



## Review

# Systematic review of physical activity promotion by community health workers



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## ABSTRACT

**Objective.** To assess the physical activity promotion in interventions conducted by community health workers.  
**Methods.** Systematic searches in five electronic databases (LILACS, PubMed, Scopus, Web of Science and SportDiscus) and manual searches in reference lists were conducted for papers published up until May 2014. The inclusion criteria were interventions delivered in adults by community health workers that had physical activity promotion as an objective (primary or secondary).

**Results.** Of the 950 references initially retrieved, 26 were included in the descriptive synthesis. At the operational level, action strategies were predominantly based on the model of health education grounded in counseling, and delivered in populations at risk or diagnosed with chronic non-communicable diseases. Only five studies had the primary outcome of physical activity promotion and twenty-five studies used self-report methods for evaluation. The majority of studies (72.4%) were classified as having low or moderate risk of bias. Sixteen studies (61.5%) reported positive results for different parameters of physical activity. Most studies were carried out in the United States. The successful interventions were conducted over a period averaging 6.5 months and targeted mainly women, individuals older than thirty, specific ethnic groups, and syndromic or at-risk individuals.

**Conclusions.** The community health workers were important for physical activity promotion, but further interventions should be carried out in different countries and less specific samples, that include physical activity as a primary outcome and employ direct methods for assessing physical activity.

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## Introduction

The implementation of public policies to provide universal health coverage has led to the emergence of community health workers (CHW). As a general rule, this category comprises individuals drawn from the community who receive specific health-related training to work within this setting on a voluntary or remunerated basis under short term or continuous programs. The ready contact of CHW with their peers from the community, on account of having similar ethnicity, language, socioeconomic level and life experiences, is conducive to the acceptance and adoption of the health messages they convey (United States Department of Health and Human Services, 2007; Tulenko et al., 2013).

Although the importance and potential of CHW are clear, a wide range of responsibilities of these professionals has been observed (World Health Organization, 2010). CHW can be involved in specific interventions to reduce the impact of diseases such as diabetes mellitus (Little et al., 2014), in programs for immunization and maternal/child health (Corluka et al., 2009; Lewin et al., 2010; Patel and Nowalk, 2010), HIV/AIDS (Kenya et al., 2011) and in actions for health promotion or life-style improvements (United States Department of Health and Human Services, 2007).

There is a general consensus in the literature that these professionals help foster continuous stimulus of community organization, strengthen ties between community members and providers of healthcare and services, and deliver primary health care services, particularly in the provision of guidance on a healthy life-style (World Health Organization, 2010).

In view of the high prevalence of physical inactivity and its associated deleterious effects on health, this is emerging as a major public health issue worldwide (Lee et al., 2012). The problem calls for continuous efforts in terms of prevention and some approaches implemented in primary health care settings have yielded positive results in the promotion of physical activity (PA). The meta-analysis of Orrow et al. showed a significant increase in the practice of PA in sedentary adults following a series of interventions involving at least twelve months of follow-up (Orrow et al., 2012). However, a summary of the knowledge available on the promotion of PA by CHW at the community level is lacking.

In order to bridge this gap in knowledge, the primary objective of the present study was to retrieve, analyze and compare the data from interventions for the promotion of PA in adults conducted by CHW. As a secondary objective, an in-depth analysis of the key descriptive and operational characteristics of these interventions was carried out.

## Methods

### Inclusion criteria

Trials that met the two following inclusion criteria were included: i) targeted healthy adults ( $\geq 18$  years old), or adults with/or at risk of chronic non-communicable diseases (i.e. specific samples comprising individuals with/or at risk of cardiovascular diseases, obesity and/or type 2 diabetes); and ii) reported interventions conducted by CHW, with or without the involvement of multi-professional teams, entailing the provision of practices, counseling, interviews and/or face-to-face approaches, via telephone and correspondence (letters, pamphlets, internet), promoting PA, as their primary or secondary objective.

As outlined in the introduction, CHW can be defined as individuals drawn from the community who receive specific health-related training to work within this setting on a voluntary or remunerated basis under short term or continuous programs (United States Department of Health and Human Services, 2007).

### Search of available evidence

Systematic searches were conducted from five databases for studies published up until May 10th, 2014 (LILACS, PubMed, Scopus, SportDiscus and

Web of Science). In order to prevent publication bias, manual searches of references lists were also carried out. No limitations on language or search period were imposed.

The strategy applied to the databases used the sensitive construct devised for PubMed as a reference, involving the main elements of the inclusion criteria: (community health worker) OR (chw) OR (community health care worker) OR (community health trainer) OR (community case manager) OR (community health aide) OR (community case manager) OR (family planning personnel) OR (community-based program) OR (community-based process) OR (lay health worker) OR (community health officer) OR (promoters) AND (physical activity) or (physical education) OR (sports) OR (exercise). When the database offered filters by study type, the search was limited to experimental studies or intervention studies. On other databases, the following terms were used: "pre and post-test" OR "non-controlled trials" OR "trials" OR "controlled trials" OR "randomized controlled trials". A full description of five systematic searches is given in Supplementary Material 1 in Appendix A.

### Risk of bias assessment

Original studies were assessed using the adapted version of the *Effective Public Health Practice Project Quality Assessment Tool* (Thomas et al., 2004; Guerra et al., 2014), an 18-point scale which assesses eight domains of a community-based study: (A) selection bias, (B) study design, (C) confounders, (D) blinding, (E) data collection methods, (F) withdrawals/drop-outs, (G) intervention integrity, and (H-I) analyses. For domains A–H, scores of –1, 0 and 1 were attributed, according to the tool's questions. Domain I (intention to treat method) was scored as 0 or 1. After full text assessment, the scores of all studies included were compared and ranked by study into one of three risk of bias strata (low, moderate or high). Other details of the assessment tool are given in Supplementary Material 2 in Appendix A.

### Operational process

The systematic searches were carried out by two researchers, and were reviewed prior to their application to the databases by a third researcher. The processes of assessing the articles by title/abstract and full text were divided among the four researchers who worked independently. In the event of doubts and disagreements, a consensus was reached at a meeting with all those involved. Data extraction was performed by two independent researchers centering on the following information: 1) characterization of the sample (age, percentage of women), type of study and primary objective; 2) description, duration, and number of subjects that were used in the analysis of PA, method of assessment of PA and description of results of PA.

## Results

The electronic and manual searches led to the retrieval of 950 potentially relevant studies for the assessment of the title and the abstract. Of this total, 59 references were selected for subsequent assessment of full texts and extraction of the data. Twenty one out of the 59 studies were excluded for: not having PA as an outcome ( $n = 11$ ) or not having an experimental study design ( $n = 10$ ). A further twelve articles were excluded for the following reasons: incompatible age range (adolescents) ( $n = 4$ ), lack of response from authors to requests for full texts ( $n = 3$ ), publications based on the same study ( $n = 3$ ), intervention not conducted by CHW ( $n = 1$ ) and having a sample of patients with diseases such as autism, cerebral palsy, epilepsy and developmental disabilities ( $n = 1$ ) (Fig. 1). The descriptive synthesis was based on the data of 26 original trials (Staten et al., 2004, 2005; Balcázar et al., 2005; Becker et al., 2005; Larkey, 2006; Gomes and Duarte, 2008; Plescia et al., 2008; Babamoto et al., 2009; Folta et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Treadwell et al., 2010; Allen et al., 2011; Ayala, 2011; Mier et al., 2011; Ruggiero et al., 2011; Shlay et al., 2011; Spencer et al., 2011; Coleman et al., 2012; Cene et al., 2013; Islam et al., 2013a,b; Jennings et al., 2013; Krantz et al., 2013; Duggan et al., 2014; Ursua et al., 2014).

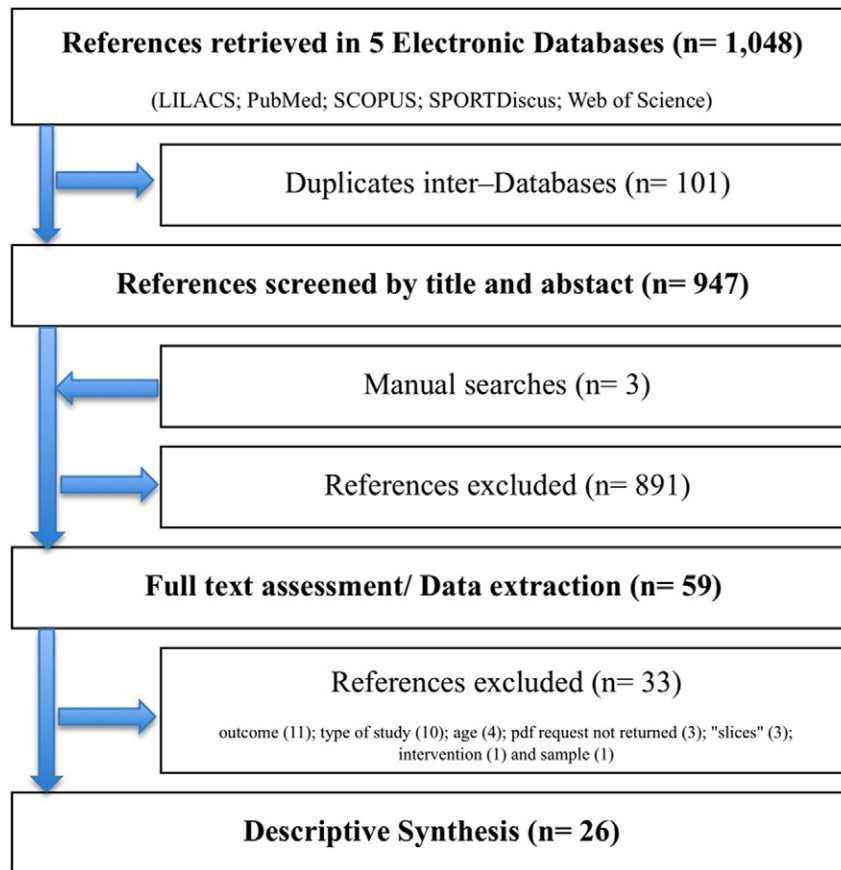


Fig. 1. Systematic review flowchart.

### Descriptive characteristics

The selected studies varied widely for age, where eighteen (69.2%) involved samples with a mean age of over 45 years. Regarding the sex of participants, women predominated in all studies comprising mixed gender samples ( $n = 18$ , 69.2%), while six studies (23.1%) consisted of women only (Table 1).

Regarding study design, the majority of trials had no control group ( $n = 15$ , 57.7%) (Balcázar et al., 2005; Staten et al., 2005; Larkey, 2006; Castillo et al., 2010; Comellas et al., 2010; Treadwell et al., 2010; Ayala, 2011; Mier et al., 2011; Ruggiero et al., 2011; Shlay et al., 2011; Cene et al., 2013; Islam et al., 2013a; Jennings et al., 2013; Krantz et al., 2013; Ursua et al., 2014) and eight were pilot studies (Castillo et al., 2010; Comellas et al., 2010; Treadwell et al., 2010; Mier et al., 2011; Cene et al., 2013; Islam et al., 2013b; Krantz et al., 2013; Ursua et al., 2014). Only two studies were performed outside the United States, one in Brazil (Gomes and Duarte, 2008) and the other in England (Jennings et al., 2013) (Table 1).

The primary purpose of most of the studies was either to reduce cardiovascular risk (Balcázar et al., 2005; Becker et al., 2005; Staten et al., 2005; Plescia et al., 2008; Folta et al., 2009; Allen et al., 2011; Shlay et al., 2011; Krantz et al., 2013) or to lower the risk of diabetes mellitus type II (Staten et al., 2005; Plescia et al., 2008; Babamoto et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Treadwell et al., 2010; Allen et al., 2011; Ruggiero et al., 2011; Spencer et al., 2011; Cene et al., 2013; Islam et al., 2013a,b; Duggan et al., 2014). On the other hand, only five studies focused on the promotion of PA as their primary outcome (Staten et al., 2004; Gomes and Duarte, 2008; Ayala, 2011; Mier et al., 2011; Coleman et al., 2012). Analysis of the samples revealed that, in terms of ethnicity/race, half of the interventions were applied in Hispanic populations (or descendants) (Staten et al., 2004, 2005; Balcázar et al., 2005; Larkey, 2006; Babamoto et al., 2009; Castillo

et al., 2010; Ayala, 2011; Mier et al., 2011; Ruggiero et al., 2011; Spencer et al., 2011; Coleman et al., 2012; Duggan et al., 2014), and five (19.2%) in Blacks (Becker et al., 2005; Plescia et al., 2008; Treadwell et al., 2010; Spencer et al., 2011; Cene et al., 2013). In relation to clinical conditions, nine studies involved samples at risk of or with diabetes mellitus type II (Babamoto et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Treadwell et al., 2010; Mier et al., 2011; Jennings et al., 2013; Islam et al., 2013a,b; Duggan et al., 2014) and four studies included overweight/obese individuals (Folta et al., 2009; Treadwell et al., 2010; Mier et al., 2011; Jennings et al., 2013) (Table 1).

The majority of studies were classified as having low (30.1%, 3–6 range) or moderate (42.3%, scoring 0–2) risk of bias and seven studies were classified as high risk of bias (26.9%, scoring between –1 and –3 points) (details in Supplementary Material 2 in Appendix A).

### Operational characteristics

The number of participants in the analyses for PA ranged from 16 to 884 individuals in intervention groups and the duration of interventions ranged from five weeks to sixty months (Table 2 and further details in Supplementary Material 3 in Appendix A). Seventeen trials (65.4%) had interventions of six months or longer (Staten et al., 2004; Balcázar et al., 2005; Becker et al., 2005; Plescia et al., 2008; Babamoto et al., 2009; Allen et al., 2011; Ayala, 2011; Ruggiero et al., 2011; Shlay et al., 2011; Spencer et al., 2011; Coleman et al., 2012; Cene et al., 2013; Islam et al., 2013a,b; Krantz et al., 2013; Duggan et al., 2014; Ursua et al., 2014).

Only one study evaluated physical activity using an objective method (pedometer) (Folta et al., 2009). All other measurements were obtained via self-reports and the questionnaires used were varied. The *Behavioral Risk Factor Surveillance System* was employed in three studies (Plescia et al., 2008; Babamoto et al., 2009; Spencer et al., 2011), the

**Table 1**  
Descriptive characteristics of included studies.

References	Mean age	Gender (%F)	Type of study	Primary objective of manuscript	Sample characteristics
Allen et al. (2011)	54.5	71	RCT	CVD; T2D RR	Participants at risk
Ayala (2011)	38.7	100	NCT	PA promotion	Hispanic
Babamoto et al. (2009)	50.0	71	RCT	T2D self-management	Hispanics with recent T2D diagnosis
Balcázar et al. (2005)	30–51 <sup>b</sup>	91	NCT	CVD RR	Hispanic
Becker et al. (2005)	47.7	63	RCT	CVD RR	Black sisters with predisposition to CVD
Castillo et al. (2010)	58.2	75	NCT	GC Improvement; T2D self-management	Hispanic with self-reported T2D
Cene et al. (2013)	57	75	NCT	T2D RR	Black participants from rural communities
Coleman et al. (2012)	52	100	RCT	PA promotion	Hispanic
Comellas et al. (2010)	66.8	70	NCT	T2D self-management	Participants with T2D
Duggan et al. (2014)	50.6	71	RCT	T2D RR; GC improvement	Hispanic with high levels of HbA1c
Folta et al. (2009)	57.4	100	RCT	CVD RR	Overweight/obese inactive participants
Gomes and Duarte (2008) <sup>a</sup>	47	83	CT	PA promotion	Apparently healthy adults
Islam et al. (2013a)	53.4	58	NCT	T2D self-management	Bangladeshi with T2D
Islam et al. (2013b)	60.1	64	RCT	HO improvement; T2D RR	Korean at T2D risk
Jennings et al. (2013) <sup>a</sup>	48.2	73	NCT	Obesity reduction; BP	Individuals seeking to lose weight
Krantz et al. (2013)	18–98 <sup>b</sup>	56	NCT	CVD RR	Individuals at CVD risk
Larkey (2006)	≥18 <sup>c</sup>	100	NCT	Cancer prevention	Hispanic
Mier et al. (2011)	32.4	100	NCT	PA promotion	Overweight/obese Mexican-Americans
Plescia et al. (2008)	≥18 <sup>c</sup>	63	CT	CVD; T2D RR	Black participants
Ruggiero et al. (2011)	37.8	93	NCT	T2D RR	Hispanic with different risk factors
Shlay et al. (2011)	56	nd	NCT	CVD RR	Users of community health centers
Spencer et al. (2011)	52.5	58	RCT	GC Improvement	Black and Hispanic with T2D
Staten et al. (2004)	57.2	100	RCT	PA Promotion	Hispanic
Staten et al. (2005)	48.9	86	NCT	CVD; CD; T2D RR	Hispanic
Treadwell et al. (2010)	≥18 <sup>c</sup>	0	NCT	Obesity reduction; T2D RR	Black participants at risk of or diagnosed with T2D/or obesity/or any other health risk
Ursua et al. (2014)	53.2	82	NCT	BP self-management	Filipino

Legend: %F: percentage of women in the sample; CD: chronic disease(s); CT: controlled trial; CVD: cardiovascular disease; GC: glycaemic control; HbA1c: hemoglobin A1c; HO: health outcome; NCT: non-controlled trial; nd: not described; PA: physical activity; RCT: randomized controlled trial; RR: risk reduction; T2D: type 2 diabetes.

<sup>a</sup> Studies not conducted in the United States of America (Gomes; Duarte in Brazil and Jennings et al. in England).

<sup>b</sup> Age range.

<sup>c</sup> Cutoff for age.

short version of the *International Physical Activity Questionnaire (IPAQ)* in two studies (Mier et al., 2011; Ruggiero et al., 2011), and the *7-Day Physical Activity Recall* was used in another two studies (Becker et al., 2005; Allen et al., 2011).

All the strategies conducted by the CHW were based on health education, focused on counseling to promote motivational attitudes and behavioral changes (details in Supplementary Material 3 in Appendix A).

Most studies entailed group meetings ( $n = 18$ , 69.2%) and ten interventions included PA practice (e.g. dance, gymnastics and walking) (Staten et al., 2004, 2005; Becker et al., 2005; Larkey, 2006; Plescia et al., 2008; Folta et al., 2009; Treadwell et al., 2010; Ayala, 2011; Islam et al., 2013a,b). Complementary strategies such as home visits and telephone contact were used to invite subjects to take part in the groups, for follow-up and monitoring or to reinforce the educational activities performed individually or in groups (Staten et al., 2004; Balcázar et al., 2005; Becker et al., 2005; Gomes and Duarte, 2008; Babamoto et al., 2009; Allen et al., 2011; Mier et al., 2011; Islam et al., 2013a; Spencer et al., 2011; Shlay et al., 2011; Duggan et al., 2014; Ursua et al., 2014).

CHW underwent training sessions prior to running the interventions in 22 studies (84.6%) (Balcázar et al., 2005; Becker et al., 2005; Staten et al., 2005; Gomes and Duarte, 2008; Plescia et al., 2008; Babamoto et al., 2009; Folta et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Treadwell et al., 2010; Allen et al., 2011; Ayala, 2011; Mier et al., 2011; Ruggiero et al., 2011; Shlay et al., 2011; Spencer et al., 2011; Coleman et al., 2012; Cene et al., 2013; Islam et al., 2013b; Krantz et al., 2013; Duggan et al., 2014; Ursua et al., 2014). A high number of studies represented specific ethnic groups and therefore fifteen interventions (57.7%) had bilingual content and agents (Staten et al., 2004, 2005; Balcázar et al., 2005; Larkey, 2006; Babamoto et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Ayala, 2011; Ruggiero et al., 2011; Shlay et al., 2011; Coleman et al., 2012; Islam et al., 2013a,b; Duggan et al., 2014; Ursua et al., 2014).

Eleven studies (42.3%) specified the use of theoretical models. Eight interventions were based on the transtheoretical model for behavioral

change (Balcázar et al., 2005; Gomes and Duarte, 2008; Babamoto et al., 2009; Allen et al., 2011; Mier et al., 2011; Shlay et al., 2011; Coleman et al., 2012; Krantz et al., 2013), and three were grounded in the social cognitive theory (Staten et al., 2004; Krantz et al., 2013; Duggan et al., 2014).

#### Summary of positive results

Sixteen studies (61.5%) reported a significant increase in PA, as assessed by different parameters (Table 2 and further details in Supplementary Material 3 in Appendix A). Twelve of these studies reported an increase in the total volume of PA in minutes or days per week, higher energy expenditure, higher scores in physical exercises and increase in the proportion of individuals who enhanced their level of PA (Staten et al., 2004; Balcázar et al., 2005; Becker et al., 2005; Larkey, 2006; Gomes and Duarte, 2008; Babamoto et al., 2009; Comellas et al., 2010; Castillo et al., 2010; Spencer et al., 2011; Coleman et al., 2012; Islam et al., 2013a; Jennings et al., 2013). Three studies reported an increase in intensity and/or duration of walking (Staten et al., 2005; Mier et al., 2011; Ruggiero et al., 2011) and only one trial observed an increase in the number of steps assessed by pedometer (Folta et al., 2009).

Among the studies reporting enhanced PA relative to baseline data, six short interventions ( $\leq$ three months) led to an increase of PA practice (Staten et al., 2005; Larkey, 2006; Folta et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Mier et al., 2011). Three studies with interventions of 12 months showed increases in energy expenditure (Becker et al., 2005), in the number of minutes in PA (Staten et al., 2004) and in the proportion of individuals that practiced moderate or vigorous PA (Coleman et al., 2012). The intervention times for promoting walking ranged from three to six months and significantly increased the number of minutes walked per week (Staten et al., 2005; Ruggiero et al., 2011) and also increased energy expenditure (Mier et al., 2011).

The majority of these studies represented specific ethnic groups: Hispanics or descendants of Hispanics ( $n = 9$ ), Blacks ( $n = 1$ ),



**Table 2**  
Characteristics of interventions and results of studies assessed.

References	No. analyzed for PA		Int. length (months)	PA assessment method	Description of results for PA
	INT	CON			
Allen et al. (2011)	261	264	12	7-Day Physical Activity Recall	Statistically non-significant result
Ayala (2011)	205	–	12	Global Physical Activity Questionnaire	Non-significant for PA (MET minutes of leisure-time physical activity); significant increase in the number of days of use of parks and places for recreation; significant increase in self-efficacy, perceived barriers to being physically active and community support for PA; significant improvement in aerobic fitness and flexibility
Babamoto et al. (2009)	75 <sup>b</sup>	60/54	6	Behavioral Risk Factor Surveillance System of Centres for Disease Control and Prevention	Significant increase in the number of individuals that practiced physical exercise at least 3 days per week in the intervention group
Balcázar et al. (2005)	320	–	6	Two questions applied for mothers (4-point scale: never, sometimes, usually or always): 1. PA in leisure time; 2. PA in transportation.	Significant improvement in the options (never, sometimes, usually or always) of the families for practicing PA during leisure time (walking, dancing, riding a bike, working in the garden, aerobic dancing, soccer) and PA in transportation (walking and use of stairs)
Becker et al. (2005)	196	168	12	7-Day Physical Activity Recall	Significant difference in energy expenditure for PA between groups: highest mean for intervention group and lower in control
Castillo et al. (2010) <sup>a</sup>	47	–	3	Summary of diabetes self-care activities	Significant increase in the number of days per week practicing at least 30 minutes of PA
Cene et al. (2013) <sup>a</sup>	30	–	6	Self-report to assess the number of days per week of PA	Statistically non-significant result
Coleman et al. (2012)	433	435	12	Physical Activity Assessment Survey (adapted)	Significant increase in the percentage of moderate PA (walking or running for fun, exercise or transportation) and vigorous PA (sports or exercise) in the intervention group
Comellas et al. (2010) <sup>a</sup>	17	–	5 weeks	Summary of diabetes self-care activities and step meter (self-report)	Significant increase in the frequency of physical exercise sessions of at least 30 minutes per day during the week; significant increase in participation in specific sessions and in days per week in physical exercise sessions; and significant increase in the use of step meter in days of the week.
Duggan et al. (2014)	154	166	6	International Physical Activity Questionnaire (adapted version)	Statistically non-significant result
Folta et al. (2009)	46	28	3	Pedometer (7 days)	Significant increase in steps/day in the intervention group compared to the control group
Gomes and Duarte (2008)	44	43	4	Baecke Questionnaire	Significantly better scores on PA during exercise time in the intervention group than in the control group
Islam et al. (2013a)	26	–	9	Self-reported daily frequency of PA	Significant increase in PA practice, to several days or every day of the week
Islam et al. (2013b) <sup>a</sup>	21	14	6	Self-report of recommended PA (150 minutes per week)	Significant changes were observed in scores on social interaction and confidence for PA practice in the intervention group; non-significant for change in recommended level of PA per week
Jennings et al. (2013)	227	–	21 weeks	Self-report of minutes per week of moderate or vigorous PA	Significant increase in minutes per week of moderate, vigorous and total PA
Krantz et al. (2013) <sup>a</sup>	698	–	12	Self-report of days per week of physical exercise practice	Statistically non-significant result
Larkey (2006)	366	–	3	Self-report of minutes per week of PA	Significant increase in minutes per week of general PA
Mier et al. (2011) <sup>a</sup>	16	–	3	International Physical Activity Questionnaire (short version)	Significant increase in minutes per week of metabolic equivalent to walking
Plescia et al. (2008)	884	2844	60	Behavioral Risk Factor Surveillance System of Centres for Disease Control and Prevention	Statistically non-significant result
Ruggiero et al. (2011)	57	–	12	International Physical Activity Questionnaire (short version)	Significant increase in minutes per week of walking only on evaluation at 6 months. However, these gains were not maintained after 12 months.
Shlay et al. (2011)	340	–	12	Self-reported weekly frequency of walking or moderate PA	Statistically non-significant result
Spencer et al. (2011)	55	72	6	Behavioral Risk Factor Surveillance System of Centres for Disease Control and Prevention	Both groups (intervention and control) showed an increase in the number of individuals meeting the PA guidelines (moderate PA of at least 30 minutes per day for 5 days a week or vigorous PA of at least 20 minutes per day for 3 days). However, no intervention effect in comparison with the control group was evident.
Staten et al. (2004)	67 <sup>c</sup>	77/71	12	Arizona Activity Frequency Questionnaire and a Health and Lifestyle Questionnaire	Significant increase in minutes per week of moderate-to-vigorous PA in the intervention group with CHW. However, no intervention effect in comparison with the control group was evident.
Staten et al. (2005)	202	–	3	Minnesota Leisure-Time PA Questionnaire	Significant increase in minutes per week of moderate walking and fast walking
Treadwell et al. (2010) <sup>a</sup>	42	–	6 weeks	Self-report of hours per week of PA	Statistically non-significant result
Ursua et al. (2014) <sup>a</sup>	33	–	14	NYU Cardiac Rehabilitation Centre survey instrument (adapted)	Statistically non-significant result

Legend: CHW: community health worker; CON: control; INT: intervention; PA: physical activity.

<sup>a</sup> Pilot study.

<sup>b</sup> Babamoto et al. (2009) intervention: CHW group, controls: case management group + standard provider care group.

<sup>c</sup> Staten et al. (2004) intervention: provider counseling + health education + CHW group, controls: provider counseling group + provider counseling + health education group.

Bangladeshis ( $n = 1$ ), Blacks and Hispanics ( $n = 1$ ), and predominantly involving syndromic groups, particularly those affected by diabetes mellitus type II and overweight or obesity. Six (37.5%) of these interventions had a control group (Staten et al., 2004; Becker et al., 2005; Babamoto et al., 2009; Folta et al., 2009; Spencer et al., 2011; Coleman et al., 2012).

In regard to risk of bias among those studies with positive results for PA, five (31.2%) were classified as having low (Staten et al., 2004; Becker et al., 2005; Folta et al., 2009; Spencer et al., 2011; Coleman et al., 2012), seven (43.7%) as moderate (Balcázar et al., 2005; Staten et al., 2005; Gomes and Duarte, 2008; Babamoto et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Mier et al., 2011) and only four (25%) as high risk of bias (Larkey, 2006; Ruggiero et al., 2011; Islam et al., 2013a; Jennings et al., 2013).

Ten studies showed no statistically significant increase for PA, although three of these did show a significant increase in self-efficacy for PA, in stage of behavioral change for PA, and in physical fitness (Ayala, 2011; Islam et al., 2013b; Shlay et al., 2011).

## Discussion

The aim of this study was to retrieve and summarize the available evidence on interventions conducted by CHW for promoting PA among adults in the primary health care settings. Results of this systematic review drew on data from 26 studies, most of which ( $n = 16$ , 61.5%) achieved significant positive results in the form of increased PA. The successful interventions were conducted over a period averaging 6.5 months and targeted mainly for individuals older than thirty years of age in specific ethnic groups, including Hispanics, Blacks and Bangladeshis. Besides these aspects, the most notable findings were related to syndromic or at-risk individuals, particularly for diabetes mellitus II or cardiovascular disease.

The vast majority of the interventions that proved effective in promoting PA had several strategies and actions in common. With regard to the duration of the interventions, eight had at least six-months of follow-up. These findings corroborate the minimum cut-off point of six months proposed by Prochaska and DiClemente (Prochaska and DiClemente, 1991) for promoting changes in PA behavior. This result also supports the study of Baker et al., which indicated six months as the minimum period for planning behavioral changes in community-based interventions for promoting PA (Baker et al., 2015). However, the results of the present review also encompassed effective strategies for promoting PA based on intervention periods of less than six months (Staten et al., 2005; Larkey, 2006; Gomes and Duarte, 2008; Folta et al., 2009; Castillo et al., 2010; Comellas et al., 2010; Mier et al., 2011; Jennings et al., 2013).

The sixteen interventions with significant results for the promotion of PA were carried out using the model of education in health via counseling. Relevant aspects of treatment and complications of diabetes and cardiovascular disease, as well as incentives to practice PA, adoption of healthy diet and assistance in setting goals were addressed in these interventions. Strategies included talking circles, flipcharts, TV soaps, magazines and videos, in addition to trips to different places in the city as a means of encouraging participants. The findings of the present study corroborate the evidence presented by Tulloch et al., showing that the acquisition of healthy behavior and its continuation can be achieved through PA counseling and recommendations provided by lay persons as well as by physicians (Tulloch et al., 2006). In this regard, the potential role of CHW in the promotion of PA is noteworthy, since their closer contact with the members of the community can lead to permanent routine guidance through home visits and group meetings, in addition to the opportunity to promote practice, as seen in some of the strategies contained in the present summary.

Most of the studies that were effective for promoting PA used the educational group format as a strategy, where seven of these also entailed the practice of PA, characterizing the combined use of strategies. With

respect to intervention strategies or types aimed at promoting and/or maintaining PA in populations, the study of Kahn et al. identified three high-impact approaches: i) informative approaches aimed at decision-making for change in knowledge and attitudes; ii) behavioral and social approaches to foster independence and empowerment for change or maintenance of behavior; and iii) environmental and political approaches (Kahn et al., 2002). The study by Cleland et al. suggests that the combined use of these strategies has a major impact on increasing PA among populations with low socioeconomic level, besides influencing inter-sector communication, community participation in devising and planning actions as well as in informing the community of the PA options available (Cleland et al., 2012).

In the present synthesis, fifteen studies effective for promoting PA targeted specific populations in terms of ethnicity, low socioeconomic level, and risk status and/or diagnosis for chronic non-communicable diseases, corroborating several previous reviews (Cleland et al., 2012; Conn et al., 2012; Nierkens et al., 2013). The studies conducted in the United States revealed that the practice of CHW could respect the ethnic and cultural aspects of the communities of interest by recruiting bilingual and bicultural professionals for work involving Hispanics, Bangladeshis, Koreans and Filipinos. The bilingual/bicultural approach of CHW is intended to provide closer ties between the professionals and individuals attending the programs by recognizing and addressing their concerns/difficulties and also by translating, facilitating and disseminating the envisaged concepts and strategies (United States Department of Health and Human Services, 2007), particularly in settings where there is a greater need for intervention (Nierkens et al., 2013). Historically, bilingual and cultural strengthening is not a recent strategy. In the early 1960s, the US government formally decided to support community health programs aimed at low-income communities, consisting largely of immigrant workers (Pérez and Martínez, 2008). Thus, being bilingual and understanding the cultural tradition of the local population became key requirements for selecting these professionals. In the studies conducted in England and Brazil, the work of CHW did not focus on any specific group, even when their responsibilities involved cultural issues, but instead were centered on more general populations. In Brazil, CHW tend to live in the same area in which they work (Brasil, 2007) and form part of multi-professional family health teams. Over the space of ten years, the professional coverage of CHW in Brazil increased from 54.2% to 65.7% (Brasil, 2014).

Concerning the methods of assessing PA, self-reporting was the most frequently used approach in the studies assessed. In this regard, given the highly heterogeneous data obtained through different self-report instruments, caution should be taken when comparing and extrapolating the results. Care should also be taken regarding the large number of surveys that used instruments tailored specifically for the purposes of the study in question and failed to report their validity and reproducibility.

CHW underwent previous training for the majority of the studies showing increased PA. In general, this training was given by specialists (physicians, nurses) and typically addressed concepts and practices related to levels of prevention, control and monitoring of cardiovascular diseases, diabetes and obesity, involving recognition of their associated risk and prognostic factors. It is known that training processes after recruitment can improve the general competencies of CHW, such as their community leadership, approaches (individual and for groups) and also enable the acquisition of the specific competencies needed for their work (Health and Services, 2007). However, in view of the small number of studies whose main objective was the promotion of PA, it has been suggested that CHW also undergo training programs based on the current recommendations for PA. In this sense, it is suggested that the CHW can develop activities focused on PA promotion both in leisure-time and in walking for transportation, as well as address and seek solutions to overcome the barriers to the practice of PA (Florindo et al., 2014).

Limitations of this review included: (i) the large variability of the studies incorporated in the summary; and (ii) the operational

limitations of the issues of blinding and selection of participants. The first limitation hinders direct comparison of results of the different studies as well as generalization of their findings, principally due to three aspects: i) the large number of studies which employed varied instruments and with different outcomes for PA, making the comparisons difficult; ii) the fact that PA constituted the secondary outcome in 21 of the studies included, which did not state whether there was sufficient power for the observation of significant improvements in relation to this outcome; and iii) the absence of a control group: although most studies were designed to pursue a pragmatic bias (i.e. oriented to the real world) this hindered meaningful comparisons. Concerning the second limitation, future studies should ensure blinding of the assessors (when conducting the interview, for instance) and of the researchers summarizing and refining the participant selection process, by opting for random methods that are less susceptible to bias. Moreover, in order to improve the quality of communication of the methods employed, future studies should be written in accordance with the items from the CONSORT initiative (Moher et al., 2010).

Several strengths of the present study should be highlighted: i) the broad search criteria resulted in a considerable number of articles for analysis, besides pooling data on the effectiveness of promoting PA in different settings; ii) this is the first systematic review analyzing the descriptive and operational characteristics of studies that used CHW as promoters of PA among adults through educational action and practice. The study findings corroborate the results of other reviews, confirming the potential of CHW in disease prevention and health promotion. The positive data from these reviews indicates that CHW (volunteers or otherwise) played an important role in PA promotion.

Given the emergence of the subject, the participation of CHW is recommended in future interventions centered on the promotion of PA conducted in different countries and applied to less specific samples than those observed in the present review. We also suggest that new studies should use outcomes standardized of PA to improve the comparison (e.g. methods of self-reports validated and that take as outcome minutes per week of PA) and use direct methods for assessing PA to better evaluate the effectiveness of interventions. Lastly, CHW could undergo specialized training within the framework of PA promotion, for subsequent inclusion into routine practice in primary health care.

#### Conflict of interest statement

The authors declare no conflicts of interest. The author PG holds a postdoctoral scholarship from the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP process no.: 2013/22204-7).

#### Authorship statement

All authors support and agree with the information presented in this study.

#### Contributorship statement

All authors made a true contribution to the development of this study.

EC (proponent of original idea): participated in research protocol development, assessment and data extraction from original studies, and in writing the manuscript.

PG: participated in research protocol development, assessment and data extraction from original studies, and in writing the manuscript.

TY: participated in assessment, and reviewing the final draft.

AF (senior researcher): participated in research protocol development, assessment and in writing this manuscript.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.ypmed.2015.08.007>.

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