

## Conceptual Model of Medication Adherence in Older Adults with High Blood Pressure-An Integrative Review of the Literature



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**Abstract: Background:** Medication adherence (MA) is the most important controlling factor of high blood pressure (HBP). There are a few MA models, but they have not been successful in predicting MA completely. Thus, this study aimed to expand a conceptual model of MA based on an ecological approach.

**Methods:** An integrative review of the literature based on theoretical and empirical studies was completed. Data source comprised: Medline (including PubMed and Ovid), ISI, Embase, Google scholar, and internal databases such as Magiran, Google, SID, and internal magazines. Primary English and Persian language studies were collected from 1940 to 2018. The steps of study included: (a) problem identification, (b) literature review and extracting studies, (c) appraising study quality, (d) gathering data, (e) data analysis using the directed content analysis, (f) concluding.

**Results:** Thirty-six articles were finally included and analyzed. After analysis, predictors of MA in older adults with hypertension were categorized into personal, interpersonal, organizational, and social factors. Although the personal factors have the most predictors in sub-categories of behavioral, biological, psychological, knowledge, disease, and medication agents, social, organizational and interpersonal factors can have indirect and important effects on elderly MA.

**Conclusion:** There are many factors influencing MA of elderly with HBP. The personal factor has the most predictors. The designed model of MA because of covering all predictor factors, can be considered as a comprehensive MA model. It is suggested that future studies should select factors for study from all levels of the model.

**Keywords:** Conceptual model, elderly, ecological approach, hypertension, medication adherence, blood pressure.

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### 1. INTRODUCTION

Despite recent advances in prevention, diagnosis and treatment of high blood pressure (HBP), as the silent killer continues with its major health and economic damages [1]. The prevalence of hypertension in older adults has been reported 80% [2].

Medication adherence (MA) can control HBP and its complications more effectively [3] but Medication non-adherence is the most common cause of uncontrolled BP [4]. Despite the critical role of MA in controlling HBP, 30-93% of patients do not take their medication as prescribed [5-7].

Medication non-adherence results in decreased treatment benefits for hypertensive patients, frequent hospital readmissions and physician visits due to deterioration of their medical condition and suffering from its complications such as coronary artery disease, heart failure, or cerebrovascular disease, and increased health costs [8, 9]. Older adults, because of reduced functional abilities, have multiple chronic diseases and polypharmacy that cannot take their medications properly [10]. So they experience more challenges in MA than younger groups [5].

To improve patient MA, using an appropriate theoretical framework was recommended [11]. Until now, different models have been used, but they were not comprehensive, specific, nor completely successful [4]. The existing models predicted that a maximum of 50 percent of variance of MA

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in hypertensive patients could be predicted [12]. However, half of MA behavior has remained unexplained.

An ecological or systematic approach is a comprehensive perspective that has a holistic view of issues [13]. Since MA is multi-factorial and its influential factors are largely consistent with the ecological approach, using the ecological approach as an all-inclusive model; our study framework could cover all possible predictors of MA. It is made from four dimensions of Patient-level factors which comprise characteristics of the individual, Micro-level factors encompass factors related to interpersonal or face-to-face relationships, Meso-level factors refer to the practice patterns or the characteristics of the healthcare organization, and Macro-level factors include the characteristics of the health care system and society [14]. The American Heart Association and American Society of Hypertension recommended using an ecological and multi-level approach in predicting MA [15]. Additionally, the World Health Organization (WHO) has strongly proposed utilizing a holistic approach to improve MA [15]. Considering the importance of MA role in controlling of HBP and the necessity of developing a comprehensive and specific MA model for older adults with HBP, the researcher aimed to design a comprehensive and specific model based on the ecological approach to predict MA in older adults with HBP.

## 2. METHODS

An integrative review of the literature, an approach that analyzes the theoretical and empirical literature, was conducted utilizing the general framework described by Whittemore [16], which described five stages including: identifying problem (MJ, FM), review of the literature (MJ, FM, KN), evaluating and extracting data (MJ, FM), analyzing data (MJ, FM, MF) and concluding (MJ, FM, AE) to extract factors which are associated with or have influenced MA and they were categorized according to dimensions of the ecological model.

### 2.1. Problem

What factors are associated with/influence or predict adherence of anti-hypertensive medication in older adults with HBP?, How are their causal relationship and their influence on MA in older adults with HBP based on ecological approach?

### 2.2. Search Strategy

Databases of Medline (PubMed and Ovid), ISI, Google Scholar, SID, Magiran and internal journals were thoroughly searched by two researchers independently. Moreover, manual searching the reference lists of identified articles were done. The searched terms extracted from the MeSH included: Adherence, Non-adherence, Medication Adherence, Medication Non-adherence, compliance, Medication Persistence, BP, Elderly, Older adults, aging and old, along with keywords of risk factors and predictors. After assessing the titles, abstracts, and keywords, related articles were extracted.

### 2.3. Evaluating and Extracting Data

The primary studies with Persian and English language between 1940 (the starting point for studies in the field of MA [17]) and 2018, with a variety of quantitative and qualitative designs, related to antihypertensive MA and its influential factors in older adults were included in the analysis. Studies with MA in other age groups were excluded. In order to ensure the extraction of all relevant related articles, the screening and selection process of the articles were carried out according to the PRISMA guideline [18] (Fig. 1).

To ensure the quality of the analyzed articles, the studies were assessed independently by two researchers (MJ, FM) using a five-point checklist [19] that has been used in the previous study [20]. The studies were classified into high quality (31 articles), with some limitations (6 articles) and low quality (0 article). Any disagreement on the quality of the articles was resolved by the third author (M.F).

### 2.4. Analyzing Data

Data were analyzed using a directed content analysis. The purpose of the directed content analysis is to validate or develop a theoretical framework (Elo & Kyngäs 2008). In the first stage of analysis, the primary sources were divided into quantitative and qualitative studies and analyzed sequentially. The data collection form included the first author's name, date of study, country, type of study, sample size, sampling method, location of the study, MA ratio and influencing factors. Data analysis was performed according to the method of Elo and Kingas with the following steps: 1- Preparation, 2- Organizing and 3- Presentation. To analyze the data, the findings of the studies were read several times. First, initial codes were identified and were categorized according to the level of similarity at the matrix made according to the ecological levels.

## 3. RESULTS

The 36 studies included in this review varied in methodology and were predominantly quantitative in design including twenty cross-sectional and descriptive, six interventional, eight Cohort and two descriptive qualitative. The studies varied in sample size from minimum 15 up to 207,473. Time of studies was from a few months to eight years, and the MA prevalence ratio was diverse from 20% to 50%. The studies were conducted in different settings including outpatient primary care centers, clinics, hospitals, community and nursing homes.

### 3.1. Conceptual Model of MA in Older Adults with HBP

The conceptual model of MA in older adults with HBP was shown in Fig. (2).

Relationship among the concepts of the MA model.

Regarding the ecological model, environment surrounds and impacts patient and is often a major reason for the success or failure in changing behavior. In our model, based on the ecological model, personal, interpersonal, health care organization and social factors influence the MA directly.

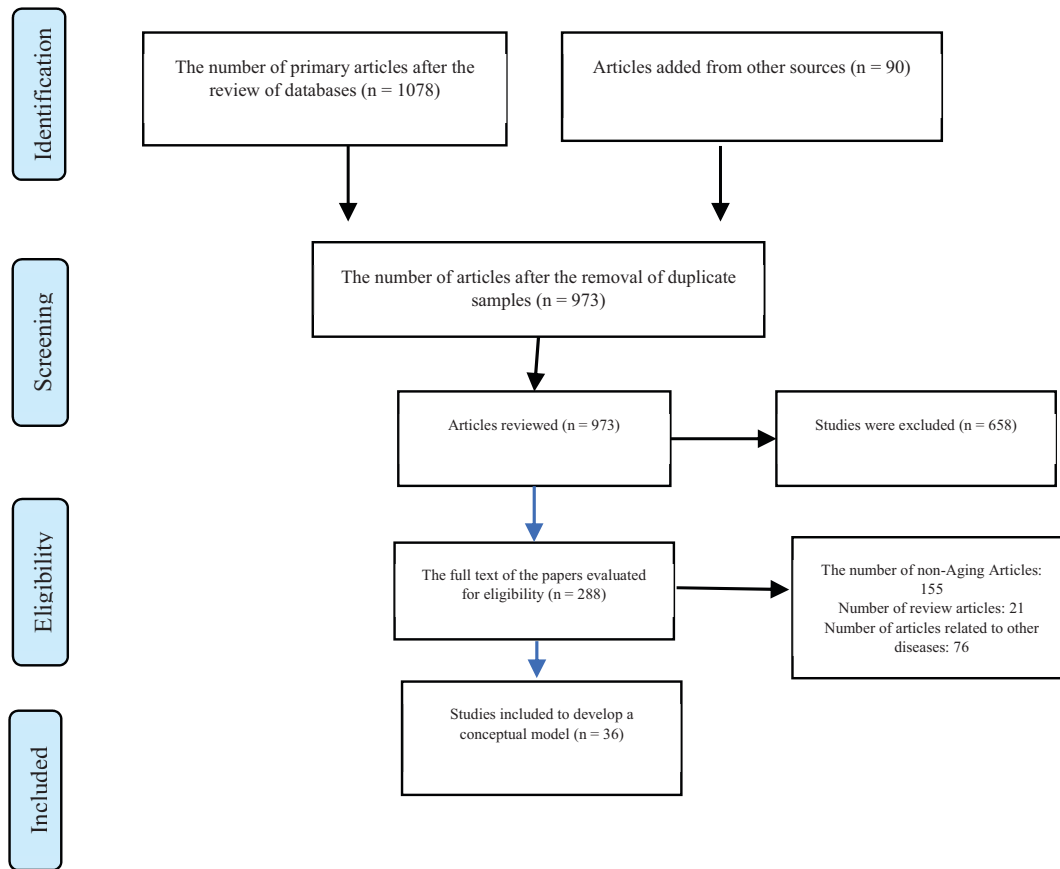


Fig. (1). The process of selecting articles based on PRISMA.

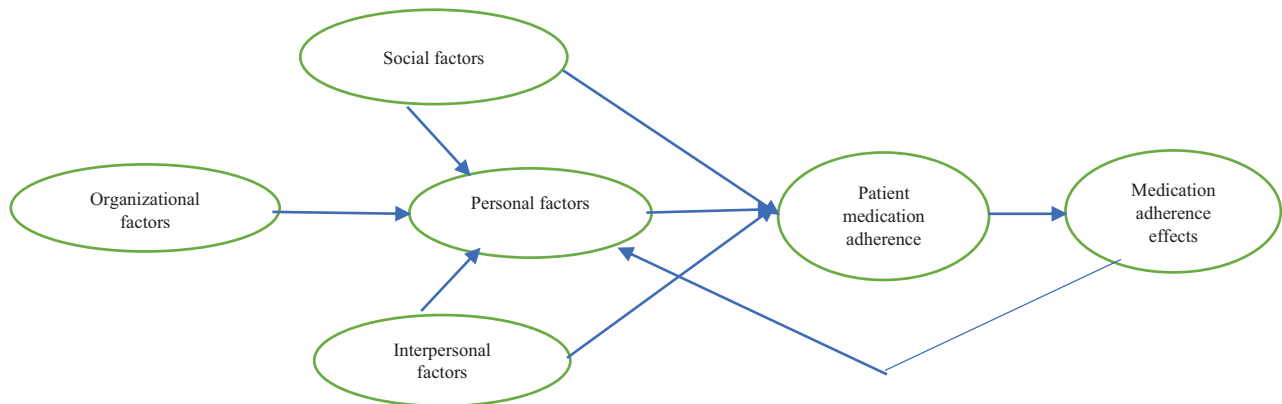


Fig. (2). Conceptual model of MA based on the ecological approach.

Also, environmental factors including interpersonal, health care organization and social factors affect the MA indirectly by influencing the personal factors first. In the following, MA leads to the MA effects, which influence the personal factors as a feedback effect. This relationship among the concepts shows that the model is dynamic. The sub-categories and codes of each concept of the model were explained in Table 1.

### 3.1.1. Patient-level Factors

There were diverse personal predictors, which were classified under the behavioral, biological, psychological, knowledge, disease and drug sub-categories.

**Behavioral characteristics:** The older adults with high self-care behavior, better lifestyle with drug taking habits [21-23], who were checking their BP regularly [24] had higher MA. Event reminders, for example, taking medications using an alarm clock as a reminder medication [12, 25] or time-based reminders like sunset time [26] were other predictors of high MA.

**Biological factors:** There were conflicting results between biological predictors and MA. In most of the studies, ageing was associated with high MA [12, 27-30], but Marcum did not find an association between age and MA [31]. Regarding the gender and body mass index (BMI), controversial findings were reported [27, 28, 30, 32]. In Kim's study,

**Table 1. The concepts of model with their subcategories and codes.**

Category	Sub-category	Codes		
		Factors with Positive Effect to MA	Factors with Negative Effect to MA	Factors with Controversy Effects
<b>Patient-level factors</b>	Behavioral characteristics	Self-care activity [20], better lifestyle [21, 22], habit of drug use [23, 24], drug use skill [24], healthy sexual behavior [25], self-assessment of health [26, 27], applying event reminders [10, 23, 28], time-based and event-based reminders [28], external memories [28]	Irregular follow-up of disease and treatment [29], interfere with routine drug like traveling [23]	-
	Biological	-	-	Age [10, 20, 30–32], gender [33, 34], BMI [30]
	Psychological characteristics	Self-care [10, 20, 26, 28]	Sleep disorder [27], Psychiatric disorders including depression and anxiety [26, 28, 35, 36], depression [25], Negative attitude to the treatment team [20], amnesia [23, 29], stress [25, 28], high mental load [28], stressful life events [37], belief in drug injury [38]	-
	Level of personal knowledge	Knowledge of BP [36], awareness of the importance of preparing early drug prescription [36], Knowledge of medication [26], health literacy [26] [35], disease perception [38, 39], perceived susceptibility [10], Belief in the necessity of medication [38], awareness of the complication and threats of the disease [40]	-	-
	Disease	Controlled BP [22, 24], hospitalization in the last 6 months [27], physical health [41], history of BP in family members [42]	Low BP duration [22], controlled BP [33], cancer [27], history of fall [27], arthritis [43], cardiovascular disease in both genders [44], mental disorders [36], hearing and vision problems [22, 27, 45]	duration of hypertension [10, 29, 46], other diseases [20, 27, 28, 34, 40, 42]
	Medication	number of medication [29, 32, 35, 43], long-time use of medication [10, 20, 28, 34], short-time use of medication [22]	Polypharmacy [47], medication cost [36] interference in medication taking routine [23]	-
<b>Inter personal level factors</b>	Patient-health care provider relationship	Trust, Learning about disease [21, 24, 48], [36, 49, 50], consulting [48], medication Training [24, 48, 51], Satisfaction with health care providers [25, 28], satisfaction with services [24, 33]	-	-
	Patient-family relationship	preparation organizer of medication [47], Internet access [52]	-	-
<b>Organizational level factors</b>	Health care organization characteristics or practice patterns	Implementation of Drug Program [52, 53]	The crowded medical centers and the inadequate visit time [52, 53]	-
	Supervising programs	Monitoring of the quality and quantity of services provided [49], following up of the patient after discharge [86]	-	-
<b>Social level factors</b>	Social factors at individual level	Income [35, 49], living in rural and marginalized areas [33], living in nursing home [33], health related quality of life [49]	Lack of access to pharmacy [23]	Being married [20] [33]
	Community health policies	Coverage of medication by insurance [36, 49], occupation [22], proximity to the health centers and access to a convenient transportation system [49], low cost of health care [25, 49], home visiting [54], community literacy level [33, 37], social support especially for men [25, 28], availability of nursing services in the community for packaging medications [86]	Lack of medication support [55], lack of caregivers and its high cost [52, 53]	-

[Table 1] contd....

Category	Sub-category	Codes		
		Factors with Positive Effect to MA	Factors with Negative Effect to MA	Factors with Controversy Effects
Medication adherence effect	Positive effects	Positive effects on work activities [42], BP control [24], uncomplicated medication [23, 29]	-	-
	Negative effects	-	Side effects [long-term adverse effects [26, 51], drug dependence [40, 51] [38], decreased sexual activity, especially in men [25]	-

older adults with high BMI had significantly higher adherence [32], while it was contrary to Wood's findings [28].

**Psychological factors:** There was a direct association between self-efficacy and MA [12, 33]. Related to the psychological disorders, the older adults with depression and anxiety had low MA than those who were without them [26, 33-35]. Other factors including high mental load caused by the high number of medication [26], forgetfulness [24, 25], stressful life events like wife's death [26, 36, 37] and sleep disturbances were predictors of low MA.

**Knowledge factors:** Cognitive ability and knowledge were other predictors of MA. The older adults with high health literacy [33] and more knowledge of HBP [35] and medication had higher MA. Having awareness and sensitivity to the severity and complication of HTN were other predictors of high MA [12, 38-41].

**Disease factors:** Having a history of hospitalization in the past 6 months [31], high physical health [31, 33], low perceived burden of disease [41, 42], history of HBP in family members [43] and healthy feeling [31] were associated with high MA. Whereas forgetfulness, visual and hearing problems, and activity limitation had a correlation with low MA [31, 44, 45] Disease factors such as duration of hypertension and comorbidity, had inconsistent associations with MA [12, 24, 27, 30, 31, 33, 35, 43, 45-47].

**Medication factors:** Poly-pharmacy, increased number of daily medication doses and complexity of the regimen were associated with low MA [23, 24, 33-35, 39, 41, 46, 48]. But the intake of medicines for a long time was a predictor of high MA [12, 26, 27, 30].

**3.2. Interpersonal Level Factors**

Interpersonal factors had a strong association with MA. This concept contained sub-categories of patient-family relationship and patient-health care provider relationship.

**Patient-health care provider relationship:** Patient trust of the health care providers [26], education about the disease and medication [35, 38, 48-52] were predictors of high MA.

**Patient-family relationship:** Providing medication organizers and distributor boxes or pharmaceutical table by family members, which could clear type and amount of medication were predictors of high MA [43, 53].

**3.3. Organizational Level Factors**

**Healthcare organization characteristics or practice patterns:** Implementation of medication program, and allocating enough time for the patient visit were predictors of high MA. But a high number of patients in the emergency room could cause visits to be rushed, without a complete assessment of patient history like past prescribed medication, which was associated with low MA.

**Supervising patterns:** Organizational control by monitoring the quality and quantity of health services and assessing patients satisfaction at the time of admission, hospitalization, and discharge were predictors of high MA [8, 51, 54]. Improving the quality of care and treatment by having regulatory checks and supervising services to make sure necessary standards at health centers were being met, was a predictor of high MA [8, 51, 54].

**3.4. Social Level Factors**

Community-related factors such as local, state, and national laws and policies related to health such as insurance coverage and regulations on reimbursement for medication could also predict MA. These factors consisted of two sub-categories of Social factors at the individual and community levels.

**Social factors at personal level:** Living alone [43], or in urban areas [32], or in nursing homes [32], having a high salary or retirement wages [34, 51] and better quality of life [51], having doctor visit at home [55] were associated with high MA. Being far away from the pharmacy and health care centers, were predictors of low MA [25]. With regard to marriage, there were controversial results [27, 32].

**Social factors at community level:** Having social support especially for men [26] and higher medication support [56], insurance coverage [35, 51], low cost of health care [37, 51] and the proper transport system in the city for older adults to gain better access to pharmacy [51] were predictors of high MA. Cultural or language barriers that could occur between the patient and the doctor had a negative association with MA [28, 57].

**3.5. Medication Adherence Effect**

After using medication, patients found positive and negative drug-related effects, which could affect to the personal factors as a feedback.

Positive effects: Controlling BP, good quality of life and satisfaction with medication were predictors of high MA by affecting personal factors like making proper patient drug beliefs [23, 24, 34, 46, 51].

Negative effects: Side effects include weakness, increasing stomach acid and upset, hypotension, fall, foot swelling, dry mouth, exacerbation of sexual problems, and diuretic effect in patients after taking anti-hypertensive medication were associated with low MA [23, 24, 34, 46].

#### 4. DISCUSSION

The purpose of this study was to design a comprehensive conceptual model of MA in older adults with HBP using an ecological approach. With an integrated literature review, the predictors of MA were identified, extracted and categorized in line with the ecological model dimension. In the following, concepts of the developed model are discussed and interpreted and the designed model was compared with the existing MA models.

##### 4.1. Patient-level Factors

According to our findings, most of the predictors of MA were categorized at the behavioral, biological, psychological, knowledge, disease and medication levels. These findings are in line with the findings of the study by Yap *et al.* [8], which were classified as personal influential factors of MA under the mental, physical, medical records, habits, attitudes, beliefs and knowledge levels. Berben *et al.* [15] found that, to date, more studies assessed the personal factors, and as a result, more personal predictors were found than other factors. This concept of the model has important clinical implications. In that way, a comprehensive assessment of the predictors of MA at the personal level is provided, which may vary from one patient to another.

##### 4.2. Interpersonal Level Factors

This concept of the model included the relation of health care providers and family members accompanying patients. These findings are consistent with findings from similar previous studies [58-60]. Patients are often affected by different sources of medical information [47] such as health team, families, friends, relatives, and all types of media, which could play a role in educating and increasing knowledge and finally changing their attitudes and adherence behavior [58]. This concept of the model can have a message for health care providers. It is suggested that, by developing confidence in patients, training and consulting them, the health-care providers can increase MA in elderly patients.

##### 4.3. Organizational Level Factors

This concept included characteristics of health centers that were associated with MA among older adults with HBP. Examples of health care organization characteristics or practice patterns are the time available for consultation and interventions implemented in daily clinical practice, that had an important role to enhance MA, which is consistent with the findings of other studies [61-64]. To increase MA of older adults with HBP, existing health centers should plan to have an execution plan for enhancing of MA.

##### 4.4. Social Level Factors

The social factors had both the personal or micro and community level or macro factors. Factors related to each of these categories have been studied in various investigations and their efficacy has been reported on MA [8, 61, 63]. This perception of the conceptual model indicates the complexity of the phenomenon of MA and reflects the factors affecting it at the community level, which could be a warning for national planners and policymakers.

##### 4.5. Medication Adherence Effect

Our findings showed that older adults after taking their anti-hypertensive medication found the positive and negative effect like BP controlling and decreased sexual activity, respectively. This finding consists with Murray MA model, which indicate as only to the positive outcome of MA such as BP control, good quality of life and satisfaction [51].

##### 4.6. Comparing the Designed Model with the Existing Models

A number of theoretical approaches [65] including the Health Belief Model (HBM), Social Cognitive Theory (SCT), Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Protection Motivation Theory (PMT), Theory of Self Care Deficit, the Trans-Theoretical Model, Social Learning Theory, also conceptual MA models designed by Murray [51], Chen and Yen [66], Johnson [67], and Krousel-Wood *et al.* [62] were applied to explain factors influencing behaviors such as MA. While these theories are helpful in understanding the contribution of patient-related factors and community or environment in MA, they generally neglect the effect of health care system- and health care team- related factors on patient behavior, so these models are not comprehensive and special for MA of older adults with HBP.

Study Limitations: One of the limitations of the present study was its linguistic limitation in selecting primary studies, which was limited to English and Persian languages. However, the study also has several strengths, including a specific study design with a systematic review of existing wide quantitative and qualitative evidence that may highlight its high credibility. Covering more databases and comprehensive reviews made it possible to access the majority of related primary studies. The designed model adopted from the ecological approach proposed by Bronfenbrenner, which is a complete approach, makes it possible to consider MA from comprehensive and different aspects. Use of such a special model for older adults with HBP that will guide the selection of factors to be examined, confirm that all vital factors are enclosed, and contribute to building scientific understanding related to the complex phenomena of medication adherence.

#### CONCLUSION

MA is the most important factor in controlling HBP. We found that the existing adherent models were not completely successful in predicting MA. The results of our study showed that MA behavior in older adults with HBP is a complex and multi-faceted phenomenon with personal, in-

terpersonal, organizational, and socio-cultural and political factors. The overarching high-level factors could affect the low-level variables. Due to the comprehensiveness and specificity of our model developed based on the evidence compared to previous models, it is expected that it can guide more elaborated upcoming studies in this area. The researchers propose that interventions aiming to improve patients' adherence should target not only the patient, but also the interpersonal level, the organizational level, and community level as well.

#### CONSENT FOR PUBLICATION

Not applicable.

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#### CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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