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Reviews

The effect of the planned behaviour theory and the transtheoretical behaviour model on physical activity. A systematic review.

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Abstract

Systematic physical activity (PA) is crucial in preventing illnesses that can become life-threatening, such as colon and breast cancer, heart disease and ischemic stroke, cardio-respiratory disease, type II diabetes, and depression. Many theory–based interventions have been applied to achieve positive outcomes in an individual's behavioural change and the ability to engage in systematic PA. This systematic review investigates the influence of the Transtheoretical model of behaviour (TTM) and the theory of planned behaviour (TPB) on PA. A substantial search in Science Direct, Wiley Online Library databases and PubMed was performed to obtain articles about the topic. Data exportation was possible after the reviewers applied exclusion–inclusion criteria to estimate evidence quality. Empirical evidence was assessed with the CONSORT checklist to appraise the risk of bias. The primary search identified 195 studies. Of those, ten original studies were comprised. All studies indicated a positive influence of TPB and TTM on physical activity in non–health and healthy populations. In particular, it was found to have an impact on energy expenditure, balance and body strength. Theory-based interventions are notably effective in promoting physical activity behaviour. Researchers and health professionals must select and utilise interventions based on the above mentioned theories and aim to enhance PA behavioural change on individual and interpersonal factors. Although the positive outcomes of theory-based interventions on PA behaviour, it is necessary for further research to be conducted.

Introduction

The definition of physical activity (PA) states that it is "an activity of the body generated by the skeletal muscles which influence the enhancement of metabolic rate over resting energy expenditure" (Neufer *et al.*, 2015). PA is a complex behaviour classified into low, moderate, and high intensity. Regulate PA is linked to considerable health benefits, such as reduced type II diabetes, breast and colon cancer, depression, ischemic stroke, and cardiovascular disease (Welch *et al.*, 2019). Medical professionals recommend PA to relieve chronic pain significantly. It is estimated that 33% of the world's population is affected by chronic pain (Dureja *et al.*, 2014). Moreover, research has indicated that exercise and PA can amplify the operation of the central nervous system, reduce cognitive operational erosion associated with ageing, and decrease the possibility of dementia (Foster *et al.*, 2018; Kennedy *et al.*, 2017). Furthermore, PA induces neurotransmitters such as norepinephrine and serotonin, which subscribe to stress reduction (Chauvet – Gelinier and Bonin, 2017).

To reduce non – communicable diseases, the World Health Organization, under the Global Action Plan

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(WHO, 2017), proposed a 25% decrease in the jeopardy of premature mortality from cancer, diabetes, and chronic respiratory disease, by 2025. Numerous reports underline that a significant percentage of people worldwide cannot become involved long–term with PA (Kohl III *et al.*, 2012). Thus, differentiating the characteristics of effective PA promotion plans has become a significant concern for public health authorities. Theory-based projects appear to be most efficacious when considering behavioural change.

Such projects are developed according to valid theories of behavioural change, which verify the assumption that behaviour moderators need to be modified to establish a behaviour change (Glanz and Bishop, 2010). A vast amount of theories have been applied to attain positive behavioural outcomes. It has been acknowledged that theory-based interventions allow scientists to collect data, test hypotheses, distinguish variables that influence behaviour, and propose mechanisms which should be included during behavioural interventions (Davis *et al.*, 2015; Michie *et al.*, 2014). A theoretical approach with a significant effect on behavioural change towards PA is the theory of planned behaviour (TPB). The TPB focuses on theoretical apprehensions concerning an individual's motivational features as determinants in establishing specific behaviour (Ajzen, 2015). Furthermore, a theory-based model is highly recognised for its ability to interpret when and how individuals are willing to change their behaviour, also known as the transtheoretical model of change (TTM). The theory mainly centers on how individuals transition from one stage to the next, decisional balance, and self–efficacy. Also, TTM explores an individual's readiness to conform to new behaviour and incorporates five behavioural change stages (Prochaska and DiClemente, 1983).

This review investigates the influence of both theories-based models on physical activity.

Methods

Study selection

Wiley Online Library databases, Science Direct, and PubMed were used to identify studies. Keywords used in the search equation were: Physical Activity (PA), Transtheoritical Model (TTM), Theory of Planned Behavior (TPB), and Exercise and Physical Activity.

Inclusive criteria: 1) studies that evaluated the effect of TPB or TTM on PA, 2) regardless of age and gender of participants, 3) randomised control trial design studies, 4) studies including non–clinical and clinical population, 5) studies including interventions, regardless of a specific structure (sequence of events, duration, location).

Exclusive criteria: 1) studies subject matter unrelated to the topic, 2) studies published in languages other than English, 3) other systematic reviews and meta-analyses, and 4) scientific protocols published providing inadequate outcomes.

Study evaluation

Specific criteria were used to assess all studies of this systematic review from the Consolidating Standards of Reporting Trial Checklist 2010 (CONSORT) (Schulz *et al.*, 2010). Criteria required for this article were: structured abstract, eligibility of participants, sufficient sample size, number of participants allocated to groups, flow diagram, percentage of drop–outs for each group, demographics and clinical information, and limitations.

Results

The primary search submitted 195 articles. Due to the absence of theory-based interventions, eight articles were excluded. Furthermore, thirty articles were excluded due to the absence of full-text availability. The non-reference to PA excluded forty-five articles. Lack of randomised control trial design excluded thirty articles. Finally, in this systematic review, ten articles were evaluated. The flow chart of article selection is presented in Figure 1.

According to the CONSORT 2010 criteria checklist, a structured abstract was not provided for three articles (Chatzisarantis *et al.*, 2015; Darker *et al.*, 2010; Shirazi *et al.*, 2007). All articles comprised eligibility criteria and pre–specified primary and secondary estimations. The sample size was determined in only half of the articles (Darker *et al.*, 2010; Marshall *et al.*, 2003; Jennings *et al.*, 2014; Shirazi *et al.*, 2007). Six articles indicated a control trial design and generation (Darabi *et al.*, 2017; Chatzisarantis *et al.*, 2015; Darker *et al.*, 2010; Jennings *et al.*, 2014; Marshall *et al.*, 2003; Shafieinia *et al.*, 2016). All articles identified statistical methods, while only two did not present a flow chart (Darker *et al.*, 2010; Mostafavi *et al.*, 2015). Participants' withdrawal rates and losses were described in all ten articles. Two articles did not provide baseline demographic tables (Darker *et al.*, 2010; Mostafavi *et al.*, 2015). Limitations were indicated in all ten articles. Overall, the studies being evaluated

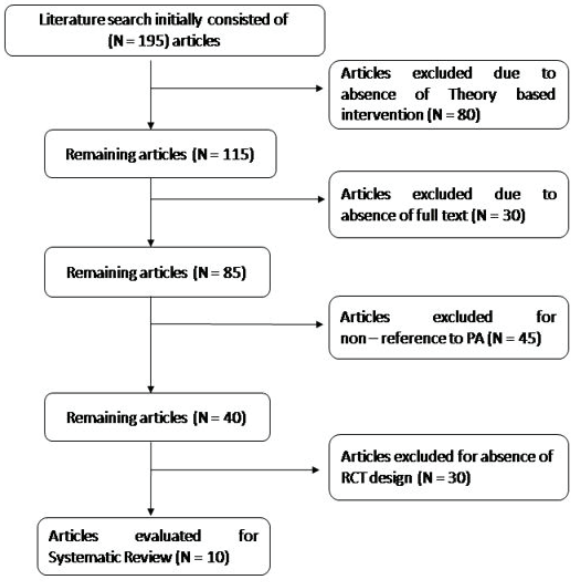

Figure 1.

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Table 1. Studies included in the systematic review.

STUDY	PARTICIPANTS	CONTROL GROUP	INTERVENTION	RESULTS
Author, Year, Origin	**sample, age, gender, characteristics**	**sample, mean age, gender**		**Main Outcomes**
Shirazi *et al.*, 2007, Iran	n=61, 40-65 yrs, females, general population osteoporosis prevention	n=55, females, 40-65 yrs	TTM 12-week intervention included an exercise program costumed for each participant on weight training and walking and an educational program based on individual (SoC).	The active group increased lower body strength and balance. Psychological (SoC) also showed positive progress. From being sedentary (SoC) to active.
Proper *et al.*,2003, Germany	n=299,males and females, over 18	n=168	Seven 20 min TTM counselling sessions structured on participants' SoC for nine months based on PACE program measures. In addition, healthy lifestyle factors were provided to increase PA behaviour.	Increased cardiovascular capacity and energy expenditure indicated TTM interventions positively affected PA.
Pinto *et al.*,2005, Netherlands	n=43, females, 18 and older, breast cancer patients	n=43, females, 18 and over, breast cancer patients	PA counseling 12 week TTM intervention based on weekly exercise info and (SoC) to enhance PA behavior.	There was a rise in moderate intensity PA levels and high energy expenditure per week after increased PA behavioral promotion.
Marshall *et al.*, 2003, Australia	n=227, males and females, 40 – 60 yrs., general population	n=235, males and females, 40 – 60 yrs., general population.	TTM intervention included 1 time mailing of 4 brochures on PA structured on participants SoC to promote PA behavior.	Short – term PA behavior was increased after TTM intervention.
Mostɑfavi *et al.*, 2015, Iran	n=71, females, mean age 52 yrs. Metabolic Syndrome	n=71, females, mean age 52 yrs. Metabolic Syndrome	TTM Intervention consisted of five 1 hour educational sessions and exercise instructions to promote PA behavior.	TTM intervention had a positive increase in PA behavior. Lowered triglyceride, and HDL cholesterol levels.
Shafieinia *et al.*, 2016, Iran	n=54, females, age between 18 – 60 yrs. general population	n=54, females, age between 18 – 60 yrs. general population	TTM intervention four 90' educational sessions and e mail reminding correspondence once every 2 weeks to increase PA behavior.	TPB had major increase on PA behavior. Increase of objective to walk longer, inspired participants to indeed walk longer.
Chatzisarantis *et al.*, 2015. Australia	n=1028, male and female adolescents, age 12 – 18 yrs. secondary students	n=344, male and female adolescents, age 12 – 18 yrs. secondary students	TPB intervention to enhance PA included reading students persuasive messages and vigorous PA four days a week for eight weeks during leisure time.	Leisure physical activity was increased and showed medium – to large change following an effective TPB intervention program.
Darker *et al.*, 2010, Ireland, UK, Aberdeen.	n=66, male and female, age 16 – 65 yrs,general population	n=64, male and female, age 16 – 65yrs, general population	During a 77 days TPB intervention to promote PA participants committed to increase walking time 10 – 20' each week. Intervention was based on coping planning, goal setting, and action planning.	TPB intervention significantly influenced walking behavior. Participants increased walking behavior during the week.
Jenning *et al.*, 2014, Australia, Canada.	n=184, males and females, age <18yrs,type II diabetes	n=202, males and females, age <18yrs,type II diabetes	12-week web - based TPB intervention to increase PA.	TPB intervention changed PA behavior. A web – based programme indicated a short term change in physical activity. All PA measures, including steps per day, moderate and vigorous physical activity ,were increased.
Darabi *et al.*, 2017, Iran.	n=289, female, age 12 – 16yrs.	n=289, female, age 12 – 16yrs.	6 months TPB intervention with 90 min educational sessions and complementary media training to increase PA behavior.	Adolescent girls improved overall PA after completing a TBA educational intervention .

were suitable to be incorporated in this review and are outlined in Table 1.

Five (50%) of the studies involved TPB interventions and five (50%) of the studies involved TTM interventions. 40% of the research focused on female participants. Eight of the studies investigated adult participants, whereas two were secondary school students. Four studies investigated TPB and TTM intervention results on clinical populations diagnosed with osteoporosis, metabolic syndrome, breast cancer, and type II diabetes. The seven remaining articles focused on non–clinical population. The mean sample size was n=232.2. The smallest size was n=43, and the largest size was n=1.028.

Discussion

This systematic review aims to investigate the influence of the TPB and the TTM on behavioural change concerning PA. Outcomes showed that both models were efficient in increasing PA. TTM- and TPB-based interventions positively influenced PA by incrementing fitness levels in clinical and non–clinical populations. A TTM 12 – week home–based intervention was conducted to decrease osteoporosis in female participants. The intervention included an educational program on weight training and walking. Secondary results indicated an increase in PA by showing an improvement in participants' lower body strength and balance. Moreover, a significant benefit in psychological SoC was apparent in the experimental group but not in the control group (Shirazi *et al.*, 2007). A different study evaluating the effect of a TTM intervention on PA indicated a significant improvement in PA by measuring the total increase in energy expenditure. Intervention periods were short and tailored for each individual on SoC. The positive increase in PA was evident in outcome measures.

According to SoC, results of the TTM 12-week intervention based on PA weekly exercise information and consultations showed a substantial improvement in PA behaviour. Differentiation among intervention and control groups showed an increase in overall time of PA at a modest – intensity per week. Moreover, the experimental group indicated a significant rise in high and very high energy expenditure over the control group (Pinto *et al.*, 2005). The outcomes of an RCT study structured as a TTM intervention on adults showed an increase in short–term PA behaviour. The intervention included a one–time mailing of four pamphlets and a letter to a randomly distributed experimental group. The brochures were evaluated carefully to represent participants' current SoC. At two months' baseline the experimental group showed a significant PA increase of 78 minutes per week, whereas at six months, PA behaviour had sustained higher for the experimental group than the control group but had been reduced insignificantly compared to two months post–baseline calculations (Marshall *et al.*, 2003). Empirical evidence in a study investigating the impact of a TTM intervention to increase PA for females with metabolic syndrome showed an increase in PA levels for the intervention group, with significant advancement in all SoC. Participants in the control group did not indicate any shift in PA behaviour. All shifts in TTM constructs were notable in the experimental group. Both exercise instructions and educational sessions positively increased PA behaviour (Mostafavi *et al.*, 2015). The efficient outcomes of both theories are highlighted in two more studies. Scientists designed an RCT intervention based on TPB to increase PA behaviour among women. The intervention was structured on a combination of emails sent once every two weeks for three months, sent once every two weeks for three months, and four educational sessions with a duration of 90'. Results indicated an enhancement in all TPB variables, with the exception of subjective norms, and an increase in PA behaviour in the intervention group compared to the control group (Shafieinia *et al.*, 2016). In addition, a TPB school–based intervention was designed to alter leisure–time PA behaviour. The intervention included a high-intensity 40' PA session four days a week for eight weeks. The study outcomes revealed a shift in PA behaviour by showing a medium to high increase in PA leisure– time (Kawabata *et al.*, 2018). A one-week TPB intervention was implemented to increase PA among the general public. The intervention aimed to promote walking based on objective measures. Results showed that brisk walking was increased from 20' to 32' over one week, thus indicating a significant enhancement in PA behavioural change (Darker *et al.*, 2010).

The positive effect of the TPB on the increase of PA was also perceivable in a 12 – week web–based intervention for adults with type II diabetes. A self–management strategy was used to increase PA behavioural change. Study's outcome by the end of the 12 weeks indicated an overall increase in PA behaviour (Jennings *et al.*, 2014). Results were consistent with those of Baker and Mutrie, (2005). Researchers designed a four–week TTM intervention to increase PA using a pedometer. Data analysis showed a positive change in PA behaviour.

Moreover, results were consistent with those of Dinger *et al.*, (2007), who indicated a significant PA behavioural change using a TTM web–based intervention. Also, research outcomes were consistent with those of Kawabata *et al.*, (2018), showing an increase in leisure–time PA after completing a four–week PA intervention among secondary school students based on the TPB. In addition, Vandelanotte *et al.*, (2007), empirically indicated an important increase in PA behaviour change utilising a web–based TPB structured intervention.

The current systematic review does not lack limitations. It is necessary to mention that 40% of the articles being evaluated had high rates of sample dropouts (Mostafavi *et al.*, 2015; Shirazi *et al.*, 2007; Darker *et al.*, 2010; Shafieinia *et al.*, 2016). Furthermore, for only a few studies, fair homogeneity was evident among participants when examining socioeconomic

status and race. This factor could limit generalisation of the outcomes (Shirazi *et al.*, 2007; Pinto *et al.*, 2003; Darabi *et al.*, 2017; Proper *et al.*, 2003). Also, a significant limitation is using self–report questionnaires in all of the articles being reviewed. Worth mentioning is that the study conducted by Marshall *et al.*, (2003) held interviews via phone. This may have as a result social desirability bias, a tendency of the respondent to answer in ways favourable to the scientist (Akbulut, 2017). Moreover, a limitation in one study designed by Darker *et al.*, (2010) is that volunteer participants were recruited to participate in the study's TPB intervention. Such action could develop an intervention group willing to increase walking behaviour than a group of non – volunteers who would be less accepting.

Conclusions

Physical activity is a significant factor in maintaining optimum health status and preventing life–threatening, non – communicable diseases. A systematical exercise program has been proven to positively affect physical and mental health. The TPB and TTM theories addressing behavioural change have been applied to modify individuals' positions towards PA. The outcomes of the current review indicated that both theoretical models positively enhance PA for non–healthy and healthy populations. However, all studies showed promising results, the fact that the sample sizes were small dictates that scientific outcomes cannot be generalised. Future studies should aim for a greater number of participants, which would increase the opportunity to generalise the findings.

Key Points

- Regular physical activity can prevent mental and physical health issues.
- Behavioural theory-based models can affect an individual's behaviour.
- The theory of planned behaviour and the transtheoretical model of behaviour can alter behaviour and increase physical activity.
- Larger sample sizes are required for research.

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