Review Article

Transtheoretical Model of Health Behavioral Change: A Systematic Review

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Abstract

Background: Transtheoretical model (TTM) is one of the most commonly used methods in behavioral change modeling. The aim of this study was to conduct a systematic review (SR) to determine research gaps with regard to this template with an emphasis on intervention for patients with chronic diseases (CDs). **Materials and Methods:** ISI-WOS, Scopus, PubMed, SID, and Magiran databases were examined systematically and on the basis of defined criteria. Titles, abstracts, and full texts of articles retrieved were examined for the presence of defined criteria. Then finalized articles were analyzed in consensus meetings. After that, references of selected articles and full text of those meeting the criteria were also analyzed. **Results:** We screened 103 articles, excluded 27 in abstract review and 34 in full-text review, leaving 42 articles for critical appraisal. Then the references of these 42 articles were also screened. Fifty articles were excluded on abstract review and 5 on full-text review, leaving 15 articles. The result of the analysis of 57 final articles of this SR determined that 28 articles were about aspects of TTM and 5 stages of change were the most commonly used aspect. Eight articles used TTM in intervention about CDs. A total of 21 articles examined TTM's pros and cons, most of which were about TTM's pros. **Conclusions:** The majority of studies focused on the effectiveness of TTM on the behavioral change management. This finding supported the hypothesis that TTM can be applied in the prevention of CDs.

Keywords: *Health behavior, review, theoretical model*

Introduction

Industrialization of societies and an increasingly mechanical lifestyle has led to increased prevalence of chronic diseases (CDs) such as obesity, heart diseases, osteoporosis, and chronic back pain.[1] The increasing prevalence of CDs has serious health implications for individuals especially nurses and may also impact general health and workforce participation.[2] Studies show that obesity in nurses will lead to various problems such as lower back pain, heart diseases, and reduced on-duty times.[3] In prevention of CDs, the main focus is on education and lifestyle improvements. One of the methods of improving lifestyle is changing behavioral patterns.[4,5]

Transtheoretical model (TTM) of behavioral change is one of the behavioral change models which states that changing a behavior is not a coincidence but instead is a process and different people are in different stages of change (SC) and readiness. In this process, people pass through five stages: precontemplation, contemplation, preparation, action, and maintenance.[6]

In this pattern, it is possible to return to a previous level as well. There are three factors controlling the transfer between different stages and the time necessary for change which include the following: process of change (PC), decisional balance (DB), and self-efficiency (SE).[7] Due to its cost and time-effective nature, TTM has been used in prevention interventions for chronic conditions such as diabetes and various forms of cancers. The results of these studies show the effectiveness of TTM in this regard.[8]

Due to the importance of this topic, this study focused on use of TTM especially in the context of healthcare with emphasis on the impacts of TTM on information-seeking behaviors of patients with CDs. The current systematic review (SR) was conducted to present a comprehensive and complete review of the studies for the following research objectives: Which studies have used different aspects of TTM? Why studies have used TTM to improve health

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behaviors in CDs? What are the pros and cons of TTM in the studies?

Materials and Methods

To start, a literature review coordination session was conducted in May 2015 for the research team to determine the inclusion criteria. The following core national and international databases were searched: Magiran, SID, Scopus, PubMed, and ISI-WOS. Two Persian core databases are the most widely used and reliable Persian databases. There are a lot of interdisciplinary articles in the field of medical sciences in Scopus, PubMed, and ISI-WOS; therefore, they were chosen based on inclusion criteria and their ability to adequately respond to the research team. There was also an overlap between articles of different databases.

The search was carried out with the following search strategies: "Stages of change model" in title, abstract, keywords, subject, or mesh, "Stages of change model" AND "pros OR cons" in title, abstract, keywords, "Trans theoretical model" OR "Stages of change model" AND "chronic diseases" in title, abstract, keywords, subject, or mesh.

All English language articles published between 2009 and 2015 were included if they met the following eligibility criteria: (a) using different aspects of TTM, (b) using TTM in CDs, (c) examining pros and cons of TTM, and (d) being written in English or Persian languages. These articles were screened by title and abstract content for inclusion by AR and MH. The references of the included articles were hand-searched for other eligible articles. Following this comprehensive process, the included articles were distributed for review among all the authors according to their expertise and experience.

All articles were reviewed by AR, MH, and all of coauthors. The authors used a data extraction template [Table 1] based on previous studies of SR team leader (AR).[9] The template kept the extracted information consistent: study types, subject area, results, goals, methods, outputs, society, dimension of data quality, and critical thinking about research. Three consensus meetings were arranged among AR, MH, and each of the coauthors to discuss and achieve final consensus and synthesis of the findings. Table 2 is used as a tool to gather opinions and similarities and differences of reviewers' opinions. Using this method, a total of 57 articles were analyzed.

Ethical consideration

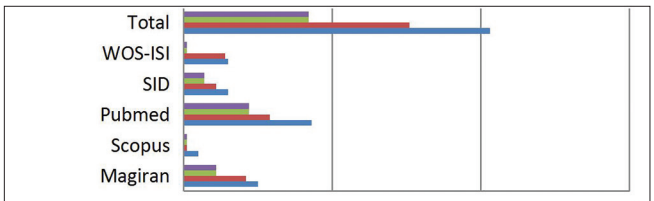
Research ethics confirmation was received from the Ethical Review Board at Isfahan University of Medical Sciences. The approval number of the project is 3995540.

Results

In the first iteration, we identified 103 articles after applying the search strategies, of which 27 were excluded in abstract review because they did not meet inclusion criteria or they were duplicates, leaving 76 articles. After full-text review, 34 articles were excluded which left 42 articles for critical appraisal [Figure 1]. After reviewing references of selected articles in previous round, a total 70 articles were retrieved, of which 50 were excluded in abstract review and 5 in full-text review. Finally, 15 articles were analyzed. Of 57 finalized articles, 28 articles examined different aspects of TTM, 8 articles used TTM in CDs, 21 articles studied pros and cons of TTM, 21 articles were in Persian, and 36 articles were in English [Figure 2].

One article responded to questions a and c at the same time.[8] Articles relevant to first research question were divided based on their subject area in Table 3 which shows various mentioned aspects of TTM such as 5 SC,[4,8,10-27] PC,[28] DB,[29-31] and SE.[32-35] However, the results indicated that the majority of studies focused on 5 SC in both Iran and other countries. Therefore, it can be concluded that the most important achievement of the TTM was the change in five-step behavior.

Table 4a shows the extensive use of TTM in healthcare. These results show that the majority of studies applied TTM specifically for some chronic conditions such as inflammatory bowel disease,[36] type 2 diabetes,[37] cancer,[38] AIDS,[39] breast cancer,[40] osteoporosis,[41] high blood pressure,[42] and anorexia nervosa.[43] The results reported that TTM was used more in healthcare context than treatment and prevention of CDs. In healthcare context,



	Magiran	Scopus	Pubmed	SID	WOS-ISI	Total
final articles	11	1	22	7	1	42
select by full text	11	1	22	7	1	42
select by abstract	21	1	29	11	14	76
select by title	25	5	43	15	15	103

Figure 1: Retrieved articles in searching selected databases in the first iteration

Table 1: Reviewers' critical appraisal template

Row	Author/ title/ reference	Type of research	Society studied	Goals	Methods/ tools	Subject area	Dimensions of data quality studied/the model presentation for evaluation	Results	Critical thinking about research: about quality of tools and method/relevancy

TTM was used to change exercise behaviors,[8,44-49] change the attitude of diet behaviors,[50-54] addiction treatment behaviors,[55-58] air pollution prevention behaviors,[43] and oral health behaviors.[59]

Table 4b also describes some studies focusing on pros and cons of TTM.[8,44-63] The results of these studies show evidence of TTM's success in treatment[54] and prevention of CDs.[59] However, few studies show some weakness of TTM effectiveness in various healthcare context such as quitting smoking,[62] diet intervention in diabetic patients,[60]

Table 2: Summary template to summarize critical appraisal differences between reviewers

Author/ title/year	First research analysis	Second research analysis	Third research analysis

Table 3: The aspects of TTM in various contexts

Aspects	Subject area	Results
SC[1]/DB[2]	Eating behavior	TTM[3] has had positive results for understanding the PC[4] in eating behaviors[29]
SC/SE[5]	Physical activities in housewives	SE and SC play important roles in physical activities[32]
DB	Using vegetable and fruits	DB has increased by going from initial to final SC[31]
SC/DB/SE	Using contraceptives	There was a direct relation between using contraceptives and three factors of sexual behavior[30]
SC	Care methods for elderly	Most of the participants were in the stages of precontemplation, action, and maintenance[10]
SC	Physical activity in adults	People in action and maintenance stages had more positive than negative scores in different dimensions[11]
SC	Sleep in laborers	There is a direct relation between stages of change and sleep quality[12]
PC	Physical activity in college students	TTM is effective for changing the pattern of physical activity[28]
SC	Diet in students	Using vegetables and fruits was in line with SC[13]
SC/SE	Exercise behavior in students	The score for SE and advancement in SC had increases in participants after study[33]
SC	Exercise behavior in female students	Perceived SE, benefits, and use of PC increases by advancing through the SC[14]
SC	Using vegetable and fruit in elderly	Educational intervention showed significant results in using fruit and vegetables[15]
SC	Physical activity in pregnant women	The participants in test group showed positive and significant improvement in physical activities after intervention[16]
SC	Physical activities of operation room nurses	People in final SC had higher scores and perceived benefits[17]
SC	Using dairy products in students	The majority of participants were in the stage of contemplation and a small number were in the stage of precontemplation[18]
SC	Addictive behaviors	The majority of participants were in the stage of contemplation and a small number were in the stage of action[19]
SC	Quitting smoking in pregnant women	The desire for quitting smoking was reduced by advancing through the stages[20]
SE	Dental health in students	The SE score of women was higher than men; the majority of participants brush their teeth twice a day[35]
SC	Protection against the sun	After intervention, the advancement of participants through the stages increased[21]
SC	Physical activities in low-income population	People with better income situations are more likely to advance in the stages[27]
SC/SE/DB	Exercise behavior in nurses and midwives	The smallest number of participants were in the action and the majority were in the contemplation stage[34]
SC	Physical activity in mothers	There is a relation between physical activity and SC[22]
SC	Physical activity in pregnant women	The majority of participants were in the action and very few were in precontemplation stage[23]
SC	Chronic pain in children and teenagers	The parent version of the questionnaire was supported by four factors of precontemplation, contemplation, action, and maintenance, whereas the children version was supported by three factors mixing the scales for action and maintenance[24]
Motivational interview	Physical condition of nurses	SE and physical condition improved in intervention group compared with the control group[4]
SC	Physical activity	The scores of SC, SE, and DB increase in experiment group after intervention[25]
SC	Exercise behavior of students	The effectiveness of patterns in changing exercise behavior was proved[8]
SC	Physical activity in disabled individuals	There is a weak but meaningful relation between barriers of physical activity in disabled individuals and SC[26]

[1]Stages of change, [2]Decisional balance, [3]Transtheoretical model, [4]Process of change, [5]Self-efficiency

and physical activities of youth.[63] Hence, it can be said that this pattern can be implemented in other areas and diseases with successful results.

Discussion

The aim of this study was to conduct an SR on utility of the TTM in health behavioral change. Overall, the result of this study indicated the applicability of TTM for creating strong change in human behavior and increasing SE which can be applied in the prevention of CDs and can also corroborate the extended use of five SC. The results not only confirmed previous results but also lead to new information in this area which are mentioned below.

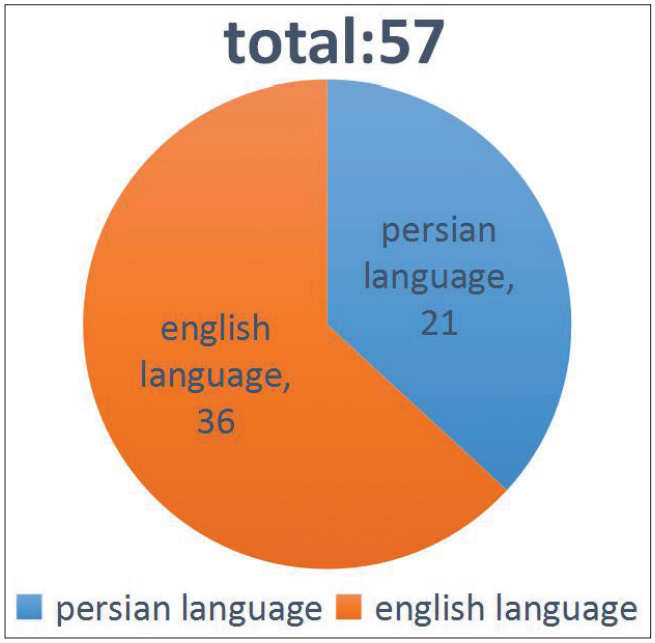


Figure 2: Finalized articles by the language

Applying different aspects of TTM

A large number of retrieved articles have used one of the aspects of TTM including SC, PC, DB, and SE. Noia *et al.* in their SR of selected databases showed the use for different aspects of this model in different subject areas. The results of their study showed that the most common aspect was the five SC.[29] Moattari *et al.* reported an increase in scores of SC, DB, and SE in nursing and midwifery students.[34] The results of this study also confirm the extended use of five SC.

The usage of TTM in CDs

The results of the review showed that only a small number of studies used this model for CDs. Despite this small number, these studies have led to positive and meaningful results. Lower popularity of this model for CDs can be due to unfamiliarity with this model and its use in medicine. Karimzadeh *et al.* in an intervention based on TTM on osteoporosis patients reported improved knowledge about increasing calcium levels and disease prevention.[39] It might be possible that the reason behind the low number of results regarding CDs is the fact that this study does not specifically target use of TTM in CDs.

The mentioned pros and cons of TTM

A small number of studies had led to negative results after using this model. Sanna Salmela *et al*. reported negative results in their SR of studies using TTM in diet studies for diabetic patients.[60] Most retrieved articles reported positive

Table 4a: Use of TTM in changing the behavior of chorionic patients

Disease	Pattern use	Results
IBD[1]	Dividing the samples into experiment and control groups and using educational program for changing behavioral pattern in experiment group	Physical activities of experiment group increased after intervention[36]
Type 2 diabetes	Dividing the samples into intervention and control groups and routine care for intervention group based on TTM and SC	At the end of 47th week, blood sugar of the intervention group improved[37]
Cancer	Using a behavioral change questionnaire in healthy adults to determine the predictors of cancer prevention stages	There is a relation between cancer prevention behavior and SE[38]
HIV	Using behavioral change questionnaire to determine the addiction to antiretroviral drugs in HIV+patients	People in the initial stages had lower dependencies compared with patients in later stages[39]
Breast cancer	Using questionnaire to determine SC in self-examination of breast and dividing the samples into intervention and control groups and conducting educational program for the intervention group	The effectiveness of TTM-based educational program was confirmed[40]
Osteoporosis	Dividing the samples into intervention and control groups and using a questionnaire for calcium intake behavioral changes and TTM-based interviews with intervention group	The intervention was effective in improving the knowledge of intervention group about osteoporosis and calcium intake[41]
Hypertension	Dividing the samples into intervention and control groups and conducting motivational TTM interviews for intervention group	TTM-based motivational interviews are effective in reducing BP[2][42]
Anorexia nervous	Using a checklist of SC, psychotherapy sessions, music therapy, etc.	Checklist can determine the danger of relapse to previous stages; contemplation stage is a positive predictor[43]

[1]Irritated bowl syndrome, [2]Blood pressure

Table 4b: Advantages and disadvantages of TTM

Pros	Cons	Pattern use method	Results
Positive influence of TTM on marijuana, cocaine, and opium addicts	-	An interview created based on five SC	People in precontemplation, contemplation, and preparation are more erratic[55]
Positive influence of TTM on predicting patterns of preventing confrontation with polluted air in pregnant women	-	Using a questionnaire to determine SC, advantages, barriers, and SE	SC, advantages, barriers, and SE are great predictors for prevention of confrontation with polluted air[61]
Positive influence of TTM on exercise behavior of students	-	Using a questionnaire to determine physical activity, SC, SE, and DB	There was a positive and significant relation between TTM patterns and exercise behavior[8]
Positive influence of TTM on improving physical activity and physical strength	-	Dividing the samples into intervention and control groups, using questionnaires and educational sessions	Physical activity and strength of intervention group increased after intervention[44]
-	Lack of effect of TTM on quitting smoking	Using SC questionnaire and educational pamphlets	No evidence of TTM being effective in people in the first three stages was observed[62]
-	Lack of effectiveness of TTM on diet intervention in diabetic patients	SR[1] of Cochran, Sinhal, Medline, Sai Info, and UBase databases	Evidence of effectiveness of TTM on diet intervention of diabetic patients was not observed[60]
Positive influence of TTM in quitting smoking	-	Using SC questionnaire and selecting people in precontemplation, contemplation, and preparation stages	By advancing through the stages, the desire to smoke is reduced[56]
Positive influence of TTM on food fat intake	-	Using TTM questionnaire to determine all factors of the model	Evidence of predictive power and repeatability of TTM was gathered[50]
Positive influence of TTM on using vegetable and fruit in elderly	-	Dividing people into intervention and control groups, using TTM questionnaire and educational sessions	Average usage of vegetables, perceived benefits, and SE was increased[51]
Positive influence of TTM on physical activity	-	Using TTM questionnaire in telephone interviews	TTM patterns are useful for predicting SC[45]
Positive influence of TTM in physical activity of medical students	-	Dividing the samples into intervention and control groups, using TTM questionnaire, training sessions, and pamphlets	The scores of SC, DB, SE, and PC increased[46]
Positive influence of TTM on diet intervention	-	Using TTM questionnaire, dividing people into intervention and control groups, and conducting training sessions	Evidence of mediation role of TTM in diet interventions was provided[52]
Positive influence of TTM on physical activities	-	Using TTM questionnaire	By advancing through SC, the scores of perceived benefits and desire for physical activity increased[47]
Positive influence of TTM on physical activities	-	Using TTM questionnaire	The reasons for moving from precontemplation to contemplation are experience change and behavioral change, the reasons for moving from contemplation to preparation are PC and DB, the reason for moving from preparation to action stage is self-sufficiency; no factor affects moving from action to maintenance[48]
Positive influence of TTM on using vegetables of fruits	-	Using TTM questionnaire in a telephone interview	People were in the final stages of behavioral change processes[53]
Positive influence of TTM on changing smoking behavior	-	Using Iranian version of TTM questionnaire	This questionnaire is a credible tool for quitting smoking in Iranians[57]

Contd...

Table 4b: Contd...

Pros	Cons	Pattern use method	Results
Positive influence of TTM on physical activity behavior	-	SR of Sai Info, Science Direct, Web of Science, Scopus, and Sports Discus databases	Results showed significant effect of TTM on intervention group[49]
Positive influence of TTM on using dental floss in students	-	Using TTM questionnaire	Using dental floss is directly influenced by perceived benefits and SE[59]
Positive influence of TTM on smoking in male students	-	Using TTM questionnaire	People in the precontemplation stage were the least prepared for quitting smoking; the average SE and perceived benefit scores are related to advancement in stages[58]
Positive influence of TTM in behavioral change in eating disorders	-	SR of Google Scholar and Sai Info databases	There is a defined relation between initial SC and treatment results for eating disorders[54]
-	Lack of effectiveness of TTM on physical activities of youth	Using TTM questionnaire and educational sessions	Using TTM pattern was not effective for change in this population[63]

[1]Systematic review

and significant results. Although many studies have been conducted on TTM and its uses, no study had specifically investigated the pros and cons of this model despite the fact that pros can lead to improved behavioral changes, whereas cons can lead to stagnation. Therefore, such studies seem necessary in this field. By knowing the possible cons of this model, it is possible to predict areas where this model is ineffective and knowing, different advantages this model can help determine what aspects of the model are useful in which condition. Restrictions existed on the full access to some databases such as Wiley and Ovid. Therefore, the research team selected the core and comprehensive databases that were used continuously and were readily accessible.

Based on the result of this study, there are insufficient studies in the application of TTM in health context. This study has also determined that few studies have used TTM in the prevention of CDs. The findings showed that TTM was not used at all for the prevention and treatment of obesity in children.

Conclusion

This review provided strong evidences for extended and effective use of TTM for changing health behaviors. According to the results, a large number of studies were about five SC, PC, DB, and SE. The majority of the current studies had investigated the five SC. Expertise behavior and physical activities were the areas in which the model was used most. Therefore, the effectiveness of TTM was proved in numerous studies while a small number of studies had reported some weakness of TTM.

Only a small number of studies had used TTM in CDs, but despite this low number, all these articles had reported positive results. Given the fact that chronic conditions are among important issues in society, it is suggested that this model can be used for areas such as obesity, multiple sclerosis, and problems in groups such as nurses who are in a greater danger of chronic conditions due to their occupation. Investigations showed that very few studies investigate the use of TTM in these areas. Therefore, it is suggested that more studies should be conducted in these subjects.

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Conflicts of interest

Nothing to declare.

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