Adherence Factors Related to Exercise Prescriptions in Healthcare Settings: A Review of the Scientific Literature

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ABSTRACT

Purpose: Physical activity on prescription (PAP) is being introduced in healthcare systems around the world. To apply a successful treatment is as important as to know if the patient is able to follow-up. In order to contribute to the development of effective PAP strategies, we have analyzed PAP-related adherence factors with a multi-dimensional approach. **Methods** PAP adherence factors in studies published in the WoS, Pubmed, and PsycInfo were reviewed, according to the WHO five dimensions adherence model. In a setting of prediction or adherence analysis of adults with high-risk factors or chronic diseases, the methods used to measure physical activity (PA), PAP treatments, PAP adherence, and mentioned theories related to human behavior change were analyzed. **Results** A total of 32 studies fulfilled our inclusion criteria. According to the WHO five dimensions adherence model, these total clustered adherence variables were observed: social/economic (n = 100), healthcare system/healthcare team (n = 18), condition-related (n = 61), therapy-related (n = 20), and patient-related (n = 47). PAP adherence has mainly been measured by adherence to measurement methods and by calculating attended versus total sessions scheduled. PA level was measured mainly by questionnaires and exercise referrals were the most frequent PAP resource in analyzed studies. Transtheoretical model of behavior change was the theory most referenced. **Conclusion** A lack of considering health system/healthcare-team factors and therapy-related factors has been identified, as most studies only analyze social/economic factors in non-pharmacological PAP adherence studies in healthcare settings. A multidimensional approach should be adopted to analyze PAP adherence in healthcare settings.

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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” (WHO, 2003). 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 (Blackstock et al., 2016). During the last century, there was a common belief that patients are solely responsible for taking their treatment and also for abandoning it. This reflects a misunderstanding of how other factors affect human behavior and the capacity to adhere to treatment. The ability of patients to follow treatments in an optimal manner is frequently affected by more than one factor. According to Venegas et al. and WHO experts, adherence is a complex, dynamic, and multifactorial phenomenon, determined by the interaction of five set of factors, termed

by WHO as dimensions, of which patient-related factors are just one of these (Venegas et al., 2018).

Although the terms adherence and compliance are often used interchangeably, compliance has judgmental overtones, whereas adherence emphasizes collaboration (van den Bemt et al., 2012). The term “concordance” extends the concept of adherence, emphasizing the therapeutic alliance between patients and healthcare professionals (Wahl et al., 2005). According to O’Neal et al., there are two types of adherence. On the one hand, adherence to intervention, according to the standardized adherence factors established by the scientific community. On the other hand, adherence to measurements, meeting the dosage requirements according to the physical activity (PA) promotion, or exercise prescription scheduled or planned for the patient (O’Neal & Blair, 2001). Irrespective of the term used, all are crucial for a positive outcome of a HC treatment. Meanwhile, scientific consensus exists that applying a successful, well-planned physical activity/exercise preventive

(Booth et al., 2017) or treatment program for non-communicable chronic diseases (NCDs; Pedersen & Saltin, 2015) is as important as to know if the patient is able to follow it (Picorelli et al., 2014).

Physical activity on prescription (PAP) is an emerging topic of interest (Lion et al., 2019), as chronic diseases are prevalently increasing in older adults and in parallel, life expectancy is rising worldwide (Dong et al., 2016). Eighty percent of Primary HC consultations are related to chronic diseases (Gamboa Moreno et al., 2013; Sanchez et al., 2015). In contrast, positive effects of PAP on many chronic diseases are well known (Pedersen & Saltin, 2015) and general practitioners and HC settings have been identified as good resources to promote PA guidelines and exercise prescriptions (Persson et al., 2013).

Non-adherence attenuates the effectiveness of any treatment benefit (WHO, 2003). But in the literature, there are some discrepancies about the existence of individualized or common patterns toward PA adherence or non-adherence (Picorelli et al., 2014) and about which behavioral factors influence in facilitating or maintaining exercise adherence (Murray et al., 2018). In order to approach all these factors, WHO proposed in 2003 a Five-dimensions adherence model, which aimed to analyze in an integrated way all factors related to socio-economical, HC system and team, condition, therapy, and patient dimensions (WHO, 2003; see methods section). WHO proposes this model to analyze 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 with PA should become a central component of efforts to improve populations' health worldwide (WHO, 2003). 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 (Picorelli et al., 2014; WHO, 2003).

The main aim of this study was to perform a critical review of the scientific literature in order to know the main adherence factors to PAP interventions in chronic patients and if these factors have been analyzed according to a multidimensional approach as the WHO five-dimension adherence model.

Materials and methods

The electronic databases WoS (*Colección principal de Web of Science*, BIOSIS Citation Index, BIOSIS Previews, Current Contents Connect, Medline, Derwent Innovations Index, KCI – Korean Journal Database, Russian Science Citation Index, SciELO Citation Index), Pubmed, and PsycInfo, were searched for studies

published between 1900 and 2017. The search formula: [(concordance OR adherence OR compliance) and (physical activity or exercise)] was entered in all databases and filtered by human, title, and ≥ 18 years. Besides of additional records identified through the bibliography. The inclusion criteria were: adults aged ≥ 18 years, both sexes (male/female), peer-reviewed journals, and no review designs, patients in HC settings and with NCDs or with risk factors or suffering from chronic diseases, besides of assessing exercise adherence measurements and analyzing clinical exercise adherence interventions.

Following the methodology proposed by Pavey et al. (2012), in their Systematic Review and Meta-analysis done in 2012, 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 supervisors. Discrepancies were solved by discussions between all authors. Data extracted were: age of participants, setting of intervention, risk factors, or chronic diseases, the method used to measure PA, PAP treatments, and PAP adherence, theories related to human behavior change, score of mentioned PAP adherence factors according to the WHO five-dimensional adherence model (WHO, 2003). All adherence-related factors are described in Table 1 and proposed by other authors in the scientific literature (Conraads et al., 2012; Venegas et al., 2018; WHO, 2003). Modified RATS review guidelines were used for this critical literature review, with more than five points (10 points Likert-type scale) for the following points: relevance of study question (regarding the quality in the research question/aim of the study?), appropriateness of the method (regarding the Quality of Therapeutic Intervention by PAP), transparency of procedures (regarding the quality of the sampling and recruitment), and soundness of interpretative approach (regarding the quality in the analysis and Discussion related to PA adherence assessment). Finally, the following studies were included: 17 Randomized Controlled Trial, 7 Cohort, and 4 Cohort-Survey studies, 2 Longitudinal, 1 Observational, and 1 Clinical studies.

Results

From a total of 903 articles identified, 32 studies met the inclusion criteria and were included in this critical review of the scientific literature. Descriptive data,

Table 1. Adherence factors included in the WHO five-dimensions adherence model (modified from WHO, 2003).

Dimensions					
	Socioeconomic factors	Healthcare 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				

methods used for PA and PAP measurements and for assessing adherence are shown in Table 2, ordered by year, from the most recent to the oldest one. Within these thirty-two studies, in 12, exercise referral is the PAP method most used as well as PA promotion, referring mainly to national PA guidelines (i.e., Norway, UK, USA, Korea, etc.).

Different kinds of methods were registered in the review to analyze adherence. Adherence to measurement was the most used in our review ($n = 30$) and two studies analyzed, adherence to intervention, including an adherence staff questionnaire in one of them (Desveaux et al., 2016). The most used methods for measuring PA were: survey and self-register PA logs ($n = 18$), Pedometers ($n = 4$), and referral load exercise training ($n = 6$). Five studies did not indicate their method (Table 2).

Table 3 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-related factors, considered in 100 times, were the dimension most-mentioned in the studies analyzed, followed by condition-related factors ($n = 61$) and patient-related factors ($n = 47$). Therapy-related factors ($n = 20$), and Health system/HC Team-factors ($n = 18$) have been less analyzed (Table 3). The factors most studied in the social/economic dimension were demographics ($n = 29$) and low educational level ($n = 22$). The condition-related factors most cited were comorbidity ($n = 22$) and symptom burden ($n = 16$). The patient-related factors most cited were (exercise) self-efficacy ($n = 11$) and psychological issues and beliefs and perceptions, both with ($n = 10$). The therapy-related factors most observed were effective treatment ($n = 7$) and previous failures

with therapy ($n = 7$). Finally, the Health system/HC Team-factors most cited were problems with patient-provider relationships ($n = 6$) and inadequate local health services ($n = 5$).

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: Transtheoretical model of behavior change (SCM/TTM; $n = 9$), Social cognitive theory (SCT; $n = 4$), HBM ($n = 2$), Self-efficacy Theory (S-ET; $n = 2$) and all the rest, SDT, Behavior model, S-RT, psychological models of Sonstroem ($n = 1$), religious leaders to promote PA ($n = 1$) and NI theories ($n = 16$; Supplemental material Table 3).

Studies were carried out in European countries (43.75%), USA & Canada (40.63%), Australia (9.38%), and Asia & Middle East (6.25%; Table 3).

Discussion

The Health system/HC Team-related factors together with therapy-related factors have received limited attention in the reviewed studies which had analyzed PAP adherence. In contrast, social/economic-related factors dimension mainly by demographic factors have traditionally been the most studied ones. In this sense, it is often presupposed that patients are the unique responsible for the capacity to adhere to HC treatments (WHO, 2003). But, in fact, social/economic and patient-related factors are only two of several in a multidimensional approach.

Furthermore, according to Martin-Borras et al., studies have not yet overcome the most relevant barriers to PA adherence (Martin-Borras et al., 2018). In their interventional study, the main barriers were poor health

Table 2. Descriptive data of the studies included in the review.

Reference	Type of study	Range age or mean	n (f, m)	Healthcare setting	Diseases	Method used to measure PA	PA on Prescription	Method used for assessing PA adherence
(Desveaux et al., 2016)	C-Survey	67	PHCs (40.7; 59.3%)	35 PHCs	Cardiac rehabilitation	Modified CRBS survey	Healthcare professional PA referral	Adherence to intervention: Staff and patient adherence
(Bergh et al., 2016)	C	18–60	n = 230 patients (78.3; 21.7%)	Hospital	Morbid Obese	IPAQ-short	PA promotion by the Norwegian National guidelines	Adherence to measurement: Meeting PA
(Kuehl et al., 2016)	RCT	>18	n = 153 (50;103)	Heidelberg University Clinic	Cancer patients	Self- registered exercise logs	Supervised exercise sessions in hospital and home exercises.	Adherence to measurement: % incomplete exercise sessions
(Tuakli-Wosornu et al., 2016)	RCT	≥45	n = 325 (186;139)	7 referral US centers	Osteoarthritis	NI	Supervised on-live exercise program and home exercises	Adherence to measurement: Attended physical therapy days
(Martin-Payo et al., 2016)	C-Survey	18–77	n = 230 (57.7; 42.3%)	HC	Several NCDs	Motiva. Diaf. Questionnaire	PA promotion by the WHO, 2010 PA guidelines	Adherence to measurement: Meeting PA guidelines
(Cooper et al., 2015)	RCT	50–71	n = 2279 (29.71%)	Heart division Hospital	Heart Failure Patients	NI	Usual care	Adherence to measurement: Exercise minutes/week
(Chrisman et al., 2015)	C	>30–<65	n = 21551 (50;50%)	HC fairs and clinics.	Obese	CTS survey PAL:(hours/week)	PA promotion by the US PA guidelines.	Adherence to measurement: Meeting PA guidelines
(Norton et al., 2015)	RCT	18–63	n = 871 (70;30%)	Hospital	NCDs risk factors	Pedometer	Group-guided exercise programme	Adherence to measurement: meeting PA guidelines and attended sessions.
(Alkerwi et al., 2015)	C	18–69	n = 3133 (51.3; 48.7%)	HC System	CV-related diseases	IPAQ	PA promotion by the WHO PA guidelines	Adherence to measurement: Meeting PA guidelines
(Jefferis et al., 2014)	C	70–93	n = 6529 (3237; 3292)	PHC	Several NCDs	Log. Dairy Survey Accelerometer	PA promotion by the UK guidelines	Adherence to measurement: Meeting PA guidelines
(Krogh et al., 2014)	RCT	18–60	n = 280 (64;36%)	Clinical setting NI	Depression	Strength-training and aerobic exercise interventions	Supervised exercise intervention by a physiotherapist	Adherence to measurement: Average exercise attendance/week
(Venditti et al., 2014)	RCT	25–>65	n = 3234 (68; 32%)	27 HC	Obesity and T2DM	N.I.	Virtual exercise classes	Adherence to measurement: % ranked of the cohort study
(Austin et al., 2013)	C-Survey	45–>64	n = 10,892 (73; 27%)	HCcenters for disease control and prevention	Arthritis	BRFSS survey	PA guidelines reported	Adherence to measurement: Yes/no questions (Patients and HC staff)
(Forhan et al., 2013)	C	18–90	n = 12,003 (21.6; 78.4%)	NI	T2DM and obesity	Exercise prescription protocol for Cardiac Rehabilitation ACSM,2006	Supervised exercise sessions on-site	Adherence to measurement: Exercised attendance rate of non-adherence and Dropout.
(Garmendia et al., 2013)	RCT	65.0–67.9	n = 996 (69.5; 30.5%)	36 PHCs	Several NCDs	Structured exercise training load	Supervised exercise programme	Adherence to measurement: Minimum classes attendance.
(Bossen et al., 2013)	RCT	50–75	n = 100 (60;40)	HC	Osteoarthritis	Join2move: self-paced 9 week programme	Virtual exercise classes	Adherence to measurement: Number of completed modules/total scheduled.
(Heerema-Poelman et al., 2013)	RCT	61.3± 10.3	n = 70 (53.3; 46.7%)	Rehab. Healthcare Center	COPD	NI	Home-care exercise program	Adherence to measurement: Exercise attendance and early dropouts.
(Austin et al., 2012)	RCT	>45	n = 33,071 (65;35%)	HC	Arthritis	BRFSS survey	American College of Rheumatology PA guidelines	Adherence to measurement: Recommended PA guidelines
(Martin & Woods, 2012)	RCT	50–85	n = 24 (9;15)	Hospital	Coronary heart disease	Exercise training load	Community run exercise programme	Adherence to measurement: Average attendance sessions

(Continued)

Table 2. (Continued).

Reference	Type of study	Range age or mean (f, m)	n	Healthcare setting	Diseases	Method used to measure PA	PA on Prescription	Method used for assessing PA adherence
(Shang et al., 2012)	RCT	60.2	n = 126 (23;77%)	University teaching hospital	Cancer patients	Pedometer daily	Brisk walking programme	Adherence to measurement: 85% of minimum adherence to exercise prescription
(Tiedemann et al., 2012)	C	66.7	n = 76 (38;38)	Physio-therapist HC centers	Stroke survivors	7d-Pedometer	Home exercise programme	Adherence to measurement: % classes attended/year
(Tobi et al., 2012)	C	46.4	n = 1089 (59.5; 60.5%)	National Health System Greenwich	6 clinical NCDs categories	NI	Exercise referral schemes NI	Adherence to measurement: % of scheduled sessions attended
(Burgos-Garrido et al., 2011)	O	39.7	n = 208 (66; 34%)	PHC	T2DM	IPAQ Spanish version	PA promotion	Adherence to measurement: Total PA (MET*week)
(Netz et al., 2011)	L	>65	n = 1663 (70;30%)	HC	8 NCDs	Israeli national survey (PA Module)	PA promotion by the 2009 ACSM guidelines	Adherence to measurement: Meeting PA recommendations
(Yeom et al., 2011)	C-Survey	65–103	n = 2241 (59.6; 40.4%)	Korean National HC System	> 3 NCDs	KNHANES IV Survey IPAQ	PA promotion by the (Korea Ministry of Health and Welfare, 2007 guidelines	Adherence to measurement: % PA (min days/week)
(Leijon et al., 2010)	RCT	18–>65	n = 2611 (1740; 871)	37 Swedish PHCs	Several NCDs	KCDC, 2007 Survey	Combination of home-based and facility-based activity	Adherence to measurement: Self-reported yes/no question.
(Kallings et al., 2009)	Clinical -S	25–78	n = 240 (75; 25%)	13 Swedish PHCs	Several NCDs	7 Day Physical Activity Recall survey	Counseling based in FYSS project	Adherence to measurement: Self-reported PA levels
(Gine-Garriga et al., 2009)	RCT	>18	n = 424 (both sexes)	9 Spanish PHCs	NI	IPAQ short form.	Physical activity promotion at home and supervised at HC	Adherence to measurement: Meeting PA guidelines
(Rejeski et al., 2007)	CS	70–89	n = 684 (471; 213)	Home and HC	Several NCDs	PA intervention	Training exercise program	Adherence to intervention: Exercise attendance (3 phases of the LIFE-P study)
(Fielding et al., 2007)	RCT	70–89	n = 424 (68.5; 31.5%)	4 clinical HC	Sedentary adults (function limits)	Training load CHAMPS survey	PA intervention. Home-based exercises Health education workshops	Adherence to measurement: Exercise sessions attended of total sessions scheduled
(Heesch et al., 2003)	RCT	44–75	n = 244 (49; 51%)	The Cooper Institute of preventive medicine.	Obese	7 Days- Pedometer Physical Recall (PAP)- 7d	PA promotion by the 1995 CDC/ ACSM guidelines	Adherence to measurement: Meeting PA guidelines and Homework and Telephone call Attendance
(Bock et al., 1997)	L	39–74	n = 45 (18; 72%)	Physician referral at HC clinic	CV disease	7 Day Physical Activity Recall questionnaire	Exercise program	Adherence to measurement: Dropouts and Completers of the exercise program.

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

Table 3. 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.

Reference	Adherence-related factors					Country
	Socioeconomic	Healthcare System	Condition	Therapy	Patient	
(Desveaux et al., 2016)	6; 8; 9.	1; 2; 4	1;4; 5.		9	Canada
(Bergh et al., 2016)	3;10.		5.	2; 3.	2; 3; 5; 6; 7; 8; 9.	Norway
(Kuehl et al., 2016)	3;5;9;10		3;5	6	2; 6	Germany
(Tuakli-Wosornu et al., 2016)	1;3; 5; 10		1;3	1;2;5	2;8;9	EEUU
(Martin-Payo et al., 2016)	3; 10.		5.		6; 8.	Spain
(Cooper et al., 2015)	1;3;5;9;10		1;3	3	2;8;9	EEUU
(Chrisman et al., 2015)	3; 4; 10.		1; 5.		7.	EEUU
(Norton et al., 2015)	10.		3; 5.	2.		Australia
(Alkerwi et al., 2015)	2; 4; 8; 10.		1; 5.		7; 9.	Luxembourg
(Jefferis et al., 2014)	5; 6; 9; 10.		3; 5.	2.	2; 8; 9.	UK
(Krogh et al., 2014)	3; 4; 5; 6; 10		2	1;3	3;8	Norway
(Venditti et al., 2014)	1; 3; 4; 5; 10.	3.	1; 5.	2.	1; 6; 8; 9.	EEUU
(Austin et al., 2013)	1; 3; 4; 9; 10.	1; 2; 5.	1; 3; 5.			EEUU
(Forhan et al., 2013)	4; 6; 10		5		2; 8	EEUU
(Garmendia et al., 2013)	1; 3; 4; 5; 9; 10.		1; 5.	3; 5.	8.	Australia
(Bossen et al., 2013)	3; 5; 10.	2.	1; 3; 5.		2; 6; 8.	Netherlands
(Heerema-Poelman et al., 2013)	3; 10		1; 3; 5		2; 8	Netherlands
(Austin et al., 2012)	1; 3; 4; 5; 10.	1, 6.	1; 3; 5.			EEUU
(Martin & Woods, 2013)	5; 10.	2; 5.	5.	2.	2; 9.	Ireland
(Shang et al., 2012)	3; 4; 5; 10.		1; 3.		2.	EEUU
(Tiedemann et al., 2012)	10.		1; 3.	3.	3.	Australia
(Tobi et al., 2012)	3; 10.		5.	2.		UK
(Burgos-Garrido et al., 2011)	3;4; 10.				7.	Spain
(Netz et al., 2011)	1, 3; 10.		1; 3; 5.			Israel
(Yeom et al., 2011)	1; 3; 9; 10.		5.			Korean
(Leijon et al., 2010)	5; 10.	1.	3; 5.	2.		Sweden
(Kallings et al., 2009)	3; 4; 10.	1; 3; 5.	5.	3.	5, 6; 9.	Sweeden
(Gine-Garriga et al., 2009)	5.		3; 5.		9.	Spain
(Rejeski et al., 2007)	3, 10.		1; 3; 4; 5.		2; 5; 9.	EEUU
(Fielding et al., 2007)			1; 3.		9.	EEUU
(Heesch et al., 2003)	10.		3; 4; 5.			EEUU
(Bock et al., 1997)	3; 4; 5 10.		3		2, 3.	EEUU

NI: Not identified; BMI: Body mass index; OA: osteoarthritis; PA: Physical Activity; MVPA: Moderate-Vigorous Physical Activity; SCM/TTM: Transtheoretical model of behavior change; 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.

(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 as the most influential ones (Kallings, 2008). Interestingly, lack of time, one of the most frequently-cited reasons for PA non-adherence (Strazdins et al., 2011) is not included in any of the five WHO adherence model dimensions for patients. In our review, the “lack of time” barrier has been included in the socio-economic dimension (such as insufficient social support because of familiar or job burden), transportation issues (travel time) or in the personal dimension (in the subcategory of belief and perceptions for the lack to manage the personal time), depending on the context. Type of exercise and load exercise training, mainly frequency intensity and duration, have been also identified as a barrier (Martin & Sinden, 2001) integrated in our study as a factor in the effectiveness

of the treatment by its complexity. Moreover, Desveaux et al. in 2016, proposed 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 facilitate exercise program participation as secondary ones (Desveaux et al., 2016). These authors, interestingly, observed discrepancies between the barriers perceived by patients and by HC providers. Furthermore, the Systematic Review of Stonerock et al., published in 2016 considered only psychological, behavioral, and environmental factors that contribute to non-adherence (Stonerock & Blumenthal, 2016). The systematic review of Horne et al., in 2012 concluded about the influence of empowering and disempowering contexts by the lack of communication or relationships with family, friends, community, or health providers. Also cultural beliefs and environmental factors determine physical activity

patterns of people (Horne & Tierney, 2012). In our review, the most cited factors to analyze PAP adherence are related to the social/economic dimension, mainly demographics, educational level, social support, and employment status, to the patient-related dimension such as beliefs and perceptions, psychological and physical fitness status, and to the condition-related dimension such as comorbidities, activity limitation, and burden of illness. Analyzing only the studies that had the aim to predict adherence (Bergh et al., 2016; Bock et al., 1997; Forhan et al., 2013; Heerema-Poelman et al., 2013; Heesch et al., 2003; Krogh et al., 2014; Rejeski et al., 2007; Tiedemann et al., 2012; Tobi et al., 2012; Tuakli-Wosornu et al., 2016), neither of them had considered healthcare system/HC team and therapy-related factors in their studies. In our opinion, to overcome these limitations, it is fundamental to categorize properly and to analyze them not only by a limited approach, as in most of the studies, but with a multidimensional approach such as the WHO 5 dimension adherence model proposed in 2003 in order to be able to establish successful adherence to long-term therapies.

This WHO multidimensional adherence model has been mainly used in medical settings to measure adherence to pharmacological treatments (Yeaman et al., 2018). 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 physical activity behaviors (WHO, 2003). Our proposal is not completely new. Blackstock et al. proposed the WHO model to measure non-adherence to both pharmacological and non-pharmacological treatments in Chronic Obstructive Pulmonary Disease patients (Blackstock et al., 2016; WHO, 2003). Recently, Venegas, et al. used the model to analyze the influencing factors in long-term adherence to physical therapy for women with urinary incontinence (Venegas et al., 2018). In a similar way, Conraads et al. used it with heart failure patients in 2012. Otherwise, all of them had been using the same multidimensional exercise adherence approach but grouping it in different related factors that should be unified (Conraads et al., 2012; Venegas et al., 2018).

Adherence rates to exercise programs and prescriptions have been estimated to range from 50% to 80% during the first 6 months and to fall to less than 50% after 1 year (Huberty et al., 2008; Martin & Sinden, 2001) similar as adherence to pharmacological and other treatments of chronic diseases (Kallings et al., 2009). Although it must be stated that the magnitude of adherence depends on the methods of assessment used (and the

inclusion or not of dropouts; Driscoll & Young-Hyman, 2014). Also, according to O'Neal et al., 2001, there are two types of adherence; adherence to measurement, mainly determined by the number of training sessions attended compared to total PAP sessions scheduled or adherence to intervention (O'Neal & Blair, 2001). There is not a robust consensus for measuring all of them, and it could lead to misunderstand the results between different studies and the advance of Science in this field (Rhodes et al., 2009). Non-adherence to medical treatment is of significant public health concern, and can result in poorer treatment outcomes, decreasing the sustainability of the HC System, and reducing health status and quality of life in patients. For these reasons, a consensus in the use of the same method to analyze PAP adherence would be necessary with a multi-factorial approach in order to compare data and improvements in their health-related benefits at HC settings.

Our review has several strengths such as the use of three scientific databases and the use of a multi-factorial adherence model for a literature review from 1900 to date. The use of adapted RATS review guidelines instead of a most specific one for a literature review can be cited as a limitation of the study.

Conclusions

The Health system/HC Team-related factors together with therapy-related factors have received limited attention in the reviewed studies to predict or classify PAP adherence. In contrast, social/economic-related factors, mainly demographics, are the most studied ones.

Future researches are needed to determine a consensus about how to classify and manage the barriers and facilitators related to PAP adherence from a multi-factorial approach to predict and manage non-pharmacological treatments and subsequent health-related benefits in patients at healthcare settings.

What does this article add?

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

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

The management of the facilitators and barriers on PAP adherence and changes toward active human behaviors in HC patients, would reduce physical inactivity

behaviors in HC patients, considering active behaviors and exercise program training as useful and adjuvant resources to many chronic diseases.

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