Se han preparado las siguientes instrucciones con el fin de estandarizar la aplicación del Cuestionario de Depresión. Es importante que se sigan en orden estas instrucciones, para proporcionar uniformidad y reducir al mínimo la influencia del entrevistador.

Rutina de aplicación

Diga al paciente: "Esto es un cuestionario; en él hay grupos de afirmaciones; leeré uno de estos grupos. Después quiero que elija la afirmación en ese grupo que describa mejor como se ha sentido en la ULTIMA SEMANA incluyendo HOY".

En ese momento alcance una copia del cuestionario al paciente y dígale: "Aquí tiene una copia para que pueda seguirme mientras leo". Lea el grupo entero de afirmaciones en la primera categoría (no lea los números que aparecen a la izquierda de las afirmaciones); luego diga: "Ahora elija una de las afirmaciones que describa mejor como se ha sentido en la ULTIMA SEMAN, incluyendo HOY"

Si el paciente indica su elección respondiendo mediante un número, vuelva a leer la afirmación que corresponda con el número dado por el paciente, con el fin de evitar confusión sobre cual de las afirmaciones elegida. Cuando el paciente dice "la primera afirmación", puede querer decir 0 ó 1. Después que se haga evidente que el paciente entiende el sistema de numeración, será suficiente la respuesta numérica para indicar su elección.

Instrucciones adicionales

A. Verifique que cada elección sea efectivamente la elección del paciente y no palabras que usted haya repetido. Haga que el paciente exprese, por su cuenta, cual afirmación ha elegido.

B. Si el paciente indica que hay dos o más afirmaciones que se ajustan a la forma en que se siente, entonces anote el mayor de los valores.

C. Si el paciente indica que la forma en que se siente está entre 2 y 3, siendo más que 2, pero no justamente 3, entonces anote el valor al cual se acerque más, ó 2.

D. Generalmente el entrevistador debe leer en voz alta las afirmaciones que se encuentran en cada categoría. A veces el paciente toma la iniciativa y empezará a leer en silencio las afirmaciones en una categoría, adelantándose al entrevistador, y empieza a dar las afirmaciones elegidas. Si el paciente está atento y parece inteligente, deje que lea en silencio las afirmaciones y que haga su elección. Dígale al paciente que, si está seguro de leer todas las afirmaciones en cada grupo antes de elegir, entonces podrá leer en silencio. Sea diplomático y tenga tacto para alentar al paciente para que reflexione suficientemente antes de elegir.

E. El puntaje de depresión obtenido debe asentarse en la hoja de registro. Simplemente corresponde a la suma de las mayores cargas de respuestas seleccionadas en cada grupo de afirmaciones del al 21. La carga es el valor numérico que figura al lado de cada afirmación.

F. El grupo 19 (pérdida de peso) fue concebido para explorar un síntoma anoréxigeno. Si el paciente responde afirmativamente a la siguiente pregunta: "¿Está tratando de perder peso comiendo menos?" el puntaje de este grupo no debe agregarse al puntaje total.

1)
No me siento triste.
Me siento triste.
Me siento triste todo el tiempo y no puedo librarme de ello.
Me siento tan triste o desdichado que no puedo soportarlo.

2)
No estoy particularmente desanimado con respecto al futuro.
Me siento desanimado con respecto al futuro.
Siento que no puedo esperar nada del futuro.
Siento que el futuro es irremediable y que las cosas no pueden mejorar.

3)
No me siento fracasado.
Siento que he fracasado más que la persona normal.
Cuando miro hacia el pasado lo único que puedo ver en mi vida es un montón de fracasos.
Siento que como persona soy un fracaso completo.

4)
Sigo obteniendo tanto placer de las cosas como antes .
No disfruto de las cosas como solía hacerlo.
Ya nada me satisface realmente.
Todo me aburre o me desagrada.

5)
No siento ninguna culpa particular.
Me siento culpable buena parte del tiempo.
Me siento bastante culpable la mayor parte del tiempo.
Me siento culpable todo el tiempo.

6)
No siento que esté siendo castigado.
Siento que puedo estar siendo castigado.
Espero ser castigado.
Siento que estoy siendo castigado.

7)
No me siento decepcionado en mí mismo.
Estoy decepcionado conmigo.
Estoy harto de mi mismo.
Me odio a mi mismo.

8)
No me siento peor que otros.
Me critico por mis debilidades o errores.
Me culpo todo el tiempo por mis faltas.
Me culpo por todas las cosas malas que suceden.

9)
No tengo ninguna idea de matarme.
Tengo ideas de matarme, pero no las llevo a cabo.
Me gustaría matarme.
Me mataría si tuviera la oportunidad.

10)
No lloro más de lo habitual.
Lloro más que antes.
Ahora lloro todo el tiempo.
Antes era capaz de llorar, pero ahora no puedo llorar nunca aunque quisiera.

11)
No me irrito más ahora que antes.
Me enojo o irrito más fácilmente ahora que antes.
Me siento irritado todo el tiempo.
No me irrito para nada con las cosas que solían irritarme.

12)
No he perdido interés en otras personas.
Estoy menos interesado en otras personas de lo que solía estar.
He perdido la mayor parte de mi interés en los demás.
He perdido todo interés en los demás.

13)
Tomo decisiones como siempre.
Dejo de tomar decisiones más frecuentemente que antes.
Tengo mayor dificultad que antes en tomar decisiones.
Ya no puedo tomar ninguna decisión.

14)
No creo que me vea peor que antes.
Me preocupa que esté pareciendo avejentado (a) o inatractivo (a).
Siento que hay cambios permanentes en mi apariencia que me hacen parecer inatractivo/a)
Creo que me veo horrible.

15)
Puedo trabajar tan bien como antes.
Me cuesta un mayor esfuerzo empezar a hacer algo.
Tengo que hacer un gran esfuerzo para hacer cualquier cosa.
No puedo hacer ningún tipo de trabajo.

16)
Puedo dormir tan bien como antes.
No duermo tan bien como antes.
Me despierto 1 ó 2 horas más temprano de lo habitual y me cuesta volver a dormir.
Me despierto varias horas más temprano de lo habitual y no puedo volver a dormirme

17)
No me canso más de lo habitual.
Me canso más fácilmente de lo que solía cansarme.
Me canso al hacer cualquier cosa.
Estoy demasiado cansado para hacer cualquier cosa.

18)
Mi apetito no ha variado.
Mi apetito no es tan bueno como antes.
Mi apetito es mucho peor que antes.
Ya no tengo nada de apetito.

19)
Últimamente no he perdido mucho peso, si es que perdí algo.
He perdido más de 2 kilos.
He perdido más de 4 kilos.
He perdido más de 6 kilos.

20)
No estoy más preocupado por mi salud de lo habitual.
Estoy preocupado por problemas físicos tales como malestares y dolores de estomago o constipación.
Estoy muy preocupado por problemas físicos y es difícil pensar en otra cosa.
Estoy tan preocupado por mis problemas físicos que no puedo pensar en nada más.

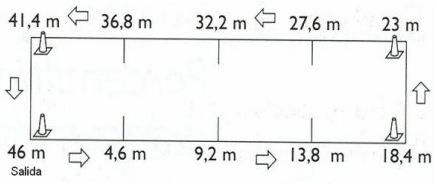
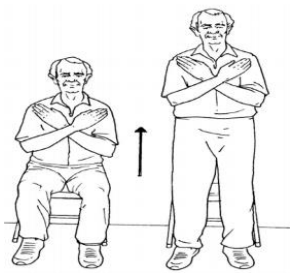
21)
No he notado cambio reciente de mi interés por el sexo.
Estoy interesado por el sexo de lo solía estar.
Estoy mucho menos interesado por el sexo ahora.
He perdido por completo mi interés por el sexo.

APPENDIX 7

Equipment used for the analyses of physical fitness tests:

Type of analyses	Equipment/Materials	Manufacturer/Battery
Aerobic capacity	Seven cones, measuring tape and a stopwatch.	Senior Fitness Test by Rikli & Jones.
Lower body strength	Standardized chair (Height: 43.18 cm) and stopwatch.	Senior Fitness Test by Rikli & Jones.
Handgrip strength	Dynamometer.	Takei TKK 5401, Tokyo, Japan, range 5-100 kg, precision 0.1 kg EUROFIT battery.

Brief explanation of the physical fitness tests:

Fitness test	Fitness assessment	Brief Explanation
6-minute walk 	**Estimated aerobic capacity.**	Number of meters that can be walked in 6 minutes around a 46 meters course. Participants were instructed to walk as far as possible for 6 minutes.
10 rep, 30-s and 60-s Chair stand tests 	**Lower body strength and power.**	The 30-s and 60-s Chair Stand Tests consists of the number of full stands in 30 and 60 seconds or the time to complete 10 repetition, with arms folded across chest. Initially, participants are seated on the chair with their back in an upright position. They are instructed to look straight forward and to rise after "signal go" command at their own preferred speed with their arms folded across their chest.
Handgrip strength 	**Maximum right and left manual strength.**	The participants squeeze gradually and continuously for at least 2 seconds, performing the test two times for each hand in standing position. The handgrip span was adjusted according to the hand size. The maximum score in kilograms for each hand was recorded.

APPENDIX 8

S T A I

A/E PD = 30 + =
A/R PD = 21 + =

AUTOEVALUACION A (E/R)

APELLIDOS Y NOMBRES : _____
EDAD:_____ SEXO: (V) (M) FECHA: _____
CENTRO : _____ ESTADO CIVIL : _____

A-E

INSTRUCCIONES

A continuación encontrará unas frases que se utilizan corrientemente para describirse uno a sí mismo. Lea cada frase y señale la puntuación 0 a 3 que indique mejor cómo se SIENTE UD. AHORA MISMO, en este momento. No hay respuestas buenas ni malas.
No emplee demasiado tiempo en cada frase y conteste señalando la respuesta que mejor describa su situación presente

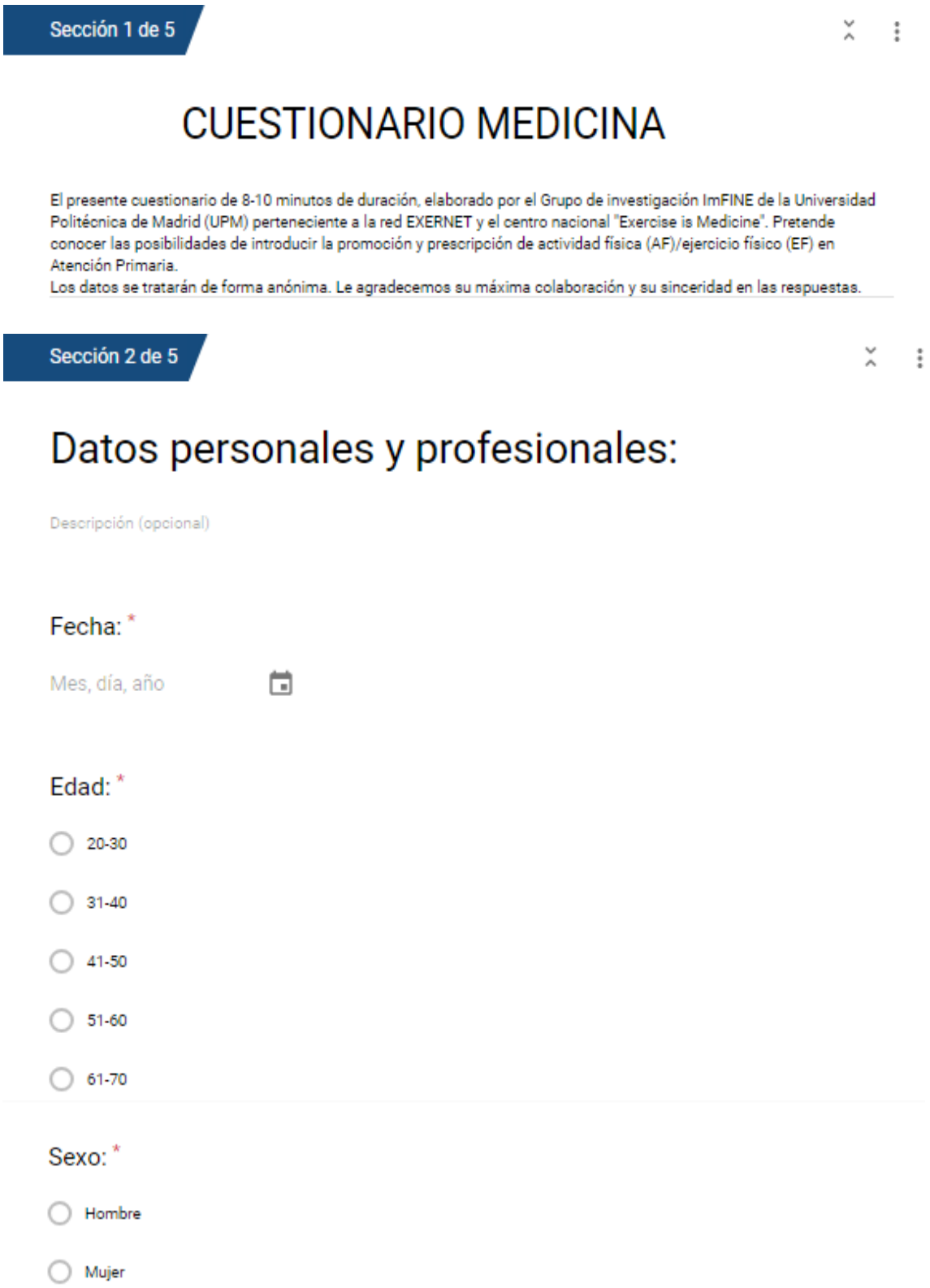
describa su situación presente

		Nada	Algo	Bastante	Mucho
1.	Me siento calmado.	0	1	2	3
2.	Me siento seguro.	0	1	2	3
3.	Estoy tenso	0	1	2	3
4.	Estoy contrariado.	0	1	2	3
5.	Me siento cómodo (estoy a gusto).	0	1	2	3
6.	Me siento alterado.	0	1	2	3
7.	Estoy preocupado ahora por posibles desgracias futuras	0	1	2	3
8.	me siento descansado	0	1	2	3
9.	Me siento angustiado.	0	1	2	3
10.	Me siento confortable	0	1	2	3
11.	tengo confianza en mi mismo.	0	1	2	3
12.	Me siento nevioso	0	1	2	3
13.	Estoy desasosegado.	0	1	2	3
14.	Me siento muy "atado" (como oprimido)	0	1	2	3
15.	Estoy relajado	0	1	2	3
16.	Me siento satisfecho	0	1	2	3
17.	Estoy preocupado.	0	1	2	3
18.	Me siento aturdido y sobreexitado.	0	1	2	3
19.	Me siento alegre.	0	1	2	3
20.	En este momento me siento bien	0	1	2	3

COMPRUEBE SI HA CONTESTADO A TODAS LAS FRASES CON UNA SOLA RESPUESTA

Ahora, vuelva la hoja y lea las instrucciones antes de comenzar a contestar las frases.

APPENDIX 9



Sección 1 de 5

CUESTIONARIO MEDICINA

El presente cuestionario de 8-10 minutos de duración, elaborado por el Grupo de investigación ImFINE de la Universidad Politécnica de Madrid (UPM) perteneciente a la red EXERNET y el centro nacional "Exercise is Medicine". Pretende conocer las posibilidades de introducir la promoción y prescripción de actividad física (AF)/ejercicio físico (EF) en Atención Primaria.
Los datos se tratarán de forma anónima. Le agradecemos su máxima colaboración y su sinceridad en las respuestas.

Sección 2 de 5

Datos personales y profesionales:

Descripción (opcional)

Fecha: *

Mes, día, año

Edad: *

- 20-30
- 31-40
- 41-50
- 51-60
- 61-70

Sexo: *

- Hombre
- Mujer

Dirección asistencial: *

- Norte
- Noroeste
- Sur
- Sur-Este
- Este
- Oeste
- Centro

Grupo /Personal trabajador: *

	Estatutario fijo	Estatutario temporal I...	Estatutario temporal ...	Estatutario temporal ...
A1	○	○	○	○

Año de finalización de su carrera Universitaria: *

Introduzca 4 dígitos numéricos

Texto de respuesta corta

Años de experiencia profesional: *

Número entero de años (1 ó 2 dígitos, según proceda).

Texto de respuesta corta

¿Ha trabajado siempre en Atención Primaria? *

- Sí
- No

En caso negativo, indique los años que lleva trabajando en Atención Primaria

Responda solamente si respondió NO en la pregunta anterior.

Texto de respuesta corta

Sección 3 de 5

Conocimientos generales sobre promoción y prescripción de Actividad Física:

Descripción (opcional)

Terminología:

- Promoción: Acción y efecto de promover (RAE).
- Prescribir: Recetar, ordenar un remedio o tratamiento.(RAE).
- Tratamiento: Conjunto de medios que se emplean para curar o aliviar una enfermedad (RAE).
- Actividad física (AF): Cualquier movimiento corporal producido por los músculos esqueléticos, que exige gasto de energía (OMS).
- Ejercicio Físico (EF): Variedad de actividad física, estructurada, planificada y repetida, que se realiza en busca de un objetivo más específico relacionado con la mejora o el mantenimiento de uno o más componentes de la condición física y motriz.

1. La AF/EF posee efectos preventivos sobre la salud *

- ○ Si
- ○ No
- ○ NS/NC

2. ¿Qué colectivo de edad puede beneficiarse en mayor medida de la AF/EF?:

Puede marcar varias opciones

	20-30 años	31-49 años	50-65 años	> 65 años
Hombre	☐	☐	☐	☐
Mujer	☐	☐	☐	☐

3. ¿Cuándo se considera que una persona adulta es activa?: *

Puede marcar varias opciones

- ☐ Si realiza, al menos, 150 minutos/semana AF de intensidad moderada y además ejercicios de fuerza y flexibilidad, ...
- ☐ Si realiza, al menos, 75 minutos/semana AF de intensidad vigorosos y además ejercicios de fuerza y flexibilidad, al...
- ☐ Sólo si se somete a estímulos físicos que aumenten la condición física
- ☐ NS/NC

4. En la promoción y prescripción de actividad y ejercicio físico: *

	Si	No	NS/NC
La natación es el mejor ejerc...	○	○	○
En personas con obesidad e...	○	○	○
La electroestimulación pued...	○	○	○
El trabajo de fuerza, mediant...	○	○	○
Trabajar el equilibrio en pers...	○	○	○

[1]. La natación es el mejor ejercicio físico para la prevención de osteoporosis.
[2]. En personas con obesidad es aconsejable un trabajo de fuerza mucular.
[3]. La electroestimulación puede ser una alternativa para trabajar la capacidad neuromuscular de un paciente con movilidad reducida.
[4]. El trabajo de fuerza, mediante Pilates, CORE, suelo pélvico,… ¿Podría ayudar a prevenir la incontinencia urinaria en determinadas pacientes?
[5]. Trabajar el equilibrio en personas de edad avanzada podría disminuir lesiones por caídas.

Sección 4 de 5

Estado de Comportamiento:

Descripción (opcional)

5. Señale la frase con la que más se identifique, relacionada con AF y EF: *

- ○ No promociona, ni prescribe, ni pretende hacerlo
- ○ Tiene intención de promocionar y prescribir en los próximos meses
- ○ Se forma e interesa para promocionar y prescribir
- ○ Lleva promocionando y prescribiendo durante menos de 6 meses
- ○ Mantiene su promoción y prescripción como rutina durante más de 6 meses

Sección 5 de 5

Medicina

Responda a las siguientes preguntas:

6. ¿Se considera físicamente activo? *

- ○ Si
- ○ No

7. Conoce y utiliza los efectos preventivos de la AF para mejorar la salud de sus pacientes

Solamente puede seleccionar una opción

	NO los utilizo	SI los utilizo
SI Conozco efectos preventivos de la AF	☐	☐
NO conozco efectos preventivos de la ...	☐	☐

8. Su concienciación sobre los beneficios del EF favorece su uso en consulta *

- ○ Si
- ○ No
- ○ NS/NC

9. ¿Cree que posee suficiente conocimiento para promocionar AF? *

- ○ Si
- ○ No

10. ¿Cree que posee suficiente conocimiento para prescribir EF? *

- Prescribir: Recetar, ordenar un remedio o tratamiento.(RAE).
- Ejercicio Físico (EF): Variedad de actividad física, estructurada, planificada y repetida, que se realiza en busca de un objetivo más específico relacionado con la mejora o el mantenimiento de uno o más componentes de la condición física y motriz.

- ○ Si
- ○ No

11. ¿Su colectivo debe liderar la promoción de AF en Atención Primaria? *

- Promoción: Acción y efecto de promover (RAE).
- Actividad física (AF): Cualquier movimiento corporal producido por los músculos esqueléticos, que exige gasto de energía (OMS).

- ○ Si
- ○ No

12. Si su respuesta anterior fue NO ¿Quién debería liderar?

Responder sólo si su respuesta anterior fue NO.

- ○ Médicos de otras especialidades
- ○ Enfermeros
- ○ Psicólogos
- ○ Fisioterapeutas
- ○ Médicos deportivos
- ○ Licenciados AF/deporte
- ○ Nutricionistas
- ○ Ninguno
- ○ Otra...

13. ¿Considera necesario colaborar con otros profesionales? *

Puede marcar varias opciones

- ☐ Médicos de otras especialidades
- ☐ Enfermeros
- ☐ Psicólogos
- ☐ Fisioterapeutas
- ☐ Médicos deportivos
- ☐ Licenciados AF/deporte
- ☐ Nutricionistas
- ☐ Ninguno
- ☐ Otra...

14. ¿Su colectivo debe liderar la prescripción de EF en Atención Primaria? *

- Prescribir: Recetar, ordenar un remedio o tratamiento.(RAE).
- Ejercicio Físico (EF): Variedad de actividad física, estructurada, planificada y repetida, que se realiza en busca de un objetivo más específico relacionado con la mejora o el mantenimiento de uno o más componentes de la condición física y motriz.

- ○ Si
- ○ No

15. Si su respuesta anterior fue NO ¿Quién debería liderar?

Responder sólo si su respuesta anterior fue NO.

- ○ Médicos de otras especialidades
- ○ Enfermeros
- ○ Psicólogos
- ○ Fisioterapeutas
- ○ Médicos deportivos
- ○ Licenciados AF/deporte
- ○ Nutricionistas
- ○ Ninguno
- ○ Otra...

16. ¿Considera necesario colaborar con otros profesionales? *

Puede marcar varias opciones

- ☐ Médicos de otras especialidades
- ☐ Enfermeros
- ☐ Psicólogos
- ☐ Fisioterapeutas
- ☐ Médicos deportivos
- ☐ Licenciados AF/deporte
- ☐ Nutricionistas
- ☐ Ninguno
- ☐ Otra...

17. ¿Considera necesario colaborar con otros recursos de la Comunidad para una correcta promoción/prescripción de AF/EF? *

- ○ Si
- ○ No

18. En caso afirmativo. ¿Cuáles?

Responder sólo si su respuesta anterior fue SI. Puede marcar varias opciones.

- [ ] Ayuntamientos
- [ ] Centros Deportivos Municipales
- [ ] Centros de Fisioterapia
- [ ] Centros Wellness
- [ ] Consejería Juventud y Deportes
- [ ] Gimnasios privados
- [ ] Centros de enseñanza
- [ ] Ninguno
- [ ] Otra...

19. ¿Se formaría para promocionar AF y/o prescribir EF? *

- ( ) Si
- ( ) No

20. Considera necesaria la formación en otras áreas para poder optimizar la promoción de AF y/o prescripción de EF? *

- ( ) Si
- ( ) No

21. En caso afirmativo. ¿Cuáles?

Puede marcar varias opciones. Responder sólo si su respuesta anterior fue SI.

- [ ] Entrevista motivacional
- [ ] Gestión de tiempo
- [ ] Liderazgo
- [ ] Otra...

22. ¿Cómo preferiría la formación, en caso de considerarla necesaria? *

Puede marcar varias opciones

- ○ Presencial
- ○ On-line
- ○ Mixta (Presencial /on-line)
- ○ Otra...

23. Ha realizado formación sobre promoción de AF *

- ○ Si
- ○ No

24. En caso afirmativo. ¿Cuántos cursos de formación?

Responder sólo si su respuesta anterior fue SI.

0	1	2	3	4	5	6	7	8	9	10	
○	○	○	○	○	○	○	○	○	○	○	Con más de 10 cursos, seleccione la casilla 10

25. Ha realizado formación sobre prescripción de EF *

- ○ Si
- ○ No

26. En caso afirmativo. ¿Cuántos cursos de formación?

Responder sólo si su respuesta anterior fue SI.

0	1	2	3	4	5	6	7	8	9	10	
○	○	○	○	○	○	○	○	○	○	○	Con más de 10 cursos, seleccione la casilla 10

27. Considera necesario adaptar la herramienta de diagnóstico actual: *

- ○ Si
- ○ No

28. En caso afirmativo. ¿Para qué?

Puede marcar varias opciones. Responder sólo si su respuesta anterior fue SI.

- ☐ Clasificar patrón sedentarismo
- ☐ Valorar el tipo AF/EF
- ☐ Volumen AF/EF en tiempo
- ☐ Intensidad AF/EF
- ☐ Clasificar patrón AF
- ☐ Evolución histórica gráfica
- ☐ Analizar estadísticas del paciente
- ☐ Otra...

29. Clasifique de 1 (nada importante) a 6 (muy importante), según el grado de importancia que considere, las siguientes posibles BARRERAS para PROMOCIONAR y/o PRESCRIBIR ejercicio físico:

Debe seleccionar la opción que mejor se ajuste a su opinión

ESPACIOS físicos en su centro: *

	1	2	3	4	5	6	
nada importante	○	○	○	○	○	○	muy importante

Motivación de los PROFESIONALES del centro: *

	1	2	3	4	5	6	
nada importante	○	○	○	○	○	○	muy importante

GESTIÓN DEL TIEMPO *

	1	2	3	4	5	6	
nada importante	○	○	○	○	○	○	muy importante

Recursos MATERIALES y ECONÓMICOS: *

	1	2	3	4	5	6	
nada importante	○	○	○	○	○	○	muy importante

RELACIÓN EXTERNA (entre administraciones) *

	1	2	3	4	5	6	
nada importante	○	○	○	○	○	○	muy importante

MOTIVACIÓN/CONCIENCIACIÓN del paciente *

	1	2	3	4	5	6	
nada importante	○	○	○	○	○	○	muy importante

30. De entre las siguientes posibles SOLUCIONES, señale las que considere necesarias abordar para PROMOCIONAR y PRESCRIBIR ejercicio físico: *

	Si	No	NS/NC
Incorporar una nueva herra...	○	○	○
Disponer de espacios adecu...	○	○	○
Trabajo multidisciplinar entr...	○	○	○
Mejorar la formación contin...	○	○	○
Publicitar y promocionar est...	○	○	○
Implantación progresiva de ...	○	○	○
Dotación de recursos materi...	○	○	○
Fomentar el liderazgo en pro...	○	○	○
Utilizar la consulta de acogi...	○	○	○
Promover actividad física fu...	○	○	○
Dedicar más tiempo en cons...	○	○	○

*

[1]. Incorporar una nueva herramienta para evaluar el patrón de AF/sedentarismo del paciente a su historia clínica.
[2]. Disponer de espacios adecuados para evaluar el nivel de condición física del paciente.
[3]. Trabajo multidisciplinar entre profesionales.
[4]. Mejorar la formación continua de los profesionales.
[5]. Publicitar y promocionar estrategias de sensibilización del paciente.
[6]. Implantación progresiva de un modelo de promoción y prescripción de ejercicio físico.
[7]. Dotación de recursos materiales (Ej. acelerómetros, Apps telefonía móvil, etc..) para hacer un seguimiento y aumentar la motivación del paciente.
[8]. Fomentar el liderazgo en promoción de actividad física en los centros.
[9]. Utilizar la consultationa de acogida para valorar inicialmente el patrón de AF/sedentarismo y/o el nivel de condición físico del paciente.
[10]. Promover actividad física fuera del centro, supervisada por profesionales del centro. (Ej. Rutas de paseos activos).
[11]. Dedicar más tiempo en consultationa para promocionar actividad física.

APPENDIX 10

The Miracle Drug: Exercise is Medicine®

Your Prescription for Health
ExeRcise is Medicine®

Rationale

In an era of spiraling health care expenditures, getting patients to be more active may be the ultimate low-cost therapy for achieving improved health outcomes.[1] Studies show that regular physical activity (PA) has health benefits at any body weight and that it's critical for long-term weight management. In fact, recent work has shown that exercise is as effective as prescription medications in the management of several chronic diseases.[2] Consequently, PA promotion should be the foundation of clinical therapy and public health policy, whether to promote health or control weight. Just as weight and blood pressure are addressed in some manner at nearly every healthcare provider visit, so should attention be given to exercise prescription and the accumulation of [150 minutes of moderate intensity PA per week.[3]]

The Exercise is Medicine® (EIM) Solution

Assessment – Using the *Physical Activity Vital Sign* to Calculate Weekly PA Levels

1. On average, how many days/week do you engage in moderate to vigorous PA (like brisk walking)?
   _____ **days**
2. On average, how many minutes do you engage in PA at this level?
   _____ **minutes/day**
3. Total activity = days/week x minutes/day =
   _____ **minutes/week**

Prescription – Basic Exercise Recommendations

Sedentary adults should be encouraged to engage in low to moderate PA with a gradual progression to the recommended 150 minutes per week of moderate to vigorous PA.

Insufficiently active adults should be encouraged to achieve 150 minutes of moderate to vigorous PA each week.

Children and adolescents should obtain up to 60 minutes per day of moderate to vigorous PA each day including a mix of aerobic activity, muscle strengthening, and bone loading.

National Physical Activity Guidelines[4]

Age	Aerobic Activity Recommendations	Muscle Strengthening Recommendations
6-17	60 minutes of moderate to vigorous physical activity (PA) per day	As part of their 60 or more minutes of daily PA, children and adolescents should include muscle-strengthening PA on at least 3 days of the week
18-64	150 minutes of moderate PA or 75 minutes of vigorous PA a week	Activities that are moderate or high intensity and involve all major muscle groups on 2 or more days a week
65+	150 minutes of moderate PA or 75 minutes of vigorous PA a week	Activities that are moderate or high intensity and involve all major muscle groups on 2 or more days a week

Resources and References

- Consider reaching out to a health and fitness professional to work with you and your patients. Together, you can establish realistic goals and design a safe, effective and enjoyable program.
- Lifestyle activities count! Encourage patients to take up gardening or take a brisk walk with their dog.
- Physicians who are more physically active, are more likely to counsel patients regarding physical activity. It's not enough to just "talk the talk," you have to literally "walk the walk."
- For future reference, you and your patient can visit the EIM website at http://exerciseismedicine.org.

Notes

1. Blair. et al. (2004). The Fitness, Obesity, and Health Equation: Is Physical Activity the Common Denominator? JAMA; 292(10), 1232-34.
2. Naci et al. (2013). Comparative Effectiveness of Exercise and Drug Interventions on Mortality Outcomes: Meta-epidemiological study. BMJ; 347, 1-14.
3. Boden et al. (2013). Physical Activity and Structured Exercise for Patients with Stable Ischemic Heart Disease. JAMA; 309(2), 143-4.
4. 2008 Physical Activity Guidelines for Americans. http://www.health.gov/paguidelines/guidelines/

https://www.exerciseismedicine.org/assets/page_documents/EIM_HCP_1_Page_Summary.pdf

APPENDIX 11

QUESTIONÁRIO INTERNACIONAL DE ATIVIDADE FÍSICA

– FORMA CURTA -

Nome:_____

Data: ___/ ___ / ___ Idade : ____ Sexo: F ( ) M ( )

Você trabalha de forma remunerada: ( ) Sim ( ) Não

Quantas horas você trabalha por dia: _____

Quantos anos completos você estudou: _____

De forma geral sua saúde está:

( ) Excelente ( ) Muito boa ( ) Boa ( ) Regular ( ) Ruim

Nós estamos interessados em saber que tipos de atividade física as pessoas fazem como parte do seu dia a dia. Este projeto faz parte de um grande estudo que está sendo feito em diferentes países ao redor do mundo. Suas respostas nos ajudarão a entender que tão ativos nós somos em relação à pessoas de outros países. As perguntas estão relacionadas ao tempo que você gasta fazendo atividade física em uma semana **NORMAL, USUAL** ou **HABITUAL**. As perguntas incluem as atividades que você faz no trabalho, para ir de um lugar a outro, por lazer, por esporte, por exercício ou como parte das suas atividades em casa ou no jardim. Suas respostas são MUITO importantes. Por favor responda cada questão mesmo que considere que não seja ativo. Obrigado pela sua participação !

Para responder as questões lembre que:
- atividades físicas **VIGOROSAS** são aquelas que precisam de um grande esforço físico e que fazem respirar MUITO mais forte que o normal
- atividades físicas **MODERADAS** são aquelas que precisam de algum esforço físico e que fazem respirar UM POUCO mais forte que o normal

Para responder as perguntas pense somente nas atividades que você realiza **por pelo menos 10 minutos contínuos** de cada vez:

1a. Em quantos dias de uma semana normal, você realiza atividades **VIGOROSAS** por pelo menos 10 minutos contínuos, como por exemplo correr, fazer ginástica aeróbica, jogar futebol, pedalar rápido na bicicleta, jogar basquete, fazer serviços domésticos pesados em casa, no quintal ou no jardim, carregar pesos elevados ou qualquer atividade que faça você suar **BASTANTE** ou aumentem **MUITO** sua respiração ou batimentos do coração.

dias _____ por **SEMANA** ( ) Nenhum

1b. Nos dias em que você faz essas atividades vigorosas por pelo menos 10 minutos contínuos, quanto tempo no total você gasta fazendo essas atividades **por dia**?

horas: _____ Minutos: _____

2a. Em quantos dias de uma semana normal, você realiza atividades **MODERADAS** por pelo menos 10 minutos contínuos, como por exemplo pedalar leve na bicicleta, nadar, dançar, fazer ginástica aeróbica leve, jogar vólei recreativo, carregar pesos leves, fazer serviços domésticos na casa, no quintal ou no jardim como varrer, aspirar, cuidar do jardim, ou qualquer atividade que faça você suar leve ou aumentem **moderadamente** sua respiração ou batimentos do coração **(POR FAVOR NÃO INCLUA CAMINHADA)**

dias _____ por **SEMANA** ( ) Nenhum

2b. Nos dias em que você faz essas atividades moderadas por pelo menos 10 minutos contínuos quanto tempo no total você gasta fazendo essas atividades **por dia**?

horas: _____ Minutos: _____

3a. Em quantos dias de uma semana normal você caminha por pelo menos 10 minutos contínuos em casa ou no trabalho, como forma de transporte para ir de um lugar para outro, por lazer, por prazer ou como forma de exercício?

dias _____ por **SEMANA** ( ) Nenhum

3b. Nos dias em que você caminha por pelo menos 10 minutos contínuos quanto tempo no total você gasta caminhando **por dia**?

horas: _____ Minutos: _____

4a. Estas últimas perguntas são em relação ao tempo que você gasta sentado ao todo no trabalho, em casa, na escola ou faculdade e durante o tempo livre. Isto inclui o tempo que você gasta sentado no escritório ou estudando, fazendo lição de casa,visitando amigos, lendo e sentado ou deitado assistindo televisão.

Quanto tempo **por dia** você fica sentado em um dia da semana?

horas: _____ Minutos: _____

4b. Quanto tempo **por dia** você fica sentado no final de semana?

horas: _____ Minutos: _____

Sandra Matsudo, Timóteo Araújo, Victor Matsudo, Douglas Andrade, Erinaldo Andrade, Luis Carlos Oliveira, & Braggion., G. (2001). Questionário internacional de atividade física (IPAQ): estupo de validade e reprodutibilidade no brasil. Rev Bras Ativ Fis Saúde, 6 (2), 1-14. doi: https://doi.org/10.12820/rbafs.v.6n2p5-18

APPENDIX 12

Supplemental material Table 12. Descriptive data of the studies included in the review.

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Desveaux, Goldstein, Mathur, & Brooks, 2016)	CS	67	PHCs (both sexes)	35 PHCs	Cardiac rehabilitations	Questionnaire is a modified version of the CRBS (Shanmugasegaram et al., 2012)	Community based exercise	Modified questionnaire version of the CRBS (Shanmugasegaram et al., 2012).
(Martin-Payo, Suarez-Alvarez, Amieva Fernandez, Duaso, & Alvarez Gomez, 2016)	RCT	18-77	n=230 (57,7, 42,3%)	HC	NCDs	Patients without PA or dietary restriction	WHO, 2010 PA guidelines	PA and diet: •Motiva. Diaf. Questionnaire PA guidelines Crespo-Salgado et al., 2015 and WHO, 2010.
(Bergh, Lundin Kvalem, Risstad, & Sniehotta, 2016)	C	18-60	n=230 patients (78.3, 21.7%)	Hospital	Morbid Obese	IPAQ-short form. PA and Energy requirements: (MET-min/week).	General postoperative behavioral recommendations by Norwegian National guidelines for healthy diet and PA: (PA of moderate intensity for a minimum of 150 min/week or vigorous PA for 75 min/week)	Measured PA Norwegian National guidelines (by IPAQ-short form) (Pre y 1year-post operation).
(Chrisman, Daniel, Chow, Wu, & Zhao, 2015)	C	>30-<65	n= 21551 (Both sexes)	HC fairs and clinics.	Obese	California teachers study (CTS) survey PAL: Hours/week and average of months in (exercise, sport and work activities. (METs)).	US PA recommendations 150 min/week moderate PA or 75 min /week vigorous PA	US PA recommendations compliance

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Norton, Norton, & Lewis, 2015)	RCT	18-63	n= 871 (Both sexes)	Hospital	NCDs	Sports Medicine Australia screening system: (Pre-exercise Screening and Testing, measured physical fitness and PA interventions) Physical fitness: (Grip strength, sit and reach flexibility and relative VO_2 max) Pedometer-based strategy (min/week)	PA intervention: (1) a pedometer-based strategy, wherein participants were instructed to achieve at least 5,000 steps/every day in week one and increase this by 1,000 steps/wk to 10,000 steps/day by week six; and (2) a group-based strategy requiring participants to attend instructor-led activities three times/week (Monday, Wednesday, and Friday) and undertake individual activities for at least 30 minutes on all other days of the week.	Compliance (%): (Achieved daily targets, Sufficiently active after intervention) Adherence (%): (Completed versus screened, Completed versus started).
(Thomson et al., 2015)	C	44.3 ±12.2	n= 267, (both sexes)	University	Hypertension	Pedometer measured daily: (Weekly step/day) Cv Fitness measures: (6MW)	Walking group sessions Education sessions	3 markets of adherence: -Completion of homework (Self monitoring PA) -Class attendance -Completion of scheduled telephone calls • 7 adherence indicators: -Continuous ESA. -Continuous -Categorical ESA -Categorical PDS -Continuous ESA/PDS -Categorical ESA/PDS -Continuous categorical ESA/PDS
(Alkerwi et al., 2015)	CS	18-69	n= 3133 (both sexes)	HC System	NCDs	International Physical Activity Questionnaire (IPAQ)	PA recommendations: (at least 150 minutes per week of moderate-intense physical activity for adults, or accumulating a minimum 30 minutes of moderate intense physical activity on at least five days per week).	Compliance to PA recommendations by IPAQ
(Kinnafick, Thogersen-Ntoumani, & Duda, 2014)	CS	18-64	n=90 (84,6)	British university employees	Physically inactive employees with asthma.	IPAQ (Craig et al, 2003)	Walking intervention: (16 weeks)	PA adherence: (16 weeks + 6 month = 10 month). PA Non-adherenceNon-adherence (less than 10weeks). PA Lapse and Re-adaptation aprox.:2-3months of lapse and readopting)

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Jefferis et al., 2014)	C	70-93	n=6529 (3237, 3292)	PHC	NCDs	Log. Dairy Questionnaire Accelerometer: GT3x - 7d.	UK PA recommendations: (≥150 minutes/week of moderate or vigorous PA (MVPA) in bouts of ≥10 minutes	UK PA recommendations, measured by: - Log. Dairy - Questionnaire - Accelerometer
(Venditti et al., 2014)	RCT	25->65	n=3234. (68, 32%)	27 HC	Obesity and DM2T	N.I.	Published in website: http://www.bsc.gwu.edu/dpp/manuals.htmlvdoc.	Percentage ranked of the cohort study
(Austin, Qu, & Shewchuk, 2013)	CS	45->64	n=10892 (both sexes)	HCcenters for disease control and prevention	Arthritis	BRFSS questionnaire records respondents' self-reported in a usual week (PA module)	PA guidelines reported at least 30 minutes of physical activity on 5 or more days per week	Patients yes/no question: PAL Recommendations: (adhered or not) Health care providers' yes/no question: Recommendations for physical activity: (yes/no)
(Garmendia et al., 2013)	RCT	65.0-67.9	n=996 (69.5, 30.5%)	36 PHCs	NCDs	Structured training load: (only: one-hour classes twice a week (total classes offered = 228) over two years).	Structured exercise programme: a progressive resistance exercise protocol with one-hour classes twice a week (total classes offered = 228) over two years, supervised by a PA instructor. The original protocol consisted of a routine of three levels of chair stands, three levels of modified squats (with or without Thera-bands), three levels of step-ups on a stair, and six sets of arm pull-ups using rubber bands with variable resistance.	Minimum classes attendance of 24 PA classes spread over at least 12 months
(Bossen, Buskermolen, Veenhof, de Bakker, & Dekker, 2013)	RCT	50-75	n= 100 (60,4)	HC	Osteoarthritis	Web-based PA intervention by Join2move with Patients' favourite recreational activity (i.e. cycling, walking or gardening). 12 sessions of a self-guided PA and text messages (email or phone) to promote physical activity	PA program web based PA intervention: Join2move is a self-paced 9-week PA program	Number of completed modules / total modules.

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Austin, Qu, & Shewchuk, 2012)	RCT	>45	n=33071 (65%, 35%)	HC	Arthritis	Module of PA which records self-reported moderate and vigorous physical activity by respondents in a usual week in BRFSS questionnaire.	American College of Rheumatology's (ACR) PA recommendations	Physicians PA recommendation (by BRFSS questionnaire)
(Martin & Woods, 2012)	RCT	50-85	n=24 (9 ,15)	Hospital	Coronary heart disease	Training load:(1h. Run. 5times/week during 6 months)	Community run exercise programmes: (Classes are 1 hr, 15 min in length and run five times per week).	Regular attendance (average two sessions/week) at the program for the previous 6 months or longer with a lapse no greater than 1 month within that period.
(Courneya et al., 2012)	RCT	50-74	n=160 (160,0)	PHCs	Breast cancer	Heart rate monitors (Polar A3) to ensure that at least half of their total workout time was between 70%–80% of their heart rate reserve. They were instructed to warm up for 5 minutes, cool down for 5–10 minutes, and stretch. • A modified Balke treadmill protocol was used to estimate maximum oxygen consumption (VO2max) from sub-maximal exercise intensities.	Exercise prescription: Moderate-to-vigorous intensity aerobic exercise for at least 45 min/ session on 5 days/wk for 1 year (ie, 225 min/wk). The exercise prescription increased gradually over the first 3 months starting with 3 weekly sessions of 15–20 minutes at 50%–60% of heart rate reserve, resulting in an average goal of 200 min/wk over the entire 1-year period.	PA Guidelines (supervised and unsupervised) : -Sessions/wk -Min/wk (prescribed 200 exercise minutes/week

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Evers, Klusmann, Schwarzer, & Heuser, 2012)	RCT	70-93	n=171 (171, 0).	NI	Inactive and Elderly.	Training load: 6-month (26weeks) period and involved three weekly 90-min standardized training sessions in physical exercise (NI)	Standardized training exercise sessions: 6-month period and involved three weekly 90-min standardized training sessions in physical exercise or computer skills	Number of course units attended in each periods (initiation, middle, final)
(Tiedeman n et al., 2012)	Interventional study	66.7	n=76 (38,38)	11 Physiotherapist centers	Stroke survivors	Training load: 12 months intervention. Physical activity was the average pedometer steps/day measured over seven days at the end of the trial •Physical functioning: knee extensor strength, 10m walk test, &MW, maximal balance range	Home exercise programme: **Weight-bearing Exercise for Better Balance (WEBB) program**. At least 3 times per week. Exercise sessions took between 45 and 60 minutes. Over 40 weeks	Percentage of classes attended / year
(Rodriguez-Romo et al., 2011)	CS	25-74	n=1500 (78, 82%)	HC System by phone line	Low self-perceived health (smokers)	Version 2 Global Physical Activity Questionnaire (GPAQv2): (PAL: (low, moderate and high)).	PA recommendations of 20 min. Vigorous PA during 3 days/week or 30 min/week of vigorous/moderate PA recommendations during 5 days/week	Adherence PA recommendations (NI method)
(Netz, Goldsmith, Shimony, Ben-Moshe, & Zeev, 2011)	L	>65	n=1536 (both sexes)	HC	NCDs	Israeli national survey (Module of PA)	PA recommendations (ACSM, 2009; AHA,Nelson et al., 2007; USDHHS, 2008): moderate-intensity activity for at least 150 min, 75 min of vigorous-intensity aerobic activity, or an equivalent mix of moderate- and vigorous-intensity aerobic activity per week	Meeting PA recommendations according to Israeli national survey

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Yeom, Jung, & Choi, 2011)	CS	65-103	n=2241. (59.6, 40.4%)	Korean National HC System	> 3 NCDs	Fourth Korean National Health and Nutrition Examination Survey (KNHANES IV) World Health Organization's International Physical Activity Questionnaire (WHO's IPAQ) (KCDC, 2007).	PA recommendation (Korea Ministry of Health and Welfare, 2007): Adults: 20 minutes of vigorous PA at least 3 days per week, and 30 minutes of moderate PA or walking at least 5 days per week	PA Korean recommendations, 2007–2008: -Percentage of older adults participating in PA -Percentage of older adults meeting national PA guidelines. -Duration of PA in minutes or days/week
(Leijon et al., 2010)	RCT	18->65	n=2611 (1740, 871)	37 Swedish PHCs	NCDs	PA recall-7d: (1) regularly active (those who reported 5-7 days of 30 minutes of moderately intense physical activity); (2) moderately active (3-4 days); (3) somewhat active (1-2 days); and (4) inactive (0 days)	Home-based activity Facility-based activity Combination of home-based and facility-based activity. (e.g. group gymnastics, aerobics: walking, jogging or cycling, water aerobics, weight and circuit training.).	PA self-reported adherence at 3 and 12 month, by one yes/no question: "have you adhered to your physical activity prescription?"
(Smits, Tart, Presnell, Rosenfield, & Otto, 2010)	RCT	19.43	n=92 (51, 41)	College students	Obese	PARQ, (1981) IPAQ (2003) Estimate cardio respiratory fitness related to IPAQ category	PA Intervention: 20 min on treadmill exercise (at 70% of their age-adjusted predicted maximum heart rate)	PA adherence, after intervention 6 and 12 month (by IPAQ)
(Kallings, Leijon, Kowalski, Hellenius, & Stahle, 2009)	RS	25-78	n=240 (75, 25%)	13 Swedish PHCs	NCDs	Self-reported PAL	Counselling based in FYSS project: (recommended physical activity level of at least 30 minutes of moderate physical activity at least 5 days a week and/or vigorous physical activity 3 times a week) and 6-month follow-up questionnaire.	Self reported adherence by and 6-month follow-up survey.

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Gine-Garriga et al., 2009)	RCT	>18	n= 424 (both sexes)	9 Spanish PHCs	NI	International Physical Activity Questionnaire (IPAQ) short form.	PA promotion programme: (Duration: 3 months Frequency: 2 days/week per session of 60 min. With aerobics and resistance training). (See table 1) PA recommendation guidelines to Primary health care (PHC).	Long term adherence at 1 and 3 month (by IPAQ)
(Meseguer, Galan, Herruzo, Zorrilla, & Rodriguez-Artalejo, 2009)	CS	18-64	n=12037 (both sexes)	SIVFRENT study.	Obese	Leisure time Physical activity (LTPA) level was quantified in metabolic equivalent (MET) hours per week by questionnaire on the frequency and duration of LTPA (last 2 weeks)	WHO PA guidelines: moderate activity ≥150 min/week or vigorous activity ≥60 min/week.	LTPA and work PA adherence (NI method)
(Bergman, Grjibovski, Hagstromer, Bauman, & Sjostrom, 2008)	CS	18-74	n=1470 (both sexes)	HEPA project	Obese	IPAQ short version: (PAL and METminutes/week-1) Accelerometers.	Swedish PA recommendations (HEPA study)	Adherence to PA recommendations (by IPAQ) and the influence of socio-demographic factors
(Rejeski et al., 2007)	RCT	70-89	n= 684 (471, 213)	Home and HC	NCDs	Training load: (Intensity: (RPE), Frequency: (days/week),Volume: (time)). Functional and fitness capacity: (SPPB)	Training program Walking primary mode of PA: (150 min7week) Balance, flexibility, aerobic and lower extremity strength (To see description of PA intervention in table 2).	Follow-up PA adherence.-1y.

Reference	Type of study	Range age or mean	n (f, m)	Health care setting	Disease/s	PA measured	PA Prescription	PA assessment adherence
(Fielding et al., 2007)	RCT	70-89	n= 424 (both sexes)	4 clinical HC	Sedentary adults (functional limitations)	Training load: (RPE intensity, Walking (minutes/day), frequency of strength training (sessions/week)) CHAMPS questionnaire: (PAL at baseline: 6 and 12 months).	PA intervention (12 month): walking, strength, flexibility, and balance training supplemented in 3 phases: Adoption, Transition and maintenance (weeks 25 to end of trial) Home-based PA. SA consisted of weekly (weeks 1–26). Home-based walking/ strengthening/flexibility activities (minimum of 5 d. wk-1and one weekly, center-based session). Health education workshops (Control group).	Attendance at center-based PA sessions: - Exercise sessions attended of total sessions scheduled (in each phase) PA guidelines recommendations by CHAMPS questionnaire: (at 6 and 12 months)
(Heesch, Masse, Dunn, Frankowski, & Mullen, 2003)	RCT	44-75	n= 244 (49, 51%)	The Cooper Institute of preventive medicine.	Obese	Pedometer Physical Recall (PAP)- 7d	1995 CDC/ACSM physical activity guideline	Attendance Homework completion Self-monitoring intervention Telephone call completion Mail-delivered intervention. Meeting PA guideline
(Wilbur, Michaels Miller, Chandler, & McDevitt, 2003)	RCT	45-65	n=153 (153, 0)	Nurses practitioners in HC	CV disease	Heart rate monitor: Polar Vantage XL. Maximal aerobic fitness tests: (pre- and post intervention VO2max)	Home-based walking program-24week. (Frequency (4 times per week). Duration (increasing within the first 4 weeks from 20 to 30 min of continuous walking. Intensity of walking was Patient-related to be 50–74% MHR).	Adherence to walking: by HR monitor. Percentage of the expected 96 walks (4 walks per week for 24 weeks).
(White, Croce, Loureiro, & Vroman, 1991)	RCT	>18	n=33 (both sexes)	NI	Sedentary adults.	PA survey (NI)	Exercise Programme: 6 weeks (a): 40 min. twice a week at 60 to 70% maximal heart rate (b): 20 min. four times a week at 60 to 70% maximal heart rate of aerobic exercise	Adherence: (number of sessions attended by each subject in PA intervention) PAL on leisure time (after 6 months PA intervention) by PA survey NI.

Note. NI: Not identified; CV: cardiovascular; (M)HR: (maximum) Heart rate; OA: osteoarthritis; BMI: Body mass index; RPE: Rated Perceived Exertion; PHCs: Primary Health Care Centers; NCDs: Non-communicable chronic diseases; T2DM: Type 2 Diabetes mellitus; d: days; IPAQ: International Physical Activity Questionnaire, PA: Physical activity; 6MW: 6 Minutes Walk Test; P: Perspective report,; CS: Cross Sectional study; RCT: Randomized Controlled Trial; C: Cohort study; CS: Case Study; L: Longitudinal study; RS: Research Support.

APPENDIX 13

Supplemental material Table 13. Descriptive data related to adherence factors in exercise prescriptions according to the five-dimensions WHO adherence model and mentioned theories related to human behavior included in the review.

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Health-Care System**	**Condition**	**Therapy**	**Patient**	**Country**
(Desveaux, Goldstein, Mathur, & Brooks, 2016)	SCT	6.Transportation issues:(travel time) 8.Treatment costs 9.Environmental factors:(weather)	1.Problems with patient–provider relationships 2.Inadequate local health services:(program by an HCP, need of HCP as a case manager, Logistical issues). 4.Lack of incentives and feedback on performance: healthcare; lack of guidance regarding appropriate exercises and lack of availability of a nearby facility.	1.Symptom burden: (severity of physical symptoms) 4. Effective treatments: (program designed specifically for the patient's condition) 5.Comorbidities		9. Beliefs and perceptions:(Work /time conflict)	Canada
(Martin-Payo, SuarezAlvarez, Amieva Fernandez, Duaso, & Alvarez Gomez, 2016)	SDT	3. Low educational level. (education level) 10.Demographics factors: (social-demographics factors, civil status)		5.Comorbidities: (health status related to biological markers)		6.Motivation 8.Psychological issues: (basic psychological needs)	Spain
(Bergh, Lundin Kvalem, Risstad, & Sniehotta, 2016)	SCM/ TTM	3. Low educational level: (educational level) 4.Unemployment: (employment rate) 10.Demographics factors (sex, age, married status)		5.Comorbidities: (obesity-related to co-morbidities)	2.Treatment complexity: (Planning PA) 3.Previous failures with therapy: (preoperative PA is related to postoperative activity, Dieting experience, failed obesity-related co-morbidities)	2.Self-efficacy:(self-esteem, emotion regulation) 3. Cognitive ability:(cognitive restraint) 5. Cosmetic concerns: (body image) 6.Motivation: (intention to be physically active) 7.Attitud: (previous behaviour) 8.Psychological issues: (depression/anxiety) 9.Beliefs and perceptions: (readiness to change behaviour, expectations)	Norway

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Health-Care System**	**Condition**	**Therapy**	**Patient**	**Country**
(Chrisman, Daniel, Chow, Wu, & Zhao, 2015)	NI	3.Low educational level (education level) 4.Unemployment: (activity level of job (MET)). 10.Demographics: (age, sex, marital status, Acculturation: (time and country of birth))		1.Symptom burden: (Smoke and alcohol use) 5.Comorbidities: (obese (High BMI)).		7.Attitud: (Lifestyle factors: (sitting and sleeping time/day)	Mexico and EEUU
(Norton, Norton, & Lewis, 2015)	NI	10.Demographics factors: (age and gender)		3.Activity limitation: (pre-exercise screening and testing) 5.Comorbidities: (BMI, health biomarkers)	2.Treatment complexity: (PA intervention)		Australia
(Thomson et al., 2015)	SST SDT SCM/ TTM	1. Low socioeconomic status: (Household incomes) 3.Low educational level: 10.Demographics factors: (marital status, age)	5.Inadequate support for patient education	5.Comorbidities: (HDL/LDL, DBP, Glucose, triglycerides, etc)			EEUU
(Alkerwi et al., 2015)	N.I.	2.Low educational level: (primary, secondary, tertiary) 4.Unemployment: (employment status) 8.Treatment costs: (resources perception) 10.Demographics factors: (age, gender, marital status)		1.Symptom burden. (Smoking status) 5.Comorbidities: (morbidity score)		7.Attitud: (behavioural related factors associated) 9. Beliefs and perceptions: (health related factors associated, importance of PA for health).	Luxembourg
(Kinnafick, Thogersen-Ntoumani, & Duda, 2014)	SDT	5.Insufficient social support: (Satisfaction of needs to relatedness)			2.Treatment complexity: Internalization walking behaviour	2. Self-efficacy: (competence, autonomy) 6.Motivation	Great Britain
(Jefferis et al., 2014)	NI	5.Insufficient social support: (social and leisure activities, facilities for people your age, Feel safe walking alone in daytime, Feel safe walking alone after dark, (% (n))) Very good/good (% (n)), Social isolation: (mean)) 6.Transportation issues: (Local transport,) 9.Environmental factors: (The area has nice place to go for a walk, Feel safe walking alone after dark, (% (n))) 10.Demographics factors: (Age, Living alone vs living with others)		3.Activity limitation: (Moderate/severe mobility limitations outdoors, Falls in the past 12 months, % (n)) 5.Comorbidities: (≥3 Chronic conditions, % (n), BMI level)	2.Treatment complexity: (PAL/day: Counts/min, Steps, Sedentary, LIGHT,MVPA (minutes/day), Leaves the house 5/days/week, Cycle/walk regularly, Do most shopping walking distance from home, regularly walk a dog? (% (n))	2. Self-efficacy: (Exercise self efficacy) 8.Psychological issues: (Geriatric depression scale) 9. Beliefs and perceptions:(Exercise outcome expectations)	UK (25 towns)

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Health-Care System**	**Condition**	**Therapy**	**Patient**	**Country**
(Venditti et al., 2014)	SCM/ TTM	1. Low socioeconomic status:(Household Income) 3. Low educational level: (Education) 4.Unemployment: (Work Status) 5. Insufficient social support: (Social cues for activity changed, major life events) 10.Demographics factors: (Sex, age, marital status, race/ethnicity)	3.Insufficient PA knowledge and training for health care providers: (activity restricted by doctor)	1.Symptom burden: (Injury, aches and pains) 5.Comorbidities: (Illness)	2.Complexity and Effective treatments: (Lack of access/Safety concerns, management and planning)	1.Insufficient knowledge: (Poor/inconsistent self-monitoring) 6.Motivation: (diminished motivation) 8.Psychological issues: (Internal (thought and mood) cues) 9.Beliefs and perceptions: (Vacation, holiday, time)	EEUU
(Austin, Qu, & Shewchuk, 2013)	HBM	1.Low socioeconomic status:(income) 3.Low educational level: (education) 4.Unemployment: (employment) 9.Environmental factors: (region of residence) 10.Demographics factors: (age, race, sex, marital status)	1.Problems with patient–provider relationships :(Patient-related physician) 2.Inadequate local health services: environmental factors were issues related to access to care, access to healthcare coverage 5.Inadequate support for patient education.	1.Symptom burden: (overall health status) 3. Activity limitation. 5.Comorbidities: (obesity).			EEUU
(Garmendia et al., 2013)	NI	1.Low socioeconomic status:(average household income) 3. Low educational level: (years) 4.Unemployment: (work status) 5.Insufficient social support: (participation in community organizations/social clubs, self-perception of social support) 9.Environmental factors: (distance from home to the PA center, impoverished households by neighbourhood, community organizations by neighbourhood, well-kept community green areas by neighbourhood, arrests for violent crimes by neighbourhood) 10.Demographics factors: (sex, care of relatives, household composition: (live alone/live with family)		1.Symptom burden: (current smoker,). 5.Comorbidities: (obesity: BMI, depression, self-report of chronic illness)	3.Previous failures with therapy: (participation in PA prior to the intervention). 5. Lack of perceived beneficial effects: (satisfaction with intervention).	8.Psychological issues: (depression)	Australia

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Health-Care System**	**Condition**	**Therapy**	**Patient**	**Country**
(Bossen, Buskermolen, Veenhof, de Bakker, & Dekker, 2013)	SCM/ TTM	3. Low educational level: (educational level: low middle, high) 5.Insufficient social support: (absence of human involvement, social support from family or friends) 10.Demographics factors: (Age: older patients, gender)	2.Inadequate local health services: (Lack of Patient-related guidance)	1.Symptom burden: (active and passive pain, fatigue, duration of OA complaints) 3. Activity limitation: (Presence of physical problems, self-reported PA, physical function, OA location) 5.Comorbidities: (BMI)		2. Self-efficacy: (Low mood) 6.Motivation: (Insufficient motivation) 8.Psychological issues: (anxiety and depression)	Netherlands
(Austin, Qu, & Shewchuk, 2012)	HBM	1.Low socioeconomic status: (annual income) 3.Low educational level: (education) 4.Unemployment: (employment). 5.Insufficient social support: (social and emotional support) 10.Demographics factors: (age, sex, race, marital status)	1.Problems with patient–provider relationships 6.Insufficient reimbursement from health insurance: (health insurance)	1.Symptom burden: (health status) 3.Activity limitations 5.Comorbidities: (BMI, etc.)			EEUU (19 States)
(Martin & Woods, 2012)	S-RT S-ET SCM/ TTM	5.Insufficient social support:(Social support: emotional: family and friends) 10.Demographics factors: (age, marital status)	2.Inadequate local health services: (community-based cardiac rehabilitation staff) 5.Inadequate support for patient education : (Instrumental support: (health professionals), emotional:(fellow participants)	5.Comorbidities: (medical history)	2.Treatment complexity and effectiveness: Structured class: (Novel exercises, specialist staff, routine, purpose)	2. Self-efficacy. (Self-efficacy: task, barrier, recovery) 9. Beliefs and perceptions: (Belief in health benefits)	Ireland (Dublin)
(Courneya et al., 2012)	TPB	3.Low educational level: Education:(≤ High School or ≥ College) 4.Unemployment :(Employment status: Not working full-time or Full-time work) 5.Insufficient social support: (Injunctive norm) 9.Environmental factors: (Location) 10.Demographics factors: (Age, marital status, Ethnicity)		3.Health-related fitness, quality of life: (health-related fitness)	2.Treatment complexity and effectiveness: (supervised or unsupervised exercise program) 3. Previous failures with therapy: (Family history of breast cancer)	2. Self-efficacy 6.Motivation 7.Attitud: (Intention, Instrumental attitude, Affective attitude) 9. Beliefs and perceptions: (Perceived behavioural control and quality of life, past sports/recreational PA (min/wk))	Canada

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Health-Care System**	**Condition**	**Therapy**	**Patient**	**Country**
(Evers, Klusmann, Schwarzer, & Heuser, 2012)	HBM	1.Low socieconomic status: (own monthly income)			2.Treatment complexity and effectiveness: (coping plans)	2.Self-efficacy: (pre-action self efficacy and maintenance self efficacy) 7. Attitude: (intentions)	Germany
(Tiedemann et al., 2012)	NI	10.Demographics factors: (age, gender)		1.Symptom burden: (conditions and symptoms) 3.Activity limitation: (physical functioning: knee extensor strength, 10m walk test, &MW, maximal balance range)	3.Previous failures with therapy: (health history)	3. Cognitive ability: (Montreal Cognitive assessment) 9. Beliefs and perceptions: (Health-related quality of life)	Australia
(Rodriguez-Romo et al., 2011)	S-EM	3. Low educational level: (educational level) 4.Unemployment: (employment status) 10.Demographics factors: (gender, age, marital status)		1.Symptom burden: (Smoking status)		9. Beliefs and perceptions: (self-perceived health)	Spain
(Netz, Goldsmith, Shimony, Ben-Moshe, & Zeev, 2011)	Religion	1.Low socioeconomic status:(income) 3. Low educational level: (years of education) 10.Demographics factors: (sex, age, religion, continent origin)		1.Symptom burden: (number of medications, self-rated health) 3. Activity limitation: (Functioning level) 5.Comorbidities: (chronic illness index, BMI)			Israeli
(Yeom, Jung, & Choi, 2011)	NI	1.Low socioeconomic status: (household income) 3.Low educational level: (education: less or higher than high school) 9.Environmental factors: (living in metropolitan cities) 10.Demographics factors: (gender, age, living with family)		5.Comorbidities: (nº of diseases)			Korean
(Leijon et al., 2010)	SCM/ TTM	5.Insufficient social support: (range of age: grouping sessions) 10.Demographics factors: (Sex, age)	1.Problems with patient–provider relationships: (Need of practitioner PAP)	3.Activity limitation: PAL at baseline (7-day recall) 5.Comorbidities: (chronic illness, reasons for prescription (diseases))	2.Treatment complexity: (Age (groups), Activity type)		Sweden

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Health-Care System**	**Condition**	**Therapy**	**Patient**	**Country**
(Smits, Tart, Presnell, Rosenfield, & Otto, 2010)	SCT SCM/ TTM	10.Demographics factors: (gender, age)		3. Activity limitation: estimate cardio-respiratory fitness by IPAQ category 5.Comorbidities: (BMI)		2.Self-efficacy: (peak fear: (SUDS,wolpe 1958)) 7.Attitud: negative affect: (PANAS-NA)) 8.Psychological issues: Anxiety sensitivity index (ASI)	EEUU
(Kallings, Leijon, Kowalski, Hellenius, & Stahle, 2009)	SCM/ TTM	3. Low educational level: (elementary, upper secondary, university, others) 4.Unemployment: (main occupation) 10.Demographics factors: (born place, age, sex and civil status)	1.Problems with patient–provider relationships: (counselling, prescription) 3.Insufficient PA knowledge and training for health care providers: (increased Knowledge, not a suitable type of PA) 5.Inadequate local health services: (leisure service personnel)	5.Comorbidities (illness)	3.Previous failures with therapy:(Experience of receiving physical activity on prescription)	5. Lack of perceived beneficial effects:(experienced well-being) 6.Motivation (lack of motivation) 9. Beliefs and perceptions (not enough time, existing decision before coming to the healthcare appointment)	Sweden (5 county councils)
(Gine-Garriga et al., 2009)	SCM/ TTM	5.Insufficient social support: (level of social support for PA practice: (Social Support for Physical Activity Scale, SSPAS)).		3.Activity limitation: (PAL by IPAQ) 5.Comorbidities: (HDL, LDL and glycated haemoglobin)		9. Beliefs and perceptions: (change in perception of health: COOP/WONCA)	Spain
(Meseguer, Galan, Herruzo, Zorrilla, & Rodriguez-Artalejo, 2009)	N.I.	3. Low educational level: (study level) 4.Unemployment: (PA in work) 10.Demographics factors: (sex, age)		5.Comorbidities: (BMI)			Spain
(Bergman, Grjibovski, Hagstromer, Bauman, & Sjostrom, 2008)	N.I.	1.Low socioeconomic status: (Income) 4.Unemployment: (Employed) 9.Environmental factors: (residential community size) 10.Demographics factors : (Marital status, age, sex)		1.Symptom burden. (Smoking status)		9. Beliefs and perceptions: (Self-perceived health)	Sweden

		Adherence-related factors					
Reference	**Theory**	**Socioeconomic**	**Health-Care System**	**Condition**	**Therapy**	**Patient**	**Country**
(Rejeski et al., 2007)	SCT	3. Low educational level: (education) 10.Demographics factors: (age, race and sex).		1. Symptom burden: (self-report symptoms: (disease burden). 3. Activity limitation (Physical functioning: (grip strength, 400m walk, SPPB-chair, SPPB-balance, SPPB-walk) 4. Effective treatments 5.Comorbidities: (disease burden: arthritis, heart attack, heart failure, pacemaker, cancer, lung disease, diabetes).		2.Self-efficacy: (barriers efficacy, goal setting efficacy). 5.Cosmetic concerns: (body satisfaction) 9.Beliefs and perceptions: (desire for physical competence).	EEUU
(Fielding et al., 2007)	NI			1.Symptom burden: (health/medical-related) 3.Activity limitation: (functional limitations)		9. Beliefs and perceptions: (too busy or travel)	EEUU
(Heesch, Masse, Dunn, Frankowski, & Mullen, 2003)	SCT SCM/TTM	10.Demographics factors: (gender, age, race/ ethnicity)		3.Activity limitation: (Weekly minutes of moderate to vigorous physical activity at baseline) 4. Effective treatments: (Meeting CDC/ACSM guideline at follow-up) 5.Comorbidities: (BMI)			EEUU
(Wilbur, Michaels Miller, Chandler, & McDevitt, 2003)	SDT	3.Low educational level: (education) 4.Unemployment: (professional status) 5.Insufficient social support: (social role influence). 10.Demographics factors: (ethnicity, age, marital status, number of children)			3.Previous failures with therapy: (previous exercise experience: leisure dimension of the Lifelong Physical Activity Measure)	2. Self-efficacy: (14-item self-efficacy for exercise scale) 6.Motivation: Self-determinism: (Exercise Self-determinism Index).	EEUU
(White, Croce, Loureiro, & Vroman, 1991)	Sonstroem model				2.Treatment complexity: (same volume and intensity and different frequency		EEUU

Note. NI: Not identified; UK: United Kingdom, BMI: Body mass index; OA: osteoarthritis; PA: Physical Activity; MVPA. Moderate-Vigorous Physical Activity; SCM/TTM: Stage of Change Model/Transtheoretical Model; SCT: Social cognitive Theory; SDT: Self-Determination Theory; HBM: health Behaviour Model; S-ET: Self-efficacy Theory; TPB: Theory of Planned Behaviour, SST: Social Support Theory; S-RT: Self-Regulation Theory; S-EM: Socioecologic model.

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Caminante, no hay camino, se hace el camino al andar……

SUMMARIZED CV/CURRÍCULUM VITAE ABREVIADO

Educational background

- M.Sc. in Research in Physical Activity and Sport. University of Granada. 2011-2012.
- Degree in Physical Activity and Sport Sciences. University of Basque Country. 2008-2010.
- Degree in Physical Education Teaching. University of La Rioja. 2005-2008.
- Professional College of further education in leisure-time instructor in physical and sport activities (TAFAD). IES Virgen del Espino. 2002-2005.

Grants and awards received

- 1st Oral Communication award. XXVIII Reunión de la Sociedad Española de Nutrición. Title: "Validity of a choice-modelling Google-form questionnaire to implement Exercise is Medicine initiative by a multidisciplinary lifestyle team in healthcare settings", June 2019. Soria (Spain).
- Selected H2020-MSCA IF 2019 UPM candidate. *Writings days workshop*. Residencia Universitaria de la Universidad Politécnica de Madrid. Cercedilla, Madrid. 6/06/2019 - 07/06/2019.
- 1st Award, CoLab UPM Challenge. La movilidad como servicio en la Universidad 2019. ¿Cómo puede la 'movilidad como servicio' (App MaaS) hacer más sostenibles los desplazamientos de la comunidad universitaria en campus UPM en Madrid? Project Titled: 'Curricular and Healthy Environmental Active Campus'. Madrid, Spain. 16/05/2019.
- Competitive Grant: Iberoamérica Santander 2018. Banco Santander and Universidad Politécnica de Madrid. Stay at Sports Faculty at Porto University. Porto (Portugal). 22/08/2018 - 24/12/2018.
- Competitive grant: Erasmus + practice 2018-19. Stay at The Research Center in Physical Activity, Health and Leisure (CIAFEL). Health Science Research Unit founded by the Science Ministry of Portugal. Porto (Portugal). 22/08/2018 - 01/01/2019.
- Competitive grant: “Taller de comunicación no verbal. descubre lo que dices con tu cuerpo gracias a los caballos”. *Universidad Internacional Menéndez Pelayo*. Education, Culture and Sport Spanish Ministry. 06/08/2018 - 10/08/2018.

- Competitive grant: Meetings Excellence in Public Health Research. CIBER of Epidemiology and Public Health, CIBERESP. Instituto de Salud Carlos III, Spain. Spanish Ministry of Economy, Industry and Competitiveness. 20/09/2017 - 22/09/2017.
- Competitive grant:"XVIII Escuela de Nutrición: Francisco Grande Covián. Estilos de vida saludables". Danone Institute. *Universidad Internacional Menéndez Pelayo*, Santander, Spain. 10/07/2017 - 11/07/2017
- 2nd National Sports Medicine Award: "Effect on the physical condition of an interdialysis exercise program in patients with chronic kidney disease". University of Oviedo. Oviedo. 15/11/2016.
- Competitive grant: European Leonardo da Vinci Grant. Soria Town Hall, Spain. Work experience at Mountbatten Leisure Center. Portsmouth (England). 25/02/2013 - 25/05/2013.
- Grant: "Education, Culture and Science Spanish Ministry for Post Graduate University studies". Education, Culture and Science Spanish Ministry. 01/10/2011 - 01/06/2012.
- "Curso de inmersión lingüística en inglés". Universidad Internacional Menéndez Pelayo. 03/12/2012 - 07/12/2012. Valencia. Spain.
- Competitive grant: "English Language Immersion Course". *Universidad Internacional Menéndez Pelayo*. Education, Culture and Sport Spanish Ministry. 29/08/2011 - 02/09/2011. Madrid. Spain.
- Competitive grant: "English Language Immersion Course". *Universidad Internacional Menéndez Pelayo*. Education, Culture and Sport Spanish Ministry. 15/03/2010 - 19/03/2010. Santander. Spain.
- Competitive grant: "English Summer Language Immersion Course". *Universidad Internacional Menéndez Pelayo*. Education, Culture and Sport Spanish Ministry. 14/09/2009 - 02/10/2009. Pembroke. Malta
- Grant: "Education, Culture and Science Spanish Ministry for University studies.". Education, Culture and Science Spanish Ministry. 01/09/2005 - 01/06/2010.

Stays abroad

- FENS Summer School on Scientific basis for FBDGs: new challenges. University of Belgrade (Faculty of Pharmacy). Belgrade (Serbia). 19/08/2019 - 23/08/2019. August 2018 (5 days).
- Porto University. Recreational and leisure time Department. Porto (Portugal). August 2018 - January 2019. (4 months and 8 days).
- CIAFEL Research Center in Physical Activity, Health and Leisure. Health Science Research Unit founded by the Fundação para a Ciência e Tecnologia (Science Ministry of Portugal). Porto (Portugal). August 2018 - January 2019. (4 months and 8 days).
- Ulm University. Faculty of Sports Science and rehabilitation. Expert meeting ERASMUS+(sport) project 2018.Ulm (Germany) 07/03/2018 - 11/03/2018 (4 days).

Teaching and invited lectures

- **Invited lectures: "Ejercicio es medicina: prescripción de ejercicio físico", Unidad de Formación y Docencia de la Dirección General de Salud Pública** (1 h). Subdirección General de Promoción, Prevención y Educación para la Salud. June, 24th 2019.
- **Official teaching: Nutrición, deporte y valoración de la condición física** (90 h). Faculty of Physical Activity and Sport-INEF, Universidad Politécnica de Madrid. 2017-19.
- **Lectures: ATHENS advanced technology higher education network. " Exercise is Medicine® initiative worldwide"** (1h); **"The benefits of physical exercise and better physical fitness for health"** (1h); **"The benefits of physical exercise and better physical fitness for health"** (1h); **"Physical fitness assessment" (1h); "Body composition (bioimpedance analysis)"** (1h). Universidad Politécnica de Madrid. Madrid (Spain). 18-22/03/2019.
- **Official teaching: Técnicas de relajación** (30 h). Faculty of Physical Activity and Sport-INEF, Universidad Politécnica de Madrid. 2017-18.
- **Invited lectures: "Ejercicio es medicina: prescripción de ejercicio físico", Unidad de Formación y Docencia de la Dirección General de Salud Pública**

(1 h). Subdirección General de Promoción, Prevención y Educación para la Salud. June, 15th 2018.

- **Lectures: ATHENS advanced technology higher education network. "Assessment physical fitness of the population of europe: battery test to each age"** (1h); **"WHO physical activity recommendations**" (1h); **"Physical exercise training theory"** (2h); **"The benefits of physical exercise and better physical fitness for health"** (2h). Universidad Politécnica de Madrid. Madrid (Spain). 17-21/04/2018.
- **Invited lectures: "Plan de entrenamiento físico personalizado", Aula de Salud de la Escuela Madrileña de Salud** (8 h). Consejería de Sanidad de la Comunidad de Madrid. December, 13th 2017.
- **Invited lectures: "Ejercicio es medicina: prescripción de ejercicio físico", Unidad de Formación y Docencia de la Dirección General de Salud Pública** (5 h). Subdirección General de Promoción, Prevención y Educación para la Salud. November, 18th 2017.

Research projects

- Title: **"Evolución de la condición física, composición corporal y fragilidad en personas mayores de 65 años. Mediación de la vitamina D y efectos de un programa de ejercicio: Estudio longitudinal EXERNET".** Project number: DEP2016-78309-R. Funding: Ministerio de Economía y Competitividad y por la Comisión Europea. Duration: 2017-2019. Principal researcher: Germán Vicente Rodríguez (Universidad de Zaragoza).
- Title: **Efecto del ejercicio físico controlado en el paciente en hemodiálisis. Estudio de marcadores emergentes sobre el pronóstico de la enfermedad renal crónica.** Project number: P2016/RM10. Funding: Cátedra Real Madrid-Universidad Europea de Madrid. Duration: 2016-2017. Principal researcher: Catalina Santiago Dorrego (Universidad Europea de Madrid).
- Title: **Proyecto piloto de implantación de ejercicio físico durante la hemodiálisis.** Project number: P141115303. Funding: Fundación Renal Iñigo Álvarez de Toledo. Duration: 2014-2016. Principal researcher: Marcela González-Gross (Universidad Politécnica de Madrid).

- Title: **Pilot Project: "Efecto de un entrenamiento combinado de fuerza y aeróbico y del tratamiento dietético sobre parámetros del síndrome metabólico en ratas genéticamente obesas**". Project number: DEP2011-27622. Funding: (Pilot Project) Plan Nacional I+D+i del Ministerio de Ciencia e inovación. Duration: 01/02- 04/06/2012. Principal researcher: Pilar Aranda (University of Granada)

Scientific publications apart from thesis publications

- Marcela González-Gross; Raquel Aparicio Ugarriza; Sergio Calonge-Pascual; Sonia Gómez-Martínez; Alberto Garcia-Carro; Javier Sanz-Valero; J. Alfredo Martínez; Ángel Gil; Ascensión Marcos; Luis A. Moreno. Is energy expenditure considered in the literature when energy intake is measured? a need for a methodological consensus. Annals of Nutrition and Metabolism, 2017; (suppl 2):1-1433.
- Sergio Calonge Pascual, González-Gross M. Physical activity is more than energy expenditure. An Real Acad Farm. 2016;82(Special Issue):146-57. (SJCR 2016: 0.117. Health Sciences, Life Sciences, Medicine, Biochemistry, Genetics and Molecular Biology)

Other scientific publications and abstracts

- **Calonge-Pascual S**, Fuentes-Jiménez F, Novella F, López-Diáz-Ufano ML, Villalvilla-Soria D, Casajús JA, Belmonte S , Arnal-Selfa R, González-Gross M. Self-reported facilitators and barriers of Primary healthcare general practitioners and nurses to implement exercise prescription according to Exercise is Medicine initiative. Oral communication. Annals of nutrition and metabolism. 24th Annual Congress of the European College of Sport Science. Prague (Czech Republic). July, 2019. Book of Abstract. ISBN: 978-3-9818414-2-8. p.144.
- **Calonge-Pascual, S**; Fuentes-Jiménez, F; Novella-María-Fernández, F; López-Diáz-Ufano; Villalvilla-Soria, D; Casajús-Mallén, J. A; Belmonte-Cortés, S; Arnal-Selfa, R; González-Gross, M; on behalf of EXERNET Study Group. Validity of a choice-modeling Google-form questionnaire to implement Exercise is Medicine initiative by a multidisciplinary lifestyle team in healthcare settings. Oral communication. Annals of nutrition and metabolism. XXVIII Reunión Científica de la Sociedad Española de la Nutrición (SEÑ). Soria, Spain. June

2019. Ann Nutr Metab 75 (suppl 2) 31-32 (2019). (Q2, 2018) Nutrition & Metabolism.

- Pantoja-Arevalo L; Torres-Peralta R; Escobar-Toledo D; Ugarte M; **Calonge-Pascual S**; González-Gross M. Body composition, physical activity and food intake analysis of amateur master male athletes. Oral communication. Annals of nutrition and metabolism. XXVIII Reunión Científica de la Sociedad Española de la Nutrición (SEÑ). Soria, Spain. June 2019. Ann Nutr Metab 75 (suppl 2) 72-73 (2019). (Q2, 2018) Nutrition & Metabolism.
- Gesteiro E; Escobar-Toledo D; **Calonge-Pascual S**; Pantoja-Arevalo L; Díaz Martínez AE; González-Gross M; Torres-Peralta R. Nutrients intake and blood biomarker status of amateur master male athletes. Oral communication. Annals of nutrition and metabolism. XXVIII Reunión Científica de la Sociedad Española de la Nutrición (SEÑ). Soria, Spain. June 2019. Ann Nutr Metab 75 (suppl 2) 73-74 (2019). (Q2, 2018) Nutrition & Metabolism.
- Daolio E; García-Zapico A; Calonge-Pascual S; Gómez-Parro O; Martínez-Orga V; González-Gross M; Gesteiro E. Adherence to Mediterranean diet, body composition and physical fitness among Spanish adolescents. Póster. Annals of nutrition and metabolism. XXVIII Reunión Científica de la Sociedad Española de la Nutrición (SEÑ). Soria, Spain. June 2019. Ann Nutr Metab 75 (suppl 2) 69-70 (2019). Ann Nutr Metab 75 (suppl 2) 69-70 (2019). (Q2, 2018) Nutrition & Metabolism.
- Pérez-Juana Cortes, M; **Calonge-Pascual, S**; Tobal, FM. Physical activity and Nutrition for the female athlete with polycystic ovary syndrome: An appraisal of scientific literature. Póster. Annals of nutrition and metabolism. XXVIII Reunión Científica de la Sociedad Española de la Nutrición (SEÑ). Soria, Spain. June 2019. Ann Nutr Metab 75 (suppl 2) 74-75 (2019). (Q2, 2018) Nutrition & Metabolism.
- Moradell A; Gómez-Cabello A; **Calonge S**, Gómez-Bruton Alejandro, Muniz-Pardos Borja, Martin-Garcia María, Perez-Gomez Jorge, Gusi Narcis, González-Gross M; Ara Ignacio, Vicente-Rodríguez, G. Evolución de la velocidad y la resistencia aeróbica tras 8 años de seguimiento en personas mayores: EXERNET 3.0. Oral communication. II Congreso Internacional en Ciencias de la Salud y del Deporte, Huesca, Spain. May 2019.

- Villalvilla-Soria, D, **Calonge-Pascual, S,** Fuentes-Jiménez, Novella-María-Fernández, F, López-Diáz-Ufano, M.L, Casajús-Mallén, J. A, Belmonte-Cortés, S, Arnal-Selfa, R, González-Gross, M. Autoevaluación del profesional sanitario de Atención Primaria de la Comunidad de Madrid para promocionar y prescribir estilos de vida saludables mediante ejercicio físico. XI Congreso Nacional de FAECAP, I Congreso de EFEKEZE y VIII Encuentro Nacional de EIR y de Tutores. Vitoria-Gasteiz (Spain). Abril, 2019. Libro Actas. p.155.
- **Calonge-Pascual**, **S.,** Fuentes-Jiménez, F., Novella-María-Fernández, F., López-Diáz-Ufano, M.L., Villalvilla-Soria, D., Casajús-Mallén, J. A., Belmonte-Cortés, S., Arnal-Selfa, R., González-Gross, M. " Development of a questionnaire to assess barriers and facilitators for introducing Exercise is Medicine in Primary Care in Spain". XI Simposio Internacional de Actualizaciones del Entrenamiento de la Fuerza. Madrid (Spain). December, 2018. Book of Abstracts. p. 89-91. ISBN: 978-84-09-03688-2.

- Escobar Toledo, D, Gesteiro Alejos, E, **Calonge Pascual, S**, Vila-Maldonado, S, Gusi, N, Ara Royo, I, Vicente Rodríguez, G, González-Gross, M. Relación entre horas de siesta diarias y condición física en personas mayores de más de 65 años. XI Simposio Internacional de Actualizaciones del Entrenamiento de la Fuerza. Madrid (Spain). December, 2018. Book of Abstracts. p. 146-48. ISBN: 978-84-09-03688-2.

- Rafael Torres-Peralta, **Calonge Pascual, S.;** Alejandra Carretero, Álvaro Vicente Arche, Ana Mª Montero, Manuel Jiménez, Natalia Úbeda, Agustín Meléndez, Carlos Velasco, Marcela González-Gross Grip strength shows no difference according to occupation in air force flight personnel: CIMA study. XI Simposio Internacional de Actualizaciones del Entrenamiento de la Fuerza. Madrid (Spain). December, 2018. Book of Abstracts. p. 135-36. ISBN: 978-84-09-03688-2.
- **S. Calonge-Pascual**, F. Fuentes-Jiménez, M.L López Diáz-Ufano, D. Villalvilla, J. A. Casajús-Mallén, M. González-Gross. " Development of a questionnaire to assess barriers and facilitators for introducing Exercise is Medicine in Primary Care in Spain". II Simposio EXERNET. Investigación en

Ejercicio, Salud y Bienestar: "Exercise is Medicine". Pamplona (Spain). October, 2018.

- Rafael Torres-Peralta, **Sergio Calonge**, Alejandra Carretero, Álvaro Vicente Arche, Ana Mª Montero, Manuel Jiménez, Natalia Úbeda, Agustín Meléndez, Carlos Velasco, Marcela González-Gross. Propuesta de valoración de la condición física en la anamnesis del personal militar de vuelo en el Centro de Instrucción de Medicina Aeroespacial (CIMA). II Simposio EXERNET. Investigación en Ejercicio, Salud y Bienestar: "Exercise is Medicine". Pamplona (Spain). October, 2018.
- **Sergio Calonge**, Rafael Torres-Peralta, Alejandra Carretero, Álvaro Vicente-Arche, Ana Mª Montero, Manuel Jiménez, Natalia Úbeda, Agustín Meléndez, Carlos Velasco, Marcela González-Gross. Valoración de la condición física en la anamnesis del personal militar de vuelo en el CIMA. XVIII Symposium Nacional de Medicina Aeroespacial. Granada (Spain). November, 2017.
- González-Gross M, Aparicio-Ugarriza R, **Calonge-Pascual S**, Gómez-Martínez S, García-Carro A, Sanz-Valero J, Martínez A, Gil A, Marcos A, Moreno LA, on behalf of the Spanish Nutrition Society. Is energy expenditure considered in the literature when energy intake is measured? A need for a methodological consensus. IUNS 21st International Congress of Nutrition. Argentina (Buenos Aires). Ann Nutr Metab 2017; (suppl 2):1-1433.
- Vicente-Arche FC, Pedrero-Chamizo R, Vázquez-Rigueira P, Peñaranda A, Aparicio-Ugarriza R, Santiago C, **Calonge S**, Gómez-Gallego F, Palacios G, Diaz-Manjón R, Meléndez A, Barrios L, Botella A, González-Gross M, Pérez-Ruiz M. Effect of intradialisys exercise program on physical fitness in chronic kidney disease. 22nd annual Congress of the European College of Sport Science. ISSN 978-3-9818414-0-4. Essen (Germany). July, 2017.
- **Calonge S**, González-Gross M. Physical Activity: Anything more than energy expenditure. An Real Acad Farm Vol. 82, Special Issue (2016), pp.146-157
- **Calonge S**, Casajús JA, González-Gross M. "El ejercicio es medicina-España: Página web y Redes sociales". Simposio EXERNET. Investigación en Ejercicio, Salud y Bienestar: "Exercise is Medicine". Revista Andaluza de Medicina del Deporte. Cádiz (Spain). October, 2016.

- Marcela González-Gross, **Sergio Calonge Pascual**. "Actividad Física y Salud: introducción y actualización" VIII Seminario sobre Alimentación y Estilos de Vida Saludables. Las declaraciones de propiedades saludables una década después y los Nuevos Alimentos en la Unión Europea, Palma de Mallorca, Spain. July 2016.
- **Calonge, S**., Aparicio, V.A.; Nebot, E.; Camiletti-Moirón, D., Vidal, C., Aranda, P. "Efectos del entrenamiento combinado aeróbico interválico con fuerza resistencia sobre: peso, y glucemia en ratas" Book abstract VII Congreso Internacional de Ciencias del Deporte. Granada. November, 2012. ISBN. 978-84-15768-31-9. Pag.6

Book chapters

- **Calonge Pascual S**, David Cañada López, González-Gross M. Chapter 1. Beneficios de la actividad física para la salud. En Pleneufar 6: Educación Nutricional en la actividad física, 2017. ISBN: 978-84-7867-512-8.
- Cañada D, Aparicio-Ugarriza R, **Calonge Pascual S**, González-Gross M. 2nd Symposium for the exchange of experiences in promoting physical activity and health in schools, 2016. ISBN: 978-84-617-8378-6.

Organizations of Scientific Events

- XXVIII Reunión Científica de la Sociedad Española de la Nutrición (SEÑ). Local Organizing Committee. Soria (Spain). 20/06/2019-22/06/2019
- XI International Symposium in Strength Training. Organizing Committee. Universidad Politécnica de Madrid. Madrid (Spain). 14/12/2018-15/12/2018.
- "Día internacional de la actividad física"Hospital U.Infanta Leonor de Madrid. Madrid (Spain). Escuela Madrileña de Salud. 10/04/2018
- ATHENS network. advanced technology higher education network. Course: "Exercise is Medicine: from theory to practice". Universidad Politécnica de Madrid. Madrid (Spain). 17/04/2018-24/04/2018.
- X International Symposium in Strength Training. Organizing Committee. Universidad Politécnica de Madrid. Madrid (Spain). 15/12/2017-16/12/2017.

- IX International Symposium in Strength Training. Organizing Committee. Universidad Politécnica de Madrid. Madrid (Spain). 16/12/2016-17/12/2016.
- 2nd Symposium for the exchange of experiences in promoting physical activity and health in schools. ImFINE Research Group. Universidad Politécnica de Madrid. Coordination, technical secretary and organization of the event. Madrid (Spain). 06/05/2016-07/05/2016.

Project I+D+I

- Mission X project. In collaboration transfer of knowledge with the European Space Education Resource Office (ESERO) of European Space Agency (ESA) in collaboration with Imfine research group, Spain 01.01.2019 and 31-07-2019
- Aulas sem Fronteiras Project. Invited conference about Spanish culture at "Alexandre Herculano" High school and the Escola EB "Irene Lisboa". Invited by da Câmara Municipal do Porto through of Porto University. 26/11/2018 and 28/11/2018
- Experimental data collection of the Portuguese Water Polo Team and Portuguese Swimming Paralympic. Portuguese Swimming Federation-facultade do Deporto (FADEUP) Porto University. Portugal. 9-10/11/2018 and 22-23/11/2018
- "Exercise is Medicine: exercise prescription" Training courses for healthcare staff. Promotion, prevention and health education at Madrid Public Health Department. 18/11/2017 and 15/06/2018
- Participation in Human Resources Strategy for Researchers of Human Resources Excellence in Research quality strategic plan at Universidad Politécnica de Madrid. 19/03/2018
- Participation in Strategic Plan of Madrid healthcare system about: Physical exercise training program prescription. Escuela Madrileña de Salud. Spain. November, 13/12/2017.
- Participation in Strategic Plan of Sustainability (Universidad Politécnica de Madrid). 30/06/2017.

Member of scientific societies

- Member of the European College of Sport Science (ECSS).

- Member of the Spanish Nutrition Society (SEÑ).
- National manager of Exercise is Medicine®-Spain, initiative from American College of Sport Medicine (ACSM)
- Member of Spanish Research Network on physical activity and health (EXERNET).

Other achievements

- **Research member of consolidated Research Group**: ImFINE. Improvement (of health) by fitness, nutrition and exercise. Faculty of Physical Activity and Sport-INEF. Universidad Politécnica de Madrid. 2015 - ongoing.
- **Webmaster and social network manager of Exercise is medicine Spain.** From 2015 - ongoing.
- **Invited speaker M21 radio**: Habitat Madrid: Active mobility programme. 12/06/2019.
- **Peer reviewer of scientific articles**:

  1) Revisión 2192/18-G. Cadernos de Saúde Pública/Reports in public health. ISSN 1678-4464: "Influencia de la actividad física sobre los niveles de insomnio, hipersomnio y la calidad de vida de la persona mayor de 55 años". 2019.

- The PhD Student has attended more than **100 courses**.

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