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# BMJ Open

## The effects of health behaviors and beliefs based on message framing among chronic disease patients: A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055329
Article Type:	Original research
Date Submitted by the Author:	10-Jul-2021
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Keywords:	EDUCATION & TRAINING (see Medical Education & Training), MEDICAL EDUCATION & TRAINING, DIABETES & ENDOCRINOLOGY

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4 **The effects of health behaviors and beliefs based on message framing among**  
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6 **chronic disease patients: A systematic review**  
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10 **Short running title: Message Framing for Health Behaviors and Beliefs**  
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#### 24 **Acknowledgements**

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27 The authors thank all the reviewers for their assistance and support.  
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#### 30 **Funding**

31  
32 This study was funded by Interdisciplinary Research Funding Program for Doctoral  
33 Postgraduates of Jilin University (No. 101832020DJX090).  
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37 **Competing interests** The authors read and approved the final manuscript and declare  
38 that there was no conflict of interest.  
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41 **Patient consent for publication** Not required.  
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44 **Provenance and peer review** Not commissioned; externally peer reviewed.  
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47 **Data availability statement** All data relevant to the study are included in the article  
48 or uploaded as supplemental information.  
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## The effects of health behaviors and beliefs based on message framing among chronic disease patients: A systematic review

### Abstract

**Objective:** The effectiveness of integrating message framing into educational interventions to promote the health behavior of chronic diseases patients is still being debated in nursing research. The objective of this study is to assess the impact of educational interventions based on gain and loss frames on the health behaviors and beliefs of patients with chronic diseases and identifies the frame that achieves better outcomes.

**Design:** Systematic review was based on PRISMA guidelines for comprehensively searching, appraising and synthesizing research evidence. Data were extracted from PubMed, Web of Science, PsycINFO, and CINAHL databases from their inception until March 26<sup>th</sup> 2021. Intervention studies with adult patients of chronic disease, intervention methods, or contents involved in the implementation of message framing were all considered. Health behaviors or beliefs, such as knowledge, self-efficacy, intention, or attitudes were the outcomes.

**Results:** A total of 11 intervention studies were included. We found that educational intervention based on both gain and loss frames could improve better communication effects, promote healthy behaviors and beliefs with chronic disease patients. Moreover, education messages based on the loss frame might produce the same or even better effects than those based on the gain frame. Thus, behavioral attitude appears to be a promising mediating variable of the influence of frame on behavior and intention.

**Conclusions:** Integrating message framing, particularly loss framing, into health education might be a promising strategy to motivate chronic disease patients to improve their health behaviors and beliefs. More extensive and well-designed trials are needed to support the conclusions and discuss the moderators and mediators of

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4 framing.

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6 **PROSPERO registration number:** CRD42021250931.  
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9 **Key words:** message framing; chronic diseases; nursing; health behavior; health  
10 beliefs; systematic review  
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### 12 13 **Strengths and limitations of this study**

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16 ▶ This systematic review is focusing on the impact of educational interventions  
17 based on gain and loss frames on the health behaviors and beliefs of patients with  
18 chronic diseases.  
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22 ▶ This systematic review is first to identify that education messages based on the loss  
23 frame might produce the same or even better effects than those based on the gain  
24 frame of patients with chronic diseases.  
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29 ▶ In limited number of randomised clinical trials were included, limited the quality  
30 of the evidences.  
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### 36 **INTRODUCTION**

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39 Chronic diseases have become the leading cause of morbidity and mortality  
40 worldwide, accounting for 41 million deaths, more than 70% of all deaths, and 80%  
41 of total disabilities, indicating that this trend will continue to increase. <sup>1 2</sup> More than  
42 300 million people in China were diagnosed with chronic diseases since 2018. <sup>3</sup> The  
43 rising burden of various diseases has increased the medical expenses among people:  
44 just only for diabetes, the medical costs had been reached \$110 billion in China in  
45 2017, ranking second in the world. <sup>4</sup> Hence, the treatment and care of chronic diseases  
46 pose a significant impact on individuals, their families, and societies, as well as a  
47 huge demand to healthcare systems. <sup>5 6</sup>  
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57 Providing health-related information and support to patients can encourage them  
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4 to promote change and maintain their health behavior, improve their psychological  
5 and physiological outcomes,<sup>7</sup> which effectively prevent and reduce complications  
6 associated with chronic diseases, risk of death, and disease burden.<sup>8</sup> At the same time,  
7 it is more cost-effective than improving the social environment and healthcare system.  
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14 Nurses play a critical role in educating patients to improve their health. Nurses  
15 are just as reliable as doctors when it comes to health information, and patients prefer  
16 to get it from nurses because they are more accessible than doctors.<sup>7 11 12</sup> The number  
17 of people getting long-term conditions in need of nursing care is increasing rapidly.  
18 The number of health care professionals, especially registered nurses, is far from  
19 meeting the current and future demand.<sup>13 14</sup> Thus, we need to explore a more effective  
20 way to deliver messages to patients to maximize the effectiveness of health  
21 management education.  
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30 The effectiveness of educational messages in promoting behavior change may  
31 depend on the message presented rather than by the content itself. Message framing is  
32 a message tailoring method that can influence an individual's behavioral decision by  
33 adjusting the presentation of a message without changing the content, thereby  
34 promoting a particular behavior.<sup>15</sup> The most common method is to develop a message  
35 based on a gain (positive) or loss (negative) frame. The benefits of adopting the target  
36 behavior are typically emphasized in gain-framing messages whereas the costs of not  
37 adopting the target behavior are stressed in loss-framing information.<sup>15</sup> The previous  
38 study found that positive frames were better for disease prevention and negative  
39 frames were better for disease detection; however, only small effect sizes were  
40 observed.<sup>16 17</sup>  
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52 Reviewing the past literature, a large number of studies on health-related  
53 behaviors such as smoking,<sup>18</sup> drinking,<sup>19</sup> dental hygiene,<sup>20</sup> breast screenings,<sup>21</sup>  
54 Papanicolaou tests,<sup>22</sup> and vaccinations<sup>23</sup> have emerged in message framing research.  
55 These papers appear mainly in the psychological literature, with only a few appearing  
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4 in the nursing literature.<sup>24</sup> It is worth noting that many studies are involved in the  
5 general population, such as high school or college students,<sup>25 26</sup> rather than  
6 representative samples of people suffering from various diseases or high-risk groups,  
7 such as diabetes and cardiovascular diseases. At the same time, the impact of message  
8 framing on chronic disease education is inconsistent. For example, a gain-framed foot  
9 care message was more effective in changing foot care behavior in the American  
10 diabetes patients.<sup>27</sup> In contrast, the Korean diabetes patients showed loss-framed foot  
11 care message was more effective in activating attitudes and intentions to conduct foot  
12 care.<sup>28</sup>

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22 Nurses have significant opportunities to use message framing to provide health  
23 information. The primary purpose of this study was to review the impact of message  
24 framing educational interventions on the health behaviors and beliefs of chronic  
25 disease patients to introduce an innovative view in delivering health-related  
26 information.

## 27 28 29 30 31 32 **METHODS**

### 33 34 35 **Search strategy**

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37 This systematic review was carried out based on the PRISMA guidelines<sup>29</sup> and  
38 recommendations of the Cochrane Collaboration.<sup>30</sup> There was no need for ethical  
39 approval because the literature analyzed in this study was from previously published  
40 studies. The PROSPERO registration number is CRD42021250931.

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46 We searched for studies published in PubMed, Web of Science, PsycINFO, and  
47 CINAHL from their inception to March 2021. Terms related to message framing and  
48 chronic diseases used in this article were retrieved, including message framing,  
49 information framing, gain-framed, loss-framed, gain fram\*, loss fram\*, positive  
50 fram\*, negative fram\*, framing effect\*, noncommunicable diseases, comorbidity,  
51 multimorbidity, chronic disease, chronic illness, chronic condition, long term  
52 condition, long term illness, cardiovascular disease, hypertension, stroke, diabetes

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4 mellitus, metabolic syndrome, neoplasms, and chronic obstructive pulmonary disease.  
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6 The reference lists of included and relevant publications were manually screened for  
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8 additional articles.  
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### 10 **Study selection**

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12 The inclusion criteria included adult chronic diseases patients ( $\geq 18$  years old),  
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14 intervention methods or contents involved in the application of message framing, and  
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16 intervention studies (randomized controlled trials or quasi-experimental studies)  
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18 published as peer-reviewed full-text articles in the English language. These studies  
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20 had to measure health behavior or beliefs such as knowledge, self-efficacy, intention,  
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22 or attitude. Exclusion criteria included articles from patients with severe mental  
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24 disorders or cognitive impairment.  
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27 The retrieval results were imported into Endnote X 20 for literature management.  
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29 Following the removal of duplicates, two independent researchers first screened the  
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31 title and abstract based on the pre-established inclusion and exclusion criteria. If they  
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33 found any disagreement, it was resolved by a third independent researcher.  
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### 35 **Data extraction and analysis**

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38 Data extraction and entry were performed using a pre-designed data extraction form,  
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40 including first author, year of publication, country, study aims, sample size, gender,  
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42 and age, key contents of intervention, outcome measures, and findings. Two  
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44 independent researchers completed data extraction, and if there was any disagreement  
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46 or uncertainty, it was arbitrated and resolved by a third independent researcher.  
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49 Although our initial goal was to complete a systematic review and meta-analysis,  
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51 quantitative analysis could not carry out due to the large heterogeneity of the  
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53 literature.  
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### 55 **Quality assessment**

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57 Two independent researchers completed the quality assessment of the included  
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4 articles using Review Manager 5.3 software (Nordic Cochrane Center, Copenhagen,  
5 Denmark). If they found any uncertainty or difference in opinion, it was resolved by a  
6 third independent researcher. The Cochrane Collaboration's tool is used for quality  
7 assessment;<sup>31</sup> for quasi-experimental studies, the item of random sequence generation  
8 of selection bias was automatically identified as high risk.<sup>32 33</sup>

### 14 **Patient and public involvement**

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16 Neither patients nor the public were involved in this research.

## 19 **RESULT**

### 22 **Literature search**

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24 After removing duplicate literature and screening the titles and abstracts, a total of  
25 2253 pieces of literature were systematically retrieved, with 42 pieces of literature  
26 were read the full text. A total of 11 studies were included,<sup>27,34-43</sup> ten randomized  
27 controlled trials (RCT), and one quasi-experimental study<sup>35</sup> based on previously  
28 established inclusion and exclusion criteria. Figure 1 illustrates the literature  
29 screening process.

### 37 **Characteristics of the included studies**

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39 The included studies were published between 2004 and 2020; only three are from  
40 Asian countries, including China, Korea, and the Philippines, with the remaining eight  
41 from the United States, United Kingdom, and Canada. The number of participants  
42 ranged from 49 to 1,108, for a total of 2,216, with an average age of 40 to 71, and a  
43 male proportion of 43.7%.

44  
45 Diabetes, cardiovascular disease, and cancer are the most common chronic  
46 diseases addressed in the included literature. Seven studies were set up in two groups,  
47 with one received educational intervention based on gain frame, and the other group  
48 received educational intervention based on loss frame. Only four studies set up three  
49 groups: a gain-framed group, a loss frame group, and a standard control group for

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4 providing usual care, with no message framing.<sup>35 39 40 43</sup> The content of message  
5 intervention primarily focused on healthy behaviors such as physical activity, medical  
6 adherence, and self-management for chronic disease patients. The gain framing  
7 condition highlighted the positive outcomes of completing or adhering to the healthy  
8 behavior, while the loss framing condition emphasized the undesirable consequences  
9 of failing to comply or adhere to the healthy behavior, which corresponded to the  
10 positive framing outcomes. Messages were delivered via video, pamphlet, and online  
11 message. Nine studies only once conducted intervention, and two studies sent the  
12 pamphlet to patients to take home for further reading.<sup>38 43</sup> Table 1 presents specific  
13 information about the included studies.  
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### 23 **Quality assessment of the included studies**

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26 Out of ten RCTs, only two studies described the methods of randomization.<sup>34 39</sup> In the  
27 quasi-experimental study, non-randomized sampling was used; participants were just  
28 assigned to different groups in separate days for a single time, identified as high risk.  
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4 measured in the eleven studies were too diverse to analyze quantitatively. Table 2  
5 shows a summary of findings from the studies included in this review.  
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8 Several studies reported significant main or interactive effects of framing.  
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10 Among the included studies, we found that in chronic disease patients, loss framing  
11 messages have the same or even greater impact on the behaviors and cognitive  
12 variables such as the intention, attitude, and self-efficacy of patients to adopt or  
13 maintain health behaviors than gain framing messages. Five studies showed a main  
14 framing effect on behavior, with two studies reported a loss-framed advantage over  
15 gain-framed alternatives.<sup>37 41</sup> In contrast, two studies found that a gain-framed was  
16 slightly superior to a loss-framed message,<sup>27 43</sup> and one study reported that both gain  
17 and loss-framed messages resulted in more behavior than at baseline, with no  
18 differences between framing conditions.<sup>38</sup>  
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28 Five studies showed a main framing effect on intention. When compared to  
29 control, both gain- and loss-framed messages lead to higher intentions.<sup>40</sup> One study  
30 reported a loss-framed advantage over gain-framed alternatives.<sup>39</sup> Two additional  
31 studies reported that loss frames were not differentially persuasive than gain frames.  
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One study found that loss-framed messages contributed more knowledge gain  
than gain-framed.<sup>42</sup> Another study demonstrated that both loss-framed and  
gain-framed messages contributed to knowledge gain with no difference between the  
two.<sup>35</sup> One study reported that loss-framed messages increased self-efficacy more  
than gain-framed.<sup>41</sup> However, another study found that although both frames  
improved self-efficacy, the average increase of the following intervention in a

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4 gain-framed group was slightly higher than in the loss-framed group.<sup>35</sup> Furthermore,  
5 one study found that the loss-framed group increased perceived efficacy of health  
6 behavior more than the gain-framed group.<sup>39</sup>  
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10 Notably, none of the studies discussed the effect of different message framing on  
11 physiological measures such as blood glucose levels or cardiopulmonary function.  
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### 14 **Moderator and mediator variables of framing effects**

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17 Several studies focused on moderators and mediators of framing effects. In particular,  
18 Park et al. reported that message framing had a significant indirect impact on  
19 intentions for diabetes self-care behavior, mediated through attitudes and perceived  
20 control. However, no significant interaction effects between health literacy and  
21 message framing were found.<sup>34</sup> Grady et al. found that attitude and framing are also  
22 important predictors of behavior.<sup>27</sup> Nevertheless, no mediating effects between HBM  
23 constructs and messages were observed in McCall's study.<sup>43</sup>  
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31 Zhao et al. investigated the interaction between frames and individual time  
32 perspective considering future consequences (CFC), and they found a significant  
33 interaction between the two. Their results showed that, among high-CFC patients,  
34 both gain- and loss-framed messages heightened intention and attitude regarding the  
35 no-message control. The message exposure did not affect the two outcomes, low- and  
36 medium-CFC participants.<sup>40</sup>  
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## 44 **DISCUSSION**

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46 Patients with chronic diseases need to maintain long-term health behaviors to avoid  
47 complications and improve their quality of life. It is necessary to explore the most  
48 effective method of conveying health educational information to patients in order to  
49 minimize the workload of nurses and improve patients' health behaviors. Message  
50 framing provides a new perspective for achieving this goal by presenting information  
51 in different frames without changing the content. However, there has not been  
52 sufficient research on integrating message framing into educational details. Hence, we  
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4 summarized the research on the influence of educational interventions based on  
5 message framing on the cognition and behavior of health behavior patients with  
6 long-term illnesses. In this research, we found that most studies showed that  
7 educational message intervention based on the gain and loss frame could effectively  
8 improve health behaviors and cognitive variables such as knowledge, intention,  
9 attitude, self-efficacy of patients with chronic diseases. Previous studies have  
10 suggested that gain framing is more effective for preventive behavior, but it was not  
11 concluded in this study. We suggest here that loss framing may be as effective as or  
12 even more effective than gain framing in influencing health behavior and cognitive  
13 variables in patients with chronic diseases.  
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24 The persuasion of gain and loss framing appeal seems to be more complicated  
25 than previously thought. Compared with the general population, chronic disease  
26 patients usually have a longer duration of disease, more severe illness, and may have  
27 lower health awareness. The loss framing might be more efficacious if people do not  
28 intend to take action in the foreseeable future and are unaware of the issues related to  
29 their behavior.<sup>44</sup> Besides, individuals weigh the benefits of engaging in healthy  
30 behaviors (such as reducing symptoms and improving mood) against the potential  
31 costs (such as the time and effort spent learning a new skill).<sup>42</sup> Individuals suffering  
32 from chronic diseases, who typically have a long history of illness, may have had a  
33 learning history and outcome expectation (e.g., perceived importance) that may have  
34 resulted in an avoidance tendency toward health behavior. Individuals with a  
35 dominant avoidance tendency typically respond more strongly to threat cues,<sup>45</sup>  
36 making them more receptive to loss-framing encouragement.<sup>46</sup> However, no relevant  
37 variables were assessed in this study; we only proposed a research hypothesis that  
38 requires further investigation.  
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54 Fewer studies have explored the potential mechanism of message frames, which  
55 is of great significance for designing and applying message intervention. These  
56 studies found that attitudes and intentions may act as mediating factors of framing  
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4 effect on behavior, consistent with the theory of planned behavior.<sup>27 34 47</sup> A negative  
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6 frame may allow patients without behavior change awareness to develop attitudes and  
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8 behavioral intentions, thereby promoting behavior. The interaction between message  
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10 frame and individual time perspective also suggests that individual factors must be  
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12 considered.<sup>40</sup> Matching frames with individual factors can have a greater framing  
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14 effect and help to promote the occurrence or maintenance of healthy behaviors. This  
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16 is consistent with the view raised by Latimer et al. that the effectiveness of the  
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18 message frame may be dependent on the individual's thinking and feeling about  
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20 behavior, rather than just the function or nature of the behavior itself. Failing the  
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22 influence of individual differences on message framing effects may suppress the true  
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24 framing effect and underestimate the utility of gain and loss-framed appeals.<sup>48</sup>

### 25 26 **Limitations**

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28 This review offers critical insights into the impact of message-framed education  
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30 on health behaviors of chronic disease patients; however, several limitations have to  
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32 be considered. Although we retrieved a considerable amount of literature from the  
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34 database, only 11 articles met the inclusion criteria used in the present study. In the  
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36 analysis, the diversity of outcome measurements did not permit a quantitative  
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38 analysis, limiting the reliability of the conclusions. Only five studies measured  
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40 changes in actual behavior whereas only six studies just measured changes in  
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42 cognitive variables immediately after the intervention. Of course, we are aware that  
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44 there is still some distance between the initiation of behavioral intention to the  
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46 occurrence and maintenance of actual behavior. At the same time, no physiological  
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48 indicators such as blood glucose or cardiovascular functions were measured in the  
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50 included studies. Hence, future research needs to determine the effects of message  
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52 framing on actual behavior and physiological indicators through long-term  
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54 observation or objective measurement. Few studies have been explored the underlying  
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56 mechanisms of the influence of message framing on behavioral or cognitive variables.  
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58 However, in general, the included studies have relatively high bias risk and low  
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4 methodological quality, limiting the reliability of the results. Besides, among the 11  
5 articles included here, only three are from Asian countries; thus, further research is  
6 needed to explore if there are regional or cultural limitations on the feasibility and  
7 suitability of educational interventions based on the gain and loss-frame for health  
8 behaviors of chronic disease patients. Therefore, with these limitations of the present  
9 review, interpretation of the results should be made with caution.  
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### 15 16 **Implications for nursing**

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18 One of the primary goals of this research is to provide suggestions for nurses and  
19 other healthcare professionals, extend the message framing effect to chronic disease  
20 education interventions and improve patients' health, well-being, and quality of life.  
21 This study suggests that loss frame prevention messages may be more effective than a  
22 gain frame in promoting health behaviors and beliefs in patients with chronic  
23 diseases. The present findings add to the growing evidence that the way health  
24 education messages are delivered has an impact on results that are more than the  
25 content of messages. Proper design and delivery of messages can improve the  
26 persuasiveness of education, effectiveness, and efficiency of nursing, enabling chronic  
27 disease patients to adopt and maintain health promotion behaviors. Furthermore, by  
28 empowering patients to be active decision-makers rather than passive nursing  
29 recipients, patients' role in managing health-related issues can be strengthened.  
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### 42 43 **CONCLUSION**

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45 Message framing is an effective strategy for health communication. Besides,  
46 integration of loss framing into health education may be a promising strategy for  
47 motivating patients with chronic disease to improve health behaviors and related  
48 cognitive variables. The best framework for improving the actual health behavior of  
49 chronic disease patients, as well as its potential moderators and mediators, need to be  
50 studied further and strengthened in order to guide health education.  
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### Author contributions

RG and FL performed the conception and design of the study, drafting the article or revising it critically for important intellectual content. RG, HG, FL and YL performed the acquisition of data, or analysis and interpretation of data. MS, LX and TY performed the quality assessment. All authors read and final approval of the version to be submitted.

### Acknowledgements

The authors thank all the reviewers for their assistance and support.

### Funding

This study was funded by Interdisciplinary Research Funding Program for Doctoral Postgraduates of Jilin University (No. 101832020DJX090).

**Competing interests** The authors read and approved the final manuscript and declare that there was no conflict of interest.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** All data relevant to the study are included in the article or uploaded as supplemental information.

### References

1 World Health Organization. Noncommunicable diseases: key fact. 2018. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Accessed 03/09/2020.

2 World Health Organization. Noncommunicable Diseases: Fact sheets on sustainable

1  
2  
3  
4 development goals: health targets. WHO, 2017.  
5 [www.euro.who.int/\\_data/assets/pdf\\_file/0007/350278/Fact-sheet-SDG-NCD-FINAL](http://www.euro.who.int/_data/assets/pdf_file/0007/350278/Fact-sheet-SDG-NCD-FINAL-25-10-17)  
6 [-25-10-17](http://www.euro.who.int/_data/assets/pdf_file/0007/350278/Fact-sheet-SDG-NCD-FINAL-25-10-17).  
7  
8  
9

10 3 Yiengprugsawan VS, Browning CJ. Non-communicable diseases and cognitive  
11 impairment: Pathways and shared behavioral risk factors among older Chinese. *Front*  
12 *Public Health*. 2019;7:296.  
13  
14  
15

16 4 American Diabetes Association Economic costs of diabetes in the US In 2017.  
17 *Diabetes Care*. 2018;41(5):917–28.  
18  
19  
20

21 5 Roser M, Ritchie H. Burden of disease. *Our World in Data*. 2016.  
22 <https://ourworldindata.org/burden-of-disease>. Accessed 03/09/2020.  
23  
24  
25

26 6 Dennis SM, Zwar N, Griffiths R, et al. Chronic disease management in primary  
27 care: from evidence to policy. *Med J Aust* 2008; 188(S8):S53-6.  
28  
29  
30

31 7 Koutsopoulou S, Papathanassoglou ED, Katapodi MC, et al. A critical review of the  
32 evidence for nurses as information providers to cancer patients. *J Clin Nurs*.  
33 2010;19(5-6):749-65.  
34  
35  
36

37 8 American Diabetes Association. Introduction: standards of medical care in  
38 diabetes-2018. *Diabetes Care*. 2018;41(S1):S1–2.  
39  
40  
41

42 9 World Health Organization, 2005. *Preventing Chronic Diseases: A Vital*  
43 *Investment*. World Health Organization, Geneva.  
44  
45

46 10 McGinnis JM, Williams-Russo P, Knickman JR. The case for more active policy  
47 attention to health promotion. *Health Aff*. 2002;21(2):78-93.  
48  
49  
50

51 11 Jones LW, Sinclair RC, Courneya KS. The effects of source credibility and  
52 message framing on exercise intentions, behaviors, and attitudes: an integration of the  
53 elaboration likelihood model and prospect theory. *Journal of Applied Social*  
54 *Psychology*. 2003;33(1):179–196.  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 12 Collins S. Explanations in consultations: the combined effectiveness of doctors'  
5 and nurses' communication with patients. *Med Educ.* 2005;39(8):785-96  
6  
7

8 13 Coster S, Norman I. Cochrane reviews of educational and self-management  
9 interventions to guide nursing practice: a review. *Int J Nurs Stud.* 2009;46(4):508-28.  
10  
11

12 14 American Association of Colleges of Nursing. Nursing shortage fact sheet. 2008.

13  
14 Accessed March 1, 2009 at

15  
16 <http://www.aacn.nche.edu/Media/FactSheets/NursingShortage.htm>.  
17  
18

19 15 Rothman AJ, Salovey P. Shaping perceptions to motivate healthy behavior: the  
20 role of message framing. *Psychol Bull.* 1997;121(1):3-19  
21  
22

23 16 O'Keefe DJ, Jensen JD. The Advantages of Compliance or the Disadvantages of  
24 Noncompliance? A Meta-Analytic Review of the Relative Persuasive Effectiveness of  
25 Gain-Framed and Loss-Framed Messages. *Annals of the International*  
26 *Communication Association.* 2006;30:1, 1-43.  
27  
28  
29

30 17 O'Keefe DJ, Jensen JD. The Relative Persuasiveness of Gain-Framed Loss-Framed  
31 Messages for Encouraging Disease Prevention Behaviors: A Meta-Analytic Review. *J*  
32 *Health Commun.* 2007;12(7):623-44.  
33  
34  
35  
36  
37

38 18 Kim HK, Lee TK. Conditional Effects of Gain-Loss-Framed Narratives among  
39 Current Smokers at Different Stages of Change. *J Health Commun.*  
40 2017;22(12):990-998.  
41  
42  
43  
44

45 19 Churchill S, Pavey L, Jessop D, et al. Persuading People to Drink Less Alcohol:  
46 The Role of Message Framing, Temporal Focus and Autonomy. *Alcohol Alcohol.*  
47 2016;51(6):727-733.  
48  
49  
50

51 20 Gert-Jan de Bruijn. To frame or not to frame? Effects of message framing and risk  
52 priming on mouth rinse use and intention in an adult population-based sample. *J*  
53 *Behav Med.* 2019;42(2):300-314.  
54  
55  
56

57 21 Consedine NS, Horton D, Magai C, et al. Breast screening in response to gain,  
58  
59  
60

18

1  
2  
3  
4 loss, and empowerment framed messages among diverse, low-income women. *J*  
5 *Health Care Poor Underserved*. 2007;18(3):550-66.  
6  
7

8  
9 22 Lauver D, Rubin M. Message framing, dispositional optimism, and follow-up for  
10 abnormal Papanicolaou tests. *Res Nurs Health*. 1990;13(3):199-207.  
11

12  
13 23 Kasting ML, Head KJ, Cox D, et al. The effects of message framing and healthcare  
14 provider recommendation on adult hepatitis B vaccination: A randomized controlled  
15 trial. *Prev Med*. 2019;127:105798.  
16  
17

18  
19 24 Myers RE. Promoting healthy behaviors: how do we get the message across? *Int J*  
20 *Nurs Stud*. 2010;47(4):500-12.  
21  
22

23  
24 25 Robbins R, Niederdeppe J. Testing the Role of Narrative and Gain-Loss Framing  
25 in Messages to Promote Sleep Hygiene among High School Students. *J Health*  
26 *Commun*. 2019;24(1):84-93.  
27  
28

29  
30 26 Bernstein MH, Wood MD, Erickson LR. The Effectiveness of Message Framing  
31 and Temporal Context on College Student Alcohol Use and Problems: A Selective  
32 E-Mail Intervention. *Alcohol Alcohol*. 2016;51(1):106-16.  
33  
34

35  
36 27 Grady JL, Entin EB, Entin EE, et al. Using message framing to achieve long-term  
37 behavioral changes in persons with diabetes. *Appl Nurs Res*. 2011;24(1):22-8.  
38  
39

40  
41 28 Lee BJ, Gu MO. Comparison of the effects between positive message and negative  
42 message in diabetes mellitus education. *Korean Diabetes J*. 2009;33:344-52.  
43  
44

45  
46 29 Moher D, Liberati A, Teztlaff J, et al. Preferred reporting items for systematic  
47 reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*.  
48 2009;151(4):264-9.  
49  
50

51  
52 30 Higgins PT, Green S. *Cochrane handbook for systematic reviews of interventions*.  
53 Version 5.1.0 [updated March 2011]. The Cochrane Collaboration. Available at:  
54 <http://www.cochrane-handbook.org>  
55  
56  
57

1  
2  
3  
4 31 Higgins JP, Altman DG, Gøtzsche PC, et al. The Cochrane Collaboration's tool for  
5 assessing risk of bias in randomised trials. *BMJ*. 2011;343:d5928.  
6  
7

8 32 Ryan R, Hill S, Prictor M, et al. Study Quality Guide. 2013. Available from:  
9 <http://cccr.org/cochrane.org/author-resources>.  
10  
11

12 33 Cunningham AT, Crittendon DR, White N, et al. The effect of diabetes  
13 self-management education on HbA1c and quality of life in African-Americans: a  
14 systematic review and meta-analysis. *BMC Health Serv Res*. 2018;18(1):367.  
15  
16  
17

18 34 Park J, Kim SH, Kim JG. Effects of message framing and health literacy on  
19 intention to perform diabetes self-care: A randomized controlled trial. *Diabetes Res*  
20 *Clin Pract*. 2020;161:108043.  
21  
22  
23

24 35 Paragas ED Jr, Barcelo TI. Effects of message-framed informational videos on  
25 diabetes management knowledge and self-efficacy. *Int J Nurs Pract*.  
26 2019;25(4):e12737  
27  
28  
29  
30

31 36 Keyworth C, Nelson PA, Bundy C, et al. Does message framing affect changes in  
32 behavioral intentions in people with psoriasis? A randomized exploratory study  
33 examining health risk communication. *Psychol Health Med*. 2018;23(7):763-778.  
34  
35  
36  
37

38 37 Li KK, Ng L, Cheng ST, et al. Reverse Message-Framing Effects on  
39 Accelerometer-Assessed Physical Activity Among Older Outpatients With Type 2  
40 Diabetes. *J Sport Exerc Psychol*. 2017;39(3):222-227.  
41  
42  
43  
44

45 38 Hirschey R, Lipkus I, Jones L, et al. Message Framing and Physical Activity  
46 Promotion in Colorectal Cancer Survivors. *Oncol Nurs Forum*. 2016;43(6):697-705.  
47  
48  
49

50 39 Bassett-Gunter RL, Martin Ginis KA, Latimer-Cheung AE. Do You Want the  
51 Good News or the Bad News? Gain- Versus Loss-Framed Messages Following  
52 Health Risk Information: The Effects on Leisure Time Physical Activity Beliefs and  
53 Cognitions. *Health Psychol*. 2013;32(12):1188-98.  
54  
55  
56  
57

58 40 Zhao X, Villagran MM, Kreps GL, et al. Gain Versus Loss Framing in  
59  
60

1  
2  
3  
4 Adherence-Promoting Communication Targeting Patients With Chronic Diseases:  
5 The Moderating Effect of Individual Time Perspective. *Health Commun.*  
6 2012;27(1):75-85.  
7  
8

9  
10 41 Trupp RJ, Corwin EJ, Ahijevych KL, et al. The Impact of Educational Message  
11 Framing on Adherence to Continuous Positive Airway Pressure Therapy. *Behav Sleep*  
12 *Med.* 2011;9(1):38-52.  
13  
14

15  
16 42 Janke EA, Spring B, Weaver F. The effect of message framing on  
17 self-management of chronic pain: A new perspective on intervention? *Psychol Health.*  
18 2011;26(7):931-47.  
19  
20

21  
22 43 McCall LA, Martin Ginis KA. The Effects of Message Framing on Exercise  
23 Adherence and Health Beliefs Among Patients in a Cardiac Rehabilitation Program.  
24 *Journal of Applied Biobehavioral Research*, 2004;9(2):122-135.  
25  
26

27  
28 44 Prochaska JO, Redding CA, Evers KE. The transtheoretical model and stages of  
29 change. In: *Heal. Behav. Heal. Educ. Theory, Res. Pract.* 4th ed., San Francisco, CA,  
30 US: Jossey-Bass; 2008, p. 97-121.  
31  
32

33  
34 45 Carver CS, Sutton SK, Scheier MF. Action, emotion, and personality: Emerging  
35 conceptual integration. *Personality and Social Psychology Bulletin.* 2000;26(6): 741–  
36 751.  
37  
38

39  
40 46 Mann T, Sherman D, Updegraff J. Dispositional motivations and message framing:  
41 A test of the congruency hypothesis in college students. *Health Psychol.*  
42 2004;23(3):330-4.  
43  
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45  
46 47 Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*  
47 1991;50:179–211.  
48  
49

50  
51 48 Latimer AE, Brawley LR, Bassett RL. A systematic review of three approaches for  
52 constructing physical activity messages: What messages work and what  
53 improvements are needed? *Int J Behav Nutr Phys Act.* 2010;7:36.  
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**Table 1 Characteristics of studies included in this systematic review.**

Authors	Year	Country	Design	Population	Group	Sample Size (M/F) Age (years)	Key component of intervention			
							Content	Format	Frame	Dose
Park <sup>34</sup>	2020	Korea	RCT	Diabetes	Gain- frame	26 (10/16) 65.65±10.61	Content pertaining to diabetic complications in diabetes.	Video	Gain framing presented positive outcomes resulting from adherence to a diabetes care regimen, showing a patient success story about proper diabetes self-care.	1
					Loss- frame	26 (6/20) 64.92±12.21			Loss framing presented undesirable consequences resulting from failure to comply with a diabetes care regimen, showing a story about a patient with diabetic complications caused by inadequate diabetes self-care.	
Paragas <sup>35</sup>	2019	Philippines	Quasi-experimental study	Diabetes	Gain- frame	55 (25/30) 58.95±10.25	Videos including the definition of diabetes and health teachings about blood glucose monitoring; proper diet and exercise; oral hypoglycemic agents; and recognition, treatment, and prevention of hypoglycemia and hyperglycemia.	Video	Gain-framed video comprised the 10 positive outcomes of adherence to diabetes self-care in the last scenes of the videos, e.g. one statement was “If you maintain good control of your blood glucose, the acid in your blood will be normal, and being comatose will be prevented,” with a scene showing a healthy person.	1
					Loss- frame	55 (25/30) 58.60±10.23			Loss-framed video contained the 10 negative outcomes of non-adherence in the last scenes of the videos, e. g. one version was “If you do not maintain good control of your blood glucose, the acid in your blood will be elevated that could lead to being comatose,” with a	

							scene showing a comatose patient.	
			No-frame	55 (24/31) 58.96±9.74		Lecture	Standard approach of providing health teachings about diabetes self-care, with no message framing.	
Keyworth <sup>36</sup> 2018 UK	RCT	Psoriasis	Gain-frame	217 (75/126) 41.23±14.31	Information about the effects of health behavior change on either psoriasis symptoms or CVD risk.	Sheet	Gain-framed message addressed the positive outcomes for adherence to the health behaviors, e. g. “Research shows that risk factors for cardiovascular disease include smoking, having a poor diet, having insufficient physical activity, and drinking excessive amounts of alcohol. By making changes to your lifestyle, you [lower] your risk of cardiovascular disease.”	1
			Loss-frame				Loss-framed message addressed the negative outcomes for not adherence to the health behaviors, e. g. “Research shows that risk factors for cardiovascular disease include smoking, having a poor diet, having insufficient physical activity, and drinking excessive amounts of alcohol. By [not] making changes to your lifestyle, you [increase] your risk of cardiovascular disease.”	
Li <sup>37</sup> 2017 China	RCT	Diabetes	Gain-frame	211 (101/110) 71.41±6.80	The pamphlet included a brief description of PA participation in Hong Kong, the recommended PA level.	Pamphlet	Gain-framed pamphlet contained the benefits of PA participation, including physical (11 items: e.g., improve muscle strength), psychological (8 items: e.g., improve mood), and social (4 items: expand social network) domains.	1
			Loss-frame				Loss-framed pamphlet contained the absence of benefits of PA participation. The contents of the benefits were identical between the	

			frame				gain- and loss-framed messages, with differences only in the framing of the messages.	
Hirschey <sup>38</sup> 2016 USA	RCT	CRC	Gain- frame	78 (36/42) 64.3 (29.9–98.4)	Tips on how to become more physically active with examples of activities of MIPA; description of other diseases for which CRC cancer survivors are at increased risk and the protective influence of PA on these co-morbid conditions; description inverse relationship between PA and risk of cancer-specific mortality and all-cause mortality; a summary of benefits of being or disadvantages of not being physically active.	Pamphlet	Gain-framed version addresses the benefits of being physically active.	Pamphlet could be taken to home to read.
			Loss- frame	70 (35/35) 65.4 (43.2–88.5)			Loss-framed version addresses the disadvantages of not being physically active.	
Bassett <sup>39</sup> 2013 Canada	RCT	SCI	Gain- frame	94 (57/37)	Six messages contained information about benefits (showed in gain framed messages) or risks (showed in loss framed messages);	Online messages	Gain-framed messages outlined the benefits of engaging in regular LTPA (i.e. Adding LTPA to your day can help you manage your pain gain framed)	1
			Loss- frame	45±12			Loss-framed messages outlined the risks of not engaging in regular	

			frame		quotations from SCI experts and patients; summary statements about research evidence regarding LTPA.		LTPA. (i.e., By not adding LTPA to your day you miss an opportunity to manage your pain)	
			No-frame		Usual care		The control group did not receive any additional information.	
Zhao <sup>40</sup> 2012 USA	RCT	Chronic diseases	Gain-frame	1108 (411/697) 40-85	Messages addressing perceived need and perceived concerns about medications, messages content was held the same across the two frames.	Online plain text message	Gain-framed messages outlined the benefits of adherence to medication taking (i.e. You may wonder whether you really need your prescription medication. But taking your medicine as directed is very important even if you don't feel sick. It's the first step toward long-term health. Talk to your doctor about your medicine and changes you can make to your lifestyle to help manage your condition.)	1
			Loss-frame				Loss-framed messages outlined the negative outcomes of not adherence to medication taking. (i.e., You may wonder whether you really need your prescription medication. But not taking your medicine is very dangerous to your health, even when you don't have symptoms. Your condition can get worse. If you don't talk to your doctor about your medicine or other lifestyle questions, you can miss out on information that can help your condition.)	
			No-frame			Usual care	NR	

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2011			frame	(64 /91)	approximately 10 minutes in length and addressed topics about foot care such as cleaning procedures, toenail care, footwear use, and foot and footwear inspection procedures.		serious complications of nerve and blood vessel damage, and keep your feet healthy” (with a picture of healthy feet).	
USA			Loss-frame	61.2±11.4			Loss-framed version offered the negative outcome that can accrue if the desired behavior is not followed, e.g. “Poor foot care can lead to the serious complications of nerve and blood vessel damage, and unhealthy feet” (with a picture of a foot with an infected sore).	
McCall <sup>43</sup>	RCT	Post CABG surgery patients	Gain-frame	16 (15/1)	Statements regarding the effects of exercise in relation to CAD.	Sheet	Gain-framed condition listed 10 gain-framed statements regarding the benefits of exercise in relation to the progression of CAD. (i.e., Regular exercise will help you maintain a healthy body weight.)	Sheet could be taken to home to read.
2004			Loss-frame	13 (12/1)			Loss-framed condition with the same 10 statements phrased in a loss-framed manner. (i.e., By not exercising regularly, you decrease your chances of keeping a healthy body weight.)	
Canada			No-frame	20 (19/1)	Usual care	NR	The control group did not receive any additional information.	

Abbreviations: CABG: Coronary artery bypass graft; CAD: Coronary artery diseases; CRC: Colorectal cancer; CVD: Cardiovascular disease; LTPA: Leisure time physical activity; MIPA: Moderate intensity physical activity; NR: Not report; OSA: Obstructive sleep apnea; PA: Physical activity; RCT: Randomized controlled trial; SCI: Spinal cord injury; T2D: Type 2 diabetes.

**Table 2 Summary of findings of studies included in this systematic review.**

Authors Year	Outcome measures and collection time	Main findings	Mediators/Moderators
Park <sup>34</sup> 2020	Attitudes, perceived control and intentions for diabetes self-care behavior. All measured at post-intervention.	Attitudes: Loss-framed group improved more; Perceived control: Loss-framed group improved more; Intentions: Both conditions produced significant increases, but no group difference.	Significant indirect effect of message framing on intentions for diabetes self-care behavior mediated through attitudes and perceived control. No significant interaction effects were observed between health literacy level and message framing.
Paragas <sup>35</sup> 2019	Knowledge, self-efficacy. All measured at pre- and post-intervention.	Knowledge: Both loss-framed and gain framed group improved more, but no difference between the two; Self-efficacy: Both loss- and gain- framed group improved, and gain framed group improved more.	NR
Keyworth <sup>36</sup> 2018	Intention. Measured at post-intervention.	Intention: messages focused on short-term health risk, gain-framed messages were more persuasive than loss-framed messages; messages about long-term health risk a loss-framed message more persuasive than a gain-framed message	A significant frame by focus interaction was found for behavioral intention to reduce alcohol intake.
Li <sup>37</sup> 2017	PA. Measured at pre-intervention and 2-week follow up: PA.	PA: Loss-framed group improved more.	NR



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<p>Hirschev <sup>38</sup>  2016</p>	<p>PA, attitudes, subjective norms, perceived behavioral control, intention.  PA, intention were measured at pre- and post-intervention, 1-and 12-months follow up;  Attitudes, subjective norms and perceived behavioral control measured at pre-intervention and 1-month follow up.</p>	<p>PA: Both conditions produced significant increases in PA, with no differences between framing conditions;  TPB constructs: Neither the gain- nor loss-framed brochures produced significant changes from baseline to the 1- and 12-months follow-up.</p>	<p>NR</p>
<p>Bassett <sup>39</sup>  2013</p>	<p>Response efficacy, intention.  All measured at pre- and post-intervention.</p>	<p>LTPA response efficacy: Loss-framed condition increased more than gain-framed and control conditions, no difference between gain-framed and control conditions;  Intention: Loss-framed condition increased more than gain-framed and control conditions, no difference between gain-framed and control conditions.</p>	<p>NR</p>
<p>Zhao <sup>40</sup>  2012</p>	<p>Intention, attitude.  All measured at post-intervention.</p>	<p>Intention: Gain- and loss-framed messages improved more than control, no difference between gain- and loss-framed conditions;  Attitude: Gain- and loss-framed messages improved more than control, no difference between gain- and loss-framed conditions.</p>	<p>Significant interaction between frames and CFC, among high-CFC patients, both gain- and loss-framed messages heightened intention ad attitude with respect to the no-message control, and the gain frame showed a consistent superior to the loss frame. Message exposure had not effect on the two outcomes for low-and medium-CFC participants.</p>
<p>Trupp <sup>41</sup></p>	<p>Adherence to CPAP, self-efficacy.</p>	<p>CPAP use: Loss-framed group improved more;  Self-efficacy: Both conditions improved, Loss-framed group</p>	<p>NR</p>

2011	CPAP use was measured at post-intervention; Self-efficacy was measured at pre- and post-intervention.	improved more than gain-framed group.	
Janke <sup>42</sup> 2011	Knowledge, pain self-efficacy, pain readiness to change, pain self-management behavioral skills (communicating with providers, relaxation, activity pacing, pleasant activities and healthy lifestyle). Pain self-efficacy, pain readiness to change were measured at pre-intervention; Knowledge, pain self-management behavioral skills were measured at post-intervention.	Knowledge: Loss-framed group improved more; Confidence to practice relaxation: Loss-framed group improved more.	Pain self-efficacy, pain readiness to change and message frame independently influenced motivation to engage in relaxation. There were no observed interactions between message frame and either self-efficacy or readiness to change.
Grady <sup>27</sup> 2011	Knowledge, attitude, foot care behaviors. Knowledge and attitude were measured at pre- and post-intervention, 3- and 6-month follow-ups; Foot care behaviors were measured at pre-intervention, 3- and 6-month follow-ups.	Foot care behaviors: Gain-framed group improved more.	Attitude and framing are significant predictors of 6-months behavior, gain framing positively related to long-term behavior; knowledge affects attitudes, in turn, attitudes affect behavior.
McCall <sup>43</sup> 2004	Adherence to exercise, health belief cognitions (perceived susceptibility, benefits and barriers). Adherence to exercise was measured at 3-months follow-ups; Health belief cognitions were measured at post-intervention.	Adherence to exercise: Gain-framed condition attended more exercise sessions than control; loss-framed group attend more exercise, but no difference with control; Perceived susceptibility: Gain- and loss-framed conditions perceived more susceptibility than control;	HBM constructs did not mediate the effects of the educational messages.

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		Perceived barriers: Loss-framed condition perceived grater barriers than gain-framed and control conditions;  Perceived benefits: No difference among the three conditions.	
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Abbreviations: CFC: Consideration of future consequences; CPAP: Continuous positive airway pressure; HBM: Health belief model; LTPA: Leisure time physical activity; NR: Not report; PA: Physical activity; TPB: Theory of planned behavior.

**Figure legend**

- Figure 1 Flowchart of the literature search
- Figure 2 Risk of bias assessment
- Figure 3 Risk of bias summary

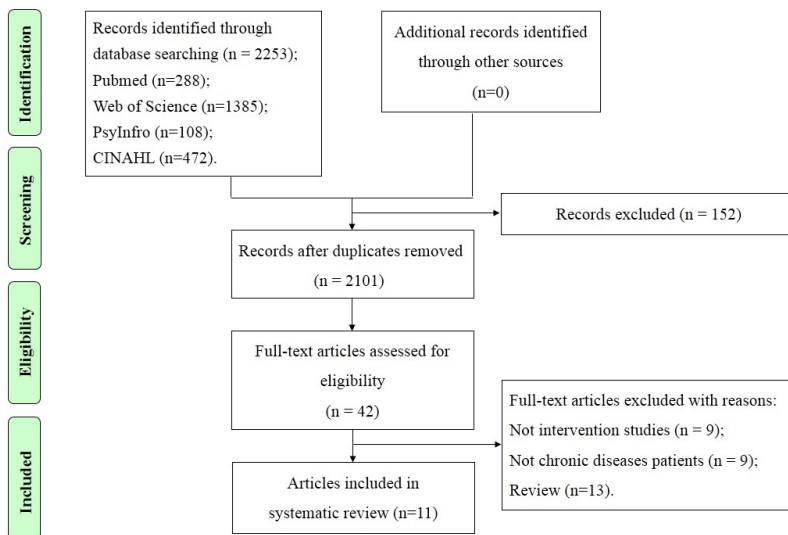


Figure 1 Flowchart of the literature search

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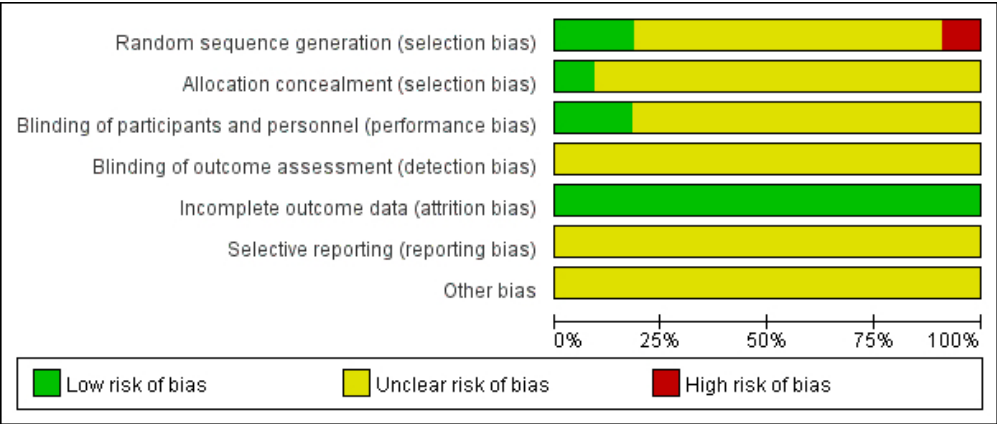


Figure 2 Risk of bias assessment

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	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Bassett 2013	+	?	?	?	+	?	?
Grady 2011	?	?	?	?	+	?	?
Hirschey 2016	?	?	?	?	+	?	?
Janke 2011	?	?	?	?	+	?	?
Keyworth 2018	?	?	?	?	+	?	?
Li 2017	?	?	?	?	+	?	?
McCall 2004	?	?	?	?	+	?	?
Paragas 2019	-	?	+	?	+	?	?
Park 2020	+	+	?	?	+	?	?
Trupp 2011	?	?	+	?	+	?	?
Zhao 2012	?	?	?	?	+	?	?

Figure 3 Risk of bias summary

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# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1,2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	none
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I <sup>2</sup> ) for each meta-analysis.	none



# PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	none
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	none
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	6,7
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	7
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	7,8,9
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	none
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	none
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	9,10,11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	11,12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	13

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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Page 2 of 2

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# BMJ Open

## The effects of health behaviors and beliefs based on message framing among patients with chronic diseases: A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055329.R1
Article Type:	Original research
Date Submitted by the Author:	10-Nov-2021
Complete List of Authors:	Gao, Ruitong; Jilin University, School of Nursing Guo, Hui; Eastern Division of the First Bethune Hospital of Jilin University, Department of endocrinology and metabolism Li, Fei; First Bethune Hospital of Jilin University, Department of endocrinology and metabolism Liu, Yandi; First Bethune Hospital of Jilin University, Department of endocrinology and metabolism Shen, Meidi; Jilin University Xu, Linqi; Jilin University Yu, Tianzhuo; Jilin University Li, Feng; Jilin University, School of Nursing
<b>Primary Subject Heading</b>:	Nursing
Secondary Subject Heading:	Nursing
Keywords:	EDUCATION & TRAINING (see Medical Education & Training), MEDICAL EDUCATION & TRAINING, DIABETES & ENDOCRINOLOGY

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4 **The effects of health behaviors and beliefs based on message framing among**  
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10 **Short running title: Message Framing for Health Behaviors and Beliefs**  
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13 Ruitong GAO<sup>1</sup>, Hui GUO<sup>2</sup>, Fei LI<sup>3</sup>, Yandi LIU<sup>3</sup>, Meidi SHEN<sup>1</sup>, Linqi XU<sup>1</sup>, Tianzhuo  
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### 25 **Acknowledgements**

26  
27 The authors thank all the reviewers for their assistance and support.  
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29

### 30 **Funding**

31  
32 This study was funded by Interdisciplinary Research Funding Program for Doctoral  
33 Postgraduates of Jilin University (No. 101832020DJX090).  
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36  
37 **Competing interests** We declare no competing interests  
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40 **Patient consent for publication** Not required.  
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43 **Provenance and peer review** Not commissioned; externally peer reviewed.  
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46 **Data availability statement** No additional data are available.  
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## The effects of health behaviors and beliefs based on message framing among patients with chronic diseases: A systematic review

### Abstract

**Objective:** The effectiveness of integrating message framing into educational interventions to promote the health behavior of patients with chronic diseases is still being debated in nursing research. The objective of this study is to assess the impact of educational interventions based on gain and loss frames on the health behaviors and beliefs of patients with chronic diseases and identifies the frame that achieves better outcomes.

**Design:** Systematic review was based on PRISMA guidelines for comprehensively searching, appraising, and synthesizing research evidence.

**Data sources:** Data were extracted from PubMed, Web of Science, PsycINFO, and CINAHL databases from their inception until March 26, 2021.

**Eligibility criteria:** Intervention studies with adult patients and chronic disease published in English, and intervention contents involved in the implementation of message framing, were considered. The outcomes were health behaviors or beliefs, such as knowledge, self-efficacy, intention, or attitudes.

**Data extraction and synthesis:** Data extraction and entry were performed using a pre-designed data extraction form and assessed independently by two reviewers using the Cochrane Collaboration Risk of Bias I.

**Results:** A total of 11 intervention studies were included. We found that educational intervention based on both gain and loss frames could enhance the positive effects of communication, promote healthy behaviors and beliefs in patients with chronic disease. Many of the studies we included here showed the advantage of loss framing messages, due to the limited number of articles included and without quantitative analysis, this result should be interpreted cautiously.

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4 **Conclusions:** Integrating message framing into health education might be a promising  
5 strategy to motivate patients with chronic disease to improve their health behaviors  
6 and beliefs. More extensive and well-designed trials are needed to support the  
7 conclusions and discuss the effective framing, moderators and mediators of framing.  
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12 **PROSPERO registration number:** CRD42021250931.  
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14  
15 **Key words:** message framing; chronic diseases; nursing; health behavior; health  
16 beliefs; systematic review  
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### 18 19 **Strengths and limitations of this study** 20

- 21  
22 ▶ This systematic review has extracted evidence from interventional studies, which  
23 had a guiding significance of practice.  
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- 25  
26 ▶ A limited number of randomised clinical trials were included, limiting the quality  
27 of the evidence.  
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- 29  
30 ▶ Heterogeneity of different patient samples and health messages and the diversity of  
31 outcome measurements did not permit quantitative analysis.  
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## INTRODUCTION

Chronic diseases have become the leading cause of morbidity and mortality worldwide, accounting for 41 million deaths, more than 70% of all deaths, and 80% of total disabilities.<sup>1 2</sup> An aging population, lifestyle factors influencing diseases such as high-fat diets and low levels of physical activity indicate that this trend will continue to increase.<sup>3</sup> More than 300 million people in China have been diagnosed with chronic diseases since 2018.<sup>4</sup> The rising burden of various diseases has increased medical expenses; for example, diabetes, a common chronic disease, according to the International Diabetes Federation, diabetes-related direct medical expenditures amounted to approximately \$25 billion in China in 2017.<sup>5</sup> Hence, the treatment and care of chronic diseases pose a significant impact on individuals, their families, and societies, as well as a huge demand to healthcare systems.<sup>6 7</sup>

Providing health-related information and support to patients can encourage them to promote change and maintain their health behavior, improve their psychological and physiological outcomes,<sup>8</sup> which effectively prevent and reduce complications associated with chronic diseases, risk of death, and disease burden.<sup>9</sup> Nurses play a critical role in educating patients about how to improve their health. When it comes to health information, nurses are just as reliable as doctors, and patients prefer to get it from nurses because they are more accessible than doctors.<sup>8 10 11</sup> The number of people developing long-term conditions that in need of nursing care is increasing rapidly.<sup>12</sup> The number of health care professionals, especially registered nurses, is far from meeting the current and future demands.<sup>12 13</sup> Thus, we need to explore a more effective way to deliver messages to patients to maximize the effectiveness of health management education.

The effectiveness of educational messages in promoting behavior change may depend on how the message is presented rather than the meaning of the content itself. Message framing is a message tailoring method that can influence an individual's behavioral decision by adjusting the presentation of a message without changing the



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4 meaning of the content, thereby promoting a particular behavior.<sup>14</sup> The most common  
5 method is to develop a message based on the gain (positive) or loss (negative) frame.  
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7 The benefits of adopting the target behavior are typically emphasized in gain-framing  
8 messages, whereas the costs of not adopting the target behavior are stressed in  
9 loss-framing information.<sup>14</sup> In O’Keefe and Jensen’s reviews, they found that  
10 positive frames were slightly better for disease prevention. However, when they  
11 classified disease prevention behaviors, only a slight advantage of positive framing  
12 was showed in dental hygiene behavior, while there was no difference between the  
13 two frames for other disease prevention behaviors such as diet/nutrition behaviors, or  
14 exercise behaviors.<sup>15 16.</sup>

23  
24 Reviewing the past literature, several studies on health-related behaviors such as  
25 smoking,<sup>17</sup> physical activity,<sup>18</sup> dental hygiene,<sup>19</sup> have emerged in message framing  
26 research. Notably, many studies are examined in messaging framing effect on  
27 health-related behaviors in the general population rather than representative samples  
28 of people suffering from various diseases or high risk groups, such as diabetes and  
29 cardiovascular diseases.<sup>20-22</sup> At the same time, the effects of message framing on  
30 chronic disease education are inconsistent. For example, Grady et al. found that a  
31 gain-framed foot care message was more effective in changing foot care behavior in  
32 patients with diabetes.<sup>23</sup> In contrast, Lee and Gu’s study showed that loss-framed foot  
33 care message was more effective in activating attitudes and intentions to conduct foot  
34 care in patients with diabetes.<sup>24</sup>

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46 There are many opportunities in nursing to provide patient health information in  
47 various settings, ranging from the distribution of written materials to teaching chronic  
48 disease self-management skills.<sup>12</sup> Meanwhile, patients feel more open and free to  
49 communicate with nurses.<sup>11</sup> Thus, nurses have significant opportunities to use  
50 message framing to provide health information. The primary purpose of this study  
51 was to review the impact of message framing educational interventions on the health  
52 behaviors and beliefs of patients with chronic disease, and to inform the design of  
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4 future health information interventions.  
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## 6 **METHODS**

### 7 **Search strategy**

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11 This systematic review was carried out based on the PRISMA guidelines<sup>25</sup> and  
12  
13 recommendations of the Cochrane Collaboration.<sup>26</sup> There was no need for ethical  
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15 approval because the literature analyzed in this study was from previously published  
16  
17 studies. The PROSPERO registration number is CRD42021250931.  
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20 We searched for studies published in PubMed, Web of Science, PsycINFO, and  
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22 CINAHL from their inception to March 26, 2021. Terms related to message framing  
23  
24 and chronic diseases used in this article were retrieved, including message framing,  
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26 information framing, gain-framed, loss-framed, gain fram\*, loss fram\*, positive  
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28 fram\*, negative fram\*, framing effect\*, noncommunicable diseases, comorbidity,  
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30 multimorbidity, chronic disease, chronic illness, chronic condition, long term  
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32 condition, long term illness. The search strategies of each database are available in the  
33  
34 in the Supplementary file 1. The reference lists of included and relevant publications  
35  
36 were manually screened for additional articles.  
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### 38 **Study selection**

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41 The inclusion criteria included adult patients aged 18 years or older with chronic  
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43 diseases (persist and require care over time, such as cardiovascular conditions,  
44  
45 diabetes, and cancer),<sup>27 28</sup> intervention contents involved in the application of  
46  
47 message framing, and intervention studies (randomized controlled trials or  
48  
49 quasi-experimental studies) published as peer-reviewed full-text articles in the  
50  
51 English language. Messages could be delivered in paper or electronic form, and there  
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53 were no restrictions on who had delivered the intervention. These studies measured  
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55 health behavior or beliefs such as knowledge, self-efficacy, intention, or attitude.  
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57 Exclusion criteria included articles from patients with severe mental disorders or  
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59 cognitive impairment.  
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4 The retrieval results were imported into Endnote X 20 for literature management.  
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6 Following the removal of duplicates, two independent researchers (RG, YL) screened  
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8 the title, abstract and full text based on the pre-established inclusion and exclusion  
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10 criteria. If they found any disagreement, it was resolved by a third independent  
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12 researcher (HG).

### 13 14 **Data extraction and analysis**

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16 Data extraction and entry were performed using a pre-designed data extraction form,  
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18 including first author, year of publication, country, sample size, gender, age, key  
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20 contents of intervention, outcome measures, and findings. Two independent  
21  
22 researchers completed data extraction (RG, LX), and if there was any disagreement or  
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24 uncertainty, it was arbitrated and resolved by a third independent researcher (FL).

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27 Although our initial goal was to complete a systematic review and meta-analysis,  
28  
29 quantitative analysis could not carry out due to the large statistical and clinical  
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31 heterogeneity of the literature.

### 32 33 **Quality assessment**

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36 Two independent researchers (RG, MS) completed the quality assessment of the  
37  
38 included articles using Cochrane Collaboration Risk of Bias I.<sup>29</sup> If they found any  
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40 uncertainty or difference in opinion, it was resolved by a third independent researcher  
41  
42 (TY). For quasi-experimental studies without randomization, the item of random  
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44 sequence generation of selection bias was automatically identified as high risk.<sup>30 31</sup>

### 45 46 **Patient and public involvement**

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49 Neither patients nor the public were involved in this research.

## 50 51 **RESULT**

### 52 53 **Literature search**

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56 After removing duplicate literature and screening the titles and abstracts, 2253 pieces

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4 of literature were systematically retrieved, with 42 articles were read the full text. A  
5 total of eleven studies were included, <sup>23 32-41</sup> ten randomized controlled trials (RCT),  
6 and one quasi-experimental study <sup>33</sup> based on previously established inclusion and  
7 exclusion criteria. Figure 1 illustrates the literature screening process.  
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### 11 **Characteristics of the included studies**

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14 The included studies were published between 2004 and 2020 and came from Korea,  
15 Philippines, the United Kingdom, China, the United States and Canada. The number  
16 of participants ranged from 49 to 1,108, for a total of 2,216, with a mean age ranging  
17 from 40 to 71 and a male proportion of 43.7%.  
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23 Diabetes, cardiovascular disease, and cancer are the most common chronic  
24 diseases addressed in the included literature. <sup>23 32 33 35 36 41</sup> Seven studies were set up in  
25 two groups, with one receiving educational intervention based on gain frame, and the  
26 other group receiving educational intervention based on loss frame. <sup>23 32 34-36 39 40</sup> Only  
27 four studies were set up in three groups: a gain-framed group, a loss frame group, and  
28 a standard control group for providing usual care, with no message framing. <sup>33 37 38 41</sup>  
29 The gain framing condition highlighted the positive outcomes of completing or  
30 adhering to the healthy behavior, whereas the loss framing condition emphasized the  
31 undesirable consequences of failing to comply or adhere to the healthy behavior,  
32 which corresponded to the positive framing outcomes. Messages were delivered via  
33 video, pamphlet, and online message. Nine studies only once conducted intervention,  
34 <sup>23 32-35 37-40</sup> and two studies sent the pamphlet to patients to take home for further  
35 reading. <sup>36 41</sup> Supplementary file 2 presents specific information about the included  
36 studies.  
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### 51 **Quality assessment of the included studies**

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53 Regarding selection bias, two RCT described adequate random sequence generation <sup>32</sup>  
54 <sup>37</sup> and other eight RCT reported randomization but did not report a specific method. <sup>23</sup>  
55 <sup>34-36 38-41</sup> One quasi-experimental study, non-randomized sampling was used;  
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4 participants were just assigned to different groups in separate days for a single time,  
5 identified as high risk.<sup>33</sup> Only one studies reported adequate allocation concealment,  
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8<sup>32</sup> and the other ten were rated as having an unclear risk of bias due to insufficient  
9 information.<sup>23 33-41</sup> Only two studies showed a low risk of performance bias.<sup>33 39</sup> The  
10 risk of detection bias was rated as unclear risk as none of the eleven articles indicated  
11 whether the blind method was applied to the outcome assessment.<sup>23 32-41</sup> Regarding  
12 attrition bias, eleven studies were rated as low risk bias.<sup>23 32-41</sup> The report and other  
13 sources bias of the eleven studies were rated as having an unclear risk of bias due to  
14 insufficient information.<sup>23 32-41</sup> Figures 2 and 3 summarize the quality assessment of  
15 the included studies.  
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### 23 **Main effects of framing**

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26 Several studies have reported effects on numerous outcomes. Six studies assessed  
27 outcomes immediately after the intervention,<sup>32-34 37 38 40</sup> and five studies measured  
28 actual behavior from four weeks to 12 months of follow-up.<sup>23 35 36 39 41</sup> The content of  
29 message intervention primarily focused on healthy behaviors such as physical  
30 activity, medical adherence, and self-management for patients with chronic disease.  
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32 However, the outcomes measured in the eleven studies were too diverse to analyze  
33 quantitatively. Supplementary file 3 presents a summary of findings from the studies  
34 included in this review.  
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43 Several studies reported significant main or interactive effects of framing.  
44 Among the included studies, five studies mainly explored the influence of educational  
45 intervention based on message framing on self-management behavior and related  
46 cognitive variables of patients with chronic disease.<sup>23 32-34 40</sup> Three of the five studies  
47 showed the advantage of loss framing messages.<sup>32 33 40</sup> Two studies found that  
48 loss-framed message was superior to gain-framed for improving the scores of  
49 intention, attitude, and knowledge of self-management behavior in patients with  
50 diabetes. However, the increase in intention and knowledge scores did not meet the  
51 criteria for statistical difference.<sup>32 33</sup> One study found that loss-framed messages  
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4 contributed more knowledge gain than gain-framed patients with chronic pain.<sup>40</sup> On  
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6 the other hand, one study found that a gain-framed was slightly superior to a  
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8 loss-framed message in sustaining long-term foot care behavior change.<sup>23</sup> Another  
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10 study of patients with psoriasis found that when messages focused on long-term  
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12 health risk, loss-framed messages were more persuasive to improving in reducing  
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14 alcohol intake intention, while messages focused on short-term health risk,  
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16 gain-framed messages were more persuasive than loss-framed messages.<sup>34</sup>

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18 Four studies mainly explored the influence of educational intervention based on  
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20 message framing on physical activity and related cognitive variables in patients with  
21  
22 chronic disease.<sup>35-37 41</sup> Three of the four studies showed the advantage of loss framing  
23  
24 messages.<sup>35-37</sup> One study found that loss-framed messages contributed more physical  
25  
26 activity gain than gain-framed in patients with diabetes.<sup>35</sup> Furthermore, one study  
27  
28 found that in patients with spinal cord injury, the loss-framed group increased their  
29  
30 physical activity intention than the gain-framed group and the usual care group, while  
31  
32 there was no significant difference between the physical activity intention in the  
33  
34 gain-frame group and the usual care group.<sup>37</sup> One study reported that both gain and  
35  
36 loss-framed messages resulted in more physical activity than at baseline, and  
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38 increased more in the loss-framed group, but the difference between the two groups  
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40 did not reach statistical significance; neither gain nor loss-framing elicited higher  
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42 physical activity intention or attitude.<sup>36</sup> In contrast, one study found that a  
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44 gain-framed was slightly superior to a loss-framed message in improving exercise  
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46 adherence among patients with cardiovascular disease.<sup>41</sup>

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48 Two studies primarily explored the influence of educational intervention based  
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50 on message framing on adherence to medicine and treatment therapy and related  
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52 cognitive variables in patients with chronic disease.<sup>38 39</sup> One study reported that  
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54 loss-framed messages increased adherence to treatment therapy and self-efficacy  
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56 more than gain-framed in patients with cardiovascular disease.<sup>39</sup> Another study found  
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58 that when compared to the usual care group, both gain- and loss-framed messages  
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60 lead to higher medicine adherence intention and attitude, but without a difference

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4 between the two conditions.<sup>38</sup>

### 5 **Moderator and mediator variables of framing effects**

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8 Several studies focused on moderators and mediators of framing effects. In particular,  
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10 Park et al. reported that message framing had a significant indirect impact on  
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12 intentions for diabetes self-care behavior, mediated through attitudes and perceived  
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14 control, but no significant differences between message framing groups.<sup>32</sup> Grady et  
15  
16 al. performed regression analyses after the intervention. They found that changes in  
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18 knowledge predicted changes in attitudes and that both framing and attitudes were  
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20 predictors of long-term diabetes self-managemnt behavior.<sup>23</sup> Nevertheless, McCall's  
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22 study observed no mediating effects between health belief model constructs and  
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24 messages.<sup>41</sup>

25  
26 Zhao et al. investigated the interaction between frames and individual time  
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28 perspective considering future consequences (CFC). They found a significant  
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30 interaction between the two, which showed that among high-CFC patients, both gain-  
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32 and loss-framed messages heightened medicine adherence intention and attitude  
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34 toward no-message control. The message exposure did not affect the two outcomes in  
35  
36 low- and medium-CFC participants.<sup>38</sup>

## 37 **DISCUSSION**

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40 Patients with chronic diseases need to maintain long-term health behaviors to avoid  
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42 complications and improve their quality of life. It is necessary to explore the most  
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44 effective method of conveying health educational information to patients to minimize  
45  
46 the nurses' workload and improve patients' health behaviors. Message framing, as an  
47  
48 effective message tailoring strategy, provides a new perspective for achieving this  
49  
50 goal by increasing the persuasiveness in promotion of healthy behaviors. Hence, we  
51  
52 summarized the research on the influence of educational interventions based on  
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54 message framing on health behavior and related cognitive variables in patients with  
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56 long-term illnesses. This research found that most studies showed educational  
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4 message intervention based on the gain and loss frame that could effectively improve  
5 health behaviors and cognitive variables such as health behavior knowledge,  
6 intention, attitude, self-efficacy of patients with chronic diseases. Previous studies  
7 have suggested that gain framing is more effective for preventive behavior, but not  
8 concluded in this study. Many of the studies we included in this review showed the  
9 advantage of loss framing messages, but due to the limited number of included  
10 articles and lack of quantitative analysis, this result should be interpreted with caution.  
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18 The persuasion of gain and loss framing appeal seems to be more complicated  
19 than previously thought. Many patients with chronic disease may have low health  
20 awareness and health literacy.<sup>42 43</sup> The loss framing might be more efficacious if  
21 people do not intend to take action in the foreseeable future and are unaware of the  
22 issues related to their behavior.<sup>44</sup> Besides, individuals weigh the benefits of engaging  
23 in healthy behaviors (such as reducing symptoms and improving mood) against the  
24 potential costs (such as the time and effort spent learning a new skill).<sup>40</sup> Individuals  
25 suffering from chronic diseases, who typically have a long history of illness, may  
26 have had a learning history and outcome expectation (e.g., perceived importance) that  
27 may have resulted in an avoidance tendency toward health behavior.<sup>45</sup> Individuals  
28 with a dominant avoidance tendency typically respond more strongly to threat cues,<sup>46</sup>  
29 making them more receptive to loss-framing encouragement.<sup>47</sup> However, no relevant  
30 variables were assessed in this study; we only proposed a research hypothesis that  
31 requires further investigation.  
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46 Fewer studies have explored the potential mechanism of message frames, which  
47 is of great significance for designing and applying message intervention. These  
48 studies found that attitudes and intentions may act as mediating factors of framing  
49 effect on behavior, consistent with the theory of planned behavior.<sup>23 32 48</sup> A negative  
50 frame may allow patients without behavior change awareness to develop attitudes and  
51 behavioral intentions, thereby promoting behavior. The interaction between message  
52 frame and individual time perspective also suggests that individual factors must be  
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4 considered.<sup>38</sup> Matching frames with individual factors may have a greater framing  
5 effect and help to promote the occurrence or maintenance of healthy behaviors. This  
6 is consistent with the view raised by Latimer et al. that the effectiveness of the  
7 message frame may be dependent on the individual's thinking and feeling about  
8 behavior, rather than just the function or nature of the behavior itself.<sup>49 50</sup> Failing the  
9 influence of individual differences on message framing effects may suppress the true  
10 framing effect and underestimate the utility of gain and loss-framed appeals.<sup>49</sup>

## 17 **Limitations**

20 This review offers critical insights into the impact of message-framed education  
21 on health behaviors of chronic disease patients; however, several limitations have to  
22 be considered. Although we retrieved a considerable amount of literature from the  
23 database, only 11 articles met the inclusion criteria used in the present study. In the  
24 analysis, heterogeneity of different patient samples and health messages, and the  
25 diversity of outcome measurements did not permit a quantitative analysis, limiting the  
26 reliability of conclusions. Furthermore, this review only included research reported in  
27 English, which may exclude some studies; language constraints are also associated  
28 with potential bias in this systematic reviews. Only five studies measured actual  
29 behavior changes, and only six studies just measured changes in cognitive variables  
30 immediately after the intervention. Of course, we know that there is still some  
31 distance between the initiation of behavioral intention to the occurrence and the  
32 maintenance of actual behavior. Hence, future research needs to determine the effects  
33 of message framing on actual behavior through long-term observation or objective  
34 measurement. Few studies have been explored the underlying mechanisms of the  
35 influence of message framing on behavioral or cognitive variables. Future studies also  
36 need to explore the different effects of message framing according to the advocated  
37 behavior and consider participants' existing beliefs and perceptions about the  
38 behavior.<sup>50 51</sup> However, in general, the included studies have relatively high bias risk  
39 and low methodological quality, limiting the reliability of the results. Therefore, with

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4 these limitations of the present review, interpretation of the results should be made  
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6 with caution.  
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### 10 11 **Implications for nursing**

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13 One of the primary goals of this research is to provide suggestions for nurses and  
14 other healthcare professionals, extend the message framing effect to chronic disease  
15 education interventions and improve patients' health, well-being, and quality of life.  
16  
17 The present findings add to the growing evidence that the way health education  
18 messages are delivered and impacts more than the meaning of the content of  
19 messages. Proper design and delivery of messages can improve the persuasiveness of  
20 education, effectiveness, and efficiency, enabling patients with chronic disease to  
21 adopt and maintain health promotion behaviors. Furthermore, by empowering patients  
22 to be active decision-makers rather than passive nursing recipients, patients' role in  
23 managing health-related issues can be strengthened.  
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### 33 **CONCLUSION**

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36 Message framing can be an effective tool for encouraging health promotion  
37 information to promote health behaviors and beliefs in patients with chronic diseases.  
38 Besides, integration of message framing, especially loss framing into health education  
39 might be a promising strategy for motivating patients with chronic disease to improve  
40 health behaviors and related cognitive variables. However, no firm recommendation  
41 could be made of this study. The best framework for improving the actual health  
42 behavior of patients with chronic disease, as well as its potential moderators and  
43 mediators, need to be studied further and strengthened in to guide health education.  
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### Author contributions

RG and FL performed the conception and design of the study, drafting the article or revising it critically for important intellectual content. RG, HG, FL, YL and LX performed the acquisition of data, or analysis and interpretation of data. RG, MS and TY performed the quality assessment. All authors read and final approval of the version to be submitted.

### Acknowledgements

The authors thank all the reviewers for their assistance and support.

### Funding

This study was funded by Interdisciplinary Research Funding Program for Doctoral Postgraduates of Jilin University (No. 101832020DJX090).

**Competing interests** We declare no competing interests.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** No additional data are available.

### References

1 World Health Organization. Noncommunicable diseases: key fact. 2018. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>.

Accessed 03/09/2020.

2 World Health Organization. Noncommunicable Diseases: Fact sheets on sustainable development goals: health targets. WHO, 2017. [www.euro.who.int/\\_\\_data/assets/pdf\\_file/0007/350278/Fact-sheet-SDG-NCD-FINAL](http://www.euro.who.int/__data/assets/pdf_file/0007/350278/Fact-sheet-SDG-NCD-FINAL)

1  
2  
3  
4 -25-10-17.  
5

6 3 Li Y, Wang DD, Ley SH, et al. Time trends of dietary and lifestyle factors and their  
7 potential impact on diabetes burden in China. *Diabetes care*. 2017;40:1685–94.  
8  
9

10 4 Yiengprugsawan VS, Browning CJ. Non-communicable diseases and cognitive  
11 impairment: Pathways and shared behavioral risk factors among older Chinese. *Front*  
12 *Public Health*. 2019;7:296.  
13  
14  
15

16 5 International Diabetes Federation (IDF). *IDF diabetes atlas (8<sup>th</sup> ed.)*, International  
17 Diabetes Federation, Brussels (2017). Available  
18 from:<http://www.diabetesatlas.org/resources/2017-atlas.html>. November 14th, 2017.  
19  
20  
21  
22

23 6 Roser M, Ritchie H. Burden of disease. *Our World in Data*. 2016.  
24 <https://ourworldindata.org/burden-of-disease>. Accessed 03/09/2020.  
25  
26  
27

28 7 Dennis SM, Zwar N, Griffiths R, et al. Chronic disease management in primary  
29 care: from evidence to policy. *Med J Aust* 2008; 188(S8):S53-6.  
30  
31

32 8 Koutsopoulou S, Papathanassoglou ED, Katapodi MC, et al. A critical review of the  
33 evidence for nurses as information providers to cancer patients. *J Clin Nurs*.  
34 2010;19(5-6):749-65.  
35  
36  
37  
38

39 9 American Diabetes Association. Introduction: standards of medical care in  
40 diabetes-2018. *Diabetes Care*. 2018;41(S1):S1–2.  
41  
42

43 10 Jones LW, Sinclair RC, Courneya KS. The effects of source credibility and  
44 message framing on exercise intentions, behaviors, and attitudes: an integration of the  
45 elaboration likelihood model and prospect theory. *Journal of Applied Social*  
46 *Psychology*. 2003;33(1):179–196.  
47  
48  
49  
50

51 11 Collins S. Explanations in consultations: the combined effectiveness of doctors'  
52 and nurses' communication with patients. *Med Educ*. 2005;39(8):785-96  
53  
54  
55

56 12 Coster S, Norman I. Cochrane reviews of educational and self-management  
57  
58  
59

60 18

1  
2  
3 interventions to guide nursing practice: a review. *Int J Nurs Stud.* 2009;46(4):508-28.

4  
5  
6 13 American Association of Colleges of Nursing. Nursing shortage fact sheet. 2008.

7  
8 Accessed March 1, 2009 at

9  
10 <http://www.aacn.nche.edu/Media/FactSheets/NursingShortage.htm>.

11  
12  
13 14 Rothman AJ, Salovey P. Shaping perceptions to motivate healthy behavior: the  
14 role of message framing. *Psychol Bull.* 1997;121(1):3-19

15  
16  
17 15 O'Keefe DJ, Jensen JD. The Advantages of Compliance or the Disadvantages of  
18 Noncompliance? A Meta-Analytic Review of the Relative Persuasive Effectiveness of  
19 Gain-Framed and Loss-Framed Messages. *Annals of the International*  
20 *Communication Association.* 2006;30:1, 1-43.

21  
22  
23 16 O'Keefe DJ, Jensen JD. The Relative Persuasiveness of Gain-Framed Loss-Framed  
24 Messages for Encouraging Disease Prevention Behaviors: A Meta-Analytic Review. *J*  
25 *Health Commun.* 2007;12(7):623-44.

26  
27  
28 17 Kim HK, Lee TK. Conditional Effects of Gain-Loss-Framed Narratives among  
29 Current Smokers at Different Stages of Change. *J Health Commun.*  
30 2017;22(12):990-998.

31  
32  
33 18 Arora R, Stoner C, Arora A. Using framing and credibility to incorporate exercise  
34 and fitness in individuals' lifestyle. *Journal of Consumer Marketing.* 2006; 23:199-  
35 207.

36  
37  
38 19 Gert-Jan de Bruijn. To frame or not to frame? Effects of message framing and risk  
39 priming on mouth rinse use and intention in an adult population-based sample. *J*  
40 *Behav Med.* 2019;42(2):300-314.

41  
42  
43 20 Myers RE. Promoting healthy behaviors: how do we get the message across? *Int J*  
44 *Nurs Stud.* 2010;47(4):500-12.

45  
46  
47 21 Robbins R, Niederdeppe J. Testing the Role of Narrative and Gain-Loss Framing  
48 in Messages to Promote Sleep Hygiene among High School Students. *J Health*  
49  
50  
51  
52  
53  
54  
55  
56  
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58  
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1  
2  
3  
4 Commun. 2019;24(1):84-93.  
5

6 22 Bernstein MH, Wood MD, Erickson LR. The Effectiveness of Message Framing  
7 and Temporal Context on College Student Alcohol Use and Problems: A Selective  
8 E-Mail Intervention. Alcohol Alcohol. 2016;51(1):106-16.  
9

10  
11  
12 23 Grady JL, Entin EB, Entin EE, et al. Using message framing to achieve long-term  
13 behavioral changes in persons with diabetes. Appl Nurs Res. 2011;24(1):22-8.  
14

15  
16 24 Lee BJ, Gu MO. Comparison of the effects between positive message and negative  
17 message in diabetes mellitus education. Korean Diabetes J. 2009;33:344-52.  
18

19  
20 25 Moher D, Liberati A, Teztlaff J, et al. Preferred reporting items for systematic  
21 reviews and meta-analyses: the PRISMA statement. Ann Intern Med.  
22 2009;151(4):264-9.  
23

24  
25 26 Higgins PT, Green S. Cochrane handbook for systematic reviews of interventions.  
26 Version 5.1.0 [updated March 2011]. The Cochrane Collaboration. Available at:  
27 <http://www.cochrane-handbook.org>  
28

29  
30 27 Centers for Disease Control and Prevention (CDC), National Center for Chronic  
31 Disease Prevention and Health Promotion. (2019). About chronic diseases. Retrieved  
32 from <https://www.cdc.gov/chronicdisease/about/index.htm>  
33

34  
35 28 Stawnychy MA, Teitelman AM, Riegel B. Caregiver autonomy support: A  
36 systematic review of interventions for adults with chronic illness and their caregivers  
37 with narrative synthesis. J Adv Nurs. 2021;77(4):1667-1682.  
38

39  
40 29 Higgins JP, Altman DG, Gøtzsche PC, et al. The Cochrane Collaboration's tool for  
41 assessing risk of bias in randomised trials. BMJ. 2011;343:d5928.  
42

43  
44 30 Ryan R, Hill S, Prictor M, et al. Study Quality Guide. 2013. Available from:  
45 <http://cccr.org/cochrane.org/author-resources>.  
46

47  
48 31 Cunningham AT, Crittendon DR, White N, et al. The effect of diabetes  
49  
50  
51

52  
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1  
2  
3  
4 self-management education on HbA1c and quality of life in African-Americans: a  
5 systematic review and meta-analysis. *BMC Health Serv Res.* 2018;18(1):367.  
6  
7

8 32 Park J, Kim SH, Kim JG. Effects of message framing and health literacy on  
9 intention to perform diabetes self-care: A randomized controlled trial. *Diabetes Res  
10 Clin Pract.* 2020;161:108043.  
11  
12

13 33 Paragas ED Jr, Barcelo TI. Effects of message-framed informational videos on  
14 diabetes management knowledge and self-efficacy. *Int J Nurs Pract.*  
15 2019;25(4):e12737  
16  
17

18 34 Keyworth C, Nelson PA, Bundy C, et al. Does message framing affect changes in  
19 behavioral intentions in people with psoriasis? A randomized exploratory study  
20 examining health risk communication. *Psychol Health Med.* 2018;23(7):763-778.  
21  
22

23 35 Li KK, Ng L, Cheng ST, et al. Reverse Message-Framing Effects on  
24 Accelerometer-Assessed Physical Activity Among Older Outpatients With Type 2  
25 Diabetes. *J Sport Exerc Psychol.* 2017;39(3):222-227.  
26  
27

28 36 Hirschey R, Lipkus I, Jones L, et al. Message Framing and Physical Activity  
29 Promotion in Colorectal Cancer Survivors. *Oncol Nurs Forum.* 2016;43(6):697-705.  
30  
31

32 37 Bassett-Gunter RL, Martin Ginis KA, Latimer-Cheung AE. Do You Want the  
33 Good News or the Bad News? Gain- Versus Loss-Framed Messages Following  
34 Health Risk Information: The Effects on Leisure Time Physical Activity Beliefs and  
35 Cognitions. *Health Psychol.* 2013;32(12):1188-98.  
36  
37

38 38 Zhao X, Villagran MM, Kreps GL, et al. Gain Versus Loss Framing in  
39 Adherence-Promoting Communication Targeting Patients With Chronic Diseases:  
40 The Moderating Effect of Individual Time Perspective. *Health Commun.*  
41 2012;27(1):75-85.  
42  
43

44 39 Trupp RJ, Corwin EJ, Ahijevych KL, et al. The Impact of Educational Message  
45 Framing on Adherence to Continuous Positive Airway Pressure Therapy. *Behav Sleep*  
46  
47

48  
49  
50  
51  
52  
53  
54  
55  
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57  
58  
59  
60 21

1  
2  
3  
4 Med. 2011;9(1):38-52.  
5

6 40 Janke EA, Spring B, Weaver F. The effect of message framing on  
7 self-management of chronic pain: A new perspective on intervention? Psychol Health.  
8 2011;26(7):931-47.  
9

10  
11  
12 41 McCall LA, Martin Ginis KA. The Effects of Message Framing on Exercise  
13 Adherence and Health Beliefs Among Patients in a Cardiac Rehabilitation Program.  
14 Journal of Applied Biobehavioral Research. 2004;9(2):122-135.  
15  
16

17  
18  
19 42 Kim SH, Song Y, Park J, Utz S. Patients' Experiences of Diabetes  
20 Self-Management Education According to Health-Literacy Levels. Clin Nurs Res.  
21 2020; 29(5):285-292.  
22  
23

24  
25  
26 43 Coskun S, Bagcivan G. Associated factors with treatment adherence of patients  
27 diagnosed with chronic disease: Relationship with health literacy. Appl Nurs Res.  
28 2021;57:151368.  
29  
30

31  
32 44 Prochaska JO, Redding CA, Evers KE. The transtheoretical model and stages of  
33 change. In: Heal. Behav. Heal. Educ. Theory, Res. Pract. 4th ed., San Francisco, CA,  
34 US: Jossey-Bass; 2008, p. 97-121.  
35  
36

37  
38  
39 45 Leeuw M, Goossens M, Linton S, et al. The fear-avoidance model of  
40 musculoskeletal pain: Current state of scientific evidence. Journal of Behavioral  
41 Medicine. 2007;30: 77-94.  
42  
43

44  
45 46 Carver CS, Sutton SK, Scheier MF. Action, emotion, and personality: Emerging  
46 conceptual integration. Personality and Social Psychology Bulletin. 2000;26(6): 741–  
47 751.  
48  
49

50  
51  
52 47 Mann T, Sherman D, Updegraff J. Dispositional motivations and message framing:  
53 A test of the congruency hypothesis in college students. Health Psychol.  
54 2004;23(3):330-4.  
55  
56

57  
58 48 Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process  
59 22  
60



1  
2  
3  
4 1991;50:179–211.  
5

6 49 Latimer AE, Brawley LR, Bassett RL. A systematic review of three approaches for  
7 constructing physical activity messages: What messages work and what  
8 improvements are needed? *Int J Behav Nutr Phys Act.* 2010;7:36.  
9

10  
11  
12 50 Werrij MQ, Ruiters RA, Van 't Riet J, et al. Self-efficacy as a potential moderator  
13 of the effects of framed health messages. *J Health Psychol.* 2011;16(2):199-207.  
14

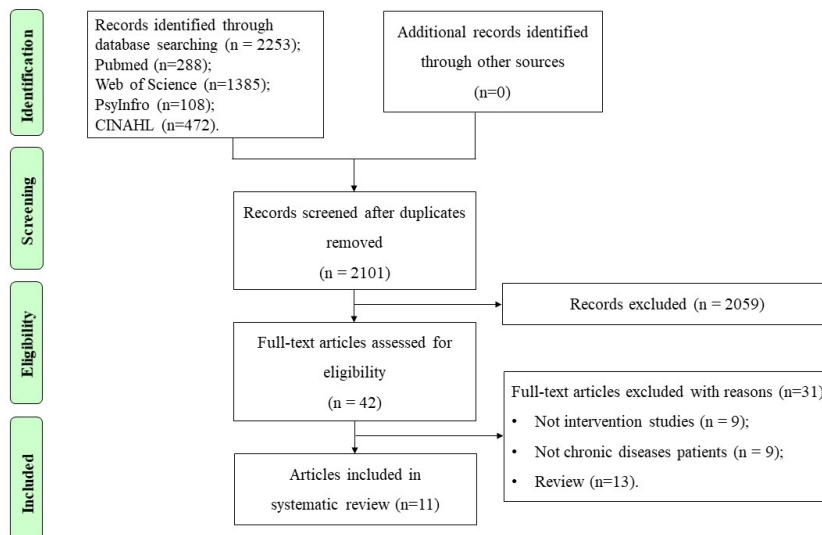
15  
16  
17 51 Lee AY, Aaker JL. Bringing the frame into focus: the influence of regulatory fit on  
18 processing fluency and persuasion. *J Pers Soc Psychol.* 2004;86(2):205-18.  
19  
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## 24 **Figure legend**

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27 Figure 1 Flowchart of the literature search  
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30 Figure 2 Risk of bias assessment  
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33 Figure 3 Risk of bias summary  
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7 Figure 1 Flowchart of the literature search

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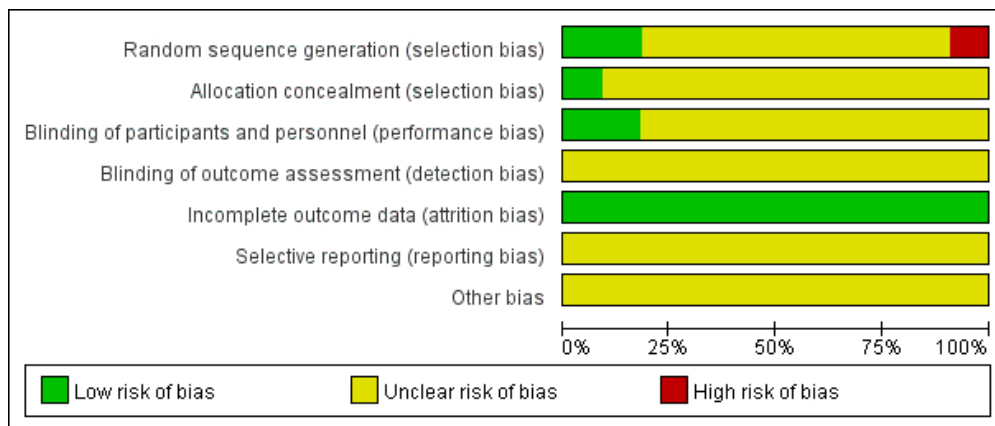


Figure 2 Risk of bias assessment

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	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Bassett 2013	+	?	?	?	+	?	?
Grady 2011	?	?	?	?	+	?	?
Hirschey 2016	?	?	?	?	+	?	?
Janke 2011	?	?	?	?	+	?	?
Keyworth 2018	?	?	?	?	+	?	?
Li 2017	?	?	?	?	+	?	?
McCall 2004	?	?	?	?	+	?	?
Paragas 2019	-	?	+	?	+	?	?
Park 2020	+	+	?	?	+	?	?
Trupp 2011	?	?	+	?	+	?	?
Zhao 2012	?	?	?	?	+	?	?

Figure 3 Risk of bias summary

111x236mm (72 x 72 DPI)

**Supplementary file 1: Search strategy**

This Supplementary file provides the search strategy details, performed March 26, 2021.

1. Pubmed	
#1	Search: (((((((((((message framing[Title/Abstract]) OR (message fram*[Title/Abstract])) OR (information framing[Title/Abstract]) OR (information fram*[Title/Abstract])) OR (gain-framed[Title/Abstract]) OR (loss-framed[Title/Abstract]) OR (gain fram*[Title/Abstract]) OR (loss fram*[Title/Abstract]) OR (positive frame[Title/Abstract]) OR (positive fram*[Title/Abstract]) OR (negative frame[Title/Abstract]) OR (negative fram*[Title/Abstract]) OR (goal fram*[Title/Abstract]) OR (framing effect*[Title/Abstract])
#2	Search: (((((((((((((((((((((((Heart disease[MeSH]) OR (Cardiovascular disease[MeSH]) OR (Heart Failure[MeSH]) OR (Hypertension[MeSH]) OR (Stroke[MeSH]) OR (Diabetes Mellitus[MeSH]) OR (Metabolic syndrome[MeSH]) OR (Neoplasms[MeSH]) OR (Pulmonary Disease, Chronic Obstructive[MeSH]) OR (Lung Diseases[MeSH]) OR (Alzheimer disease[MeSH]) OR (Dementia[MeSH]) OR (Asthma[MeSH]) OR (Hepatitis[MeSH]) OR (Fatty Liver[MeSH]) OR (Kidney diseases[MeSH]) OR (Pain[MeSH]) OR (Psoriasis[MeSH]) OR (Fibromyalgia[MeSH]) OR (Multiple Sclerosis[MeSH]) OR (Arthritis[MeSH]) OR (Osteoporosis[MeSH]) OR (((((Noncommunicable Diseases[MeSH]) OR (Comorbidity[MeSH]) OR (Multimorbidity[MeSH]) OR (Chronic disease[MeSH]) OR (Chronic illness[MeSH]))
#3	Search: (((((((((((((((((((((((((((((((((((((((non communicable[Title/Abstract]) OR (noncommunicable[Title/Abstract]) OR (NCD[Title/Abstract]) OR (comorbidity[Title/Abstract]) OR (multimorbidity[Title/Abstract]) OR (chronic disease[Title/Abstract]) OR (chronic condition[Title/Abstract]) OR (chronic illness[Title/Abstract]) OR (long term condition[Title/Abstract]) OR (long term ill[Title/Abstract]) OR (cardi*[Title/Abstract]) OR (heart disease[Title/Abstract]) OR (cardiovascular disease[Title/Abstract]) OR (Heart Failure[Title/Abstract]) OR (high blood pressure[Title/Abstract]) OR (hypertension[Title/Abstract]) OR (Stroke[Title/Abstract]) OR (diabet*[Title/Abstract]) OR (Diabetes[Title/Abstract]) OR (metabolic syndrome[Title/Abstract]) OR (cancer[Title/Abstract]) OR (neoplasm[Title/Abstract]) OR (chronic obstructive pulmonary disease[Title/Abstract]) OR (chronic respir*[Title/Abstract]) OR (Lung Diseases[Title/Abstract]) OR (respiratory disease*[Title/Abstract]) OR (Alzheimer disease[Title/Abstract]) OR (dementia[Title/Abstract]) OR (psoriasis[Title/Abstract]) OR (Asthma[Title/Abstract]) OR (Hepatitis[Title/Abstract]) OR (Fatty Liver[Title/Abstract]) OR (Kidney disease*[Title/Abstract]) OR (Pain[Title/Abstract]) OR (Fibromyalgia[Title/Abstract]) OR (multiple sclerosis[Title/Abstract]) OR (Arthritis[Title/Abstract]) OR (Osteoporosis[Title/Abstract])
#4	#2 OR #3
#5	#1 AND #4 Filters: English

	Items found: 288
<b>2. Web of Science</b>	
#1	message framing (TS) or message fram* (TS) or information framing (TS) or information fram* (TS) or gain-framed (TS) or loss-framed (TS) or gain fram* (TS) or loss fram* (TS) or positive frame (TS) or positive fram* (TS) or negative frame (TS) or negative fram* (TS) or goal fram* (TS) or framing effect* (TS)
#2	non communicable (TS) or noncommunicable (TS) or NCD (TS) or comorbidity (TS) or multimorbidity (TS) or chronic disease (TS) or chronic condition (TS) or chronic illness (TS) or long term condition (TS) or long term ill (TS) or cardi* (TS) or heart disease (TS) or cardiovascular disease (TS) or Heart Failure (TS) or high blood pressure (TS) or hypertension (TS) or Stroke (TS) or diabet* (TS) or Diabetes (TS) or metabolic syndrome (TS) or cancer (TS) or neoplasm (TS) or chronic obstructive pulmonary disease (TS) or chronic respir* (TS) or Lung Diseases (TS) or respiratory disease* (TS) or Alzheimer disease (TS) or dementia (TS) or psoriasis (TS) or Asthma (TS) or Hepatitis (TS) or Fatty Liver (TS) or Kidney disease* (TS) or Pain (TS) or Fibromyalgia (TS) or multiple sclerosis (TS) or Arthritis (TS) or Osteoporosis (TS)
#3	#1 AND #2 Filters: English; Not conference abstract/review Items found: 1385
<b>3. CINAHL</b>	
S1	TI message framing OR TI negative fram* OR TI negative frame OR TI information framing OR TI message fram* OR TI information fram* OR TI loss-framed OR TI gain fram* OR TI gain-framed
S2	TI loss fram* OR TI positive frame OR TI positive fram* OR TI goal fram* OR TI framing effect*
S3	AB message framing OR AB message fram* OR AB information framing OR AB gain-framed OR AB information fram* OR AB loss-framed OR AB gain fram* OR AB loss fram*
S4	AB positive frame OR AB positive fram* OR AB negative fram* OR AB negative frame OR AB goal fram* OR AB framing effect*
S5	S1 OR S2 OR S3 OR S4
S6	TI non communicable OR TI noncommunicable OR TI NCD OR TI comorbidity OR TI multimorbidity OR TI chronic illness OR TI long term ill OR TI chronic disease OR TI long term condition OR TI chronic condition OR TI cardi* OR TI heart disease
S7	AB non communicable OR AB NCD OR AB noncommunicable OR AB comorbidity OR AB multimorbidity OR AB chronic illness OR AB chronic disease OR AB chronic condition OR AB long term condition OR AB long term ill OR AB cardi* OR AB heart disease
S8	TI cardiovascular disease OR TI high blood pressure OR TI hypertension OR TI Heart Failure OR TI Stroke OR TI diabet* OR TI Diabetes OR TI metabolic syndrome OR TI chronic obstructive pulmonary disease OR TI chronic respir* OR TI cancer OR TI neoplasm
S9	AB cardiovascular disease OR AB Heart Failure OR AB high blood pressure OR AB hypertension OR AB Stroke OR AB diabet* OR AB Diabetes OR AB metabolic

	syndrome OR AB cancer OR AB neoplasm OR AB chronic obstructive pulmonary disease OR AB chronic respir*
S10	TI Lung Diseases OR TI respiratory disease* OR TI Alzheimer disease OR TI dementia OR TI psoriasis OR TI Asthma OR TI Hepatitis OR TI Fatty Liver OR TI Kidney disease* OR TI Pain OR TI Fibromyalgia OR TI multiple sclerosis
S11	AB Lung Diseases OR AB respiratory disease* OR AB Asthma OR AB Kidney disease* OR AB Alzheimer disease OR AB dementia OR AB psoriasis OR AB Hepatitis OR AB Fatty Liver OR AB Pain OR AB Fibromyalgia OR AB multiple sclerosis
S12	TI Arthritis OR TI Osteoporosis OR AB Arthritis OR AB Osteoporosis
S13	S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12
S14	S5 AND S13 Filter: English, Human, Adult Items found: 472
<b>4. PsycINFO</b>	
S1	TI message framing OR TI message fram* OR TI information framing OR TI information fram* OR TI loss-framed OR TI gain-framed OR TI gain fram* OR TI loss fram* OR TI positive frame OR TI positive fram* OR TI negative frame OR TI negative fram*
S2	AB message framing OR AB message fram* OR AB information framing OR AB information fram* OR AB loss-framed OR AB gain-framed OR AB gain fram* OR AB loss fram* OR AB positive frame OR AB positive fram* OR AB negative frame OR AB negative fram*
S3	AB goal fram* OR AB framing effect* OR TI goal fram* OR TI framing effect*
S4	S1 OR S2 OR S3
S5	TI non communicable OR TI noncommunicable OR TI NCD OR TI comorbidity OR TI multimorbidity OR TI chronic disease OR TI long term condition OR TI chronic condition OR TI chronic illness OR TI long term ill OR TI cardi* OR TI heart disease
S6	AB non communicable OR AB noncommunicable OR AB NCD OR AB comorbidity OR AB multimorbidity OR AB chronic disease OR AB long term condition OR AB chronic condition OR AB chronic illness OR AB long term ill OR AB cardi* OR AB heart disease
S7	AB cardiovascular disease OR AB Heart Failure OR AB high blood pressure OR AB hypertension OR AB Stroke OR AB diabet* OR AB Diabetes OR AB metabolic syndrome OR AB cancer OR AB neoplasm OR AB chronic obstructive pulmonary disease OR AB chronic respir*
S8	TI cardiovascular disease OR TI Heart Failure OR TI high blood pressure OR TI hypertension OR TI Stroke OR TI diabet* OR TI Diabetes OR TI metabolic syndrome OR TI cancer OR TI neoplasm OR TI chronic obstructive pulmonary disease OR TI chronic respir*
S9	TI Lung Diseases OR TI respiratory disease* OR TI Alzheimer disease OR TI dementia OR TI psoriasis OR TI Asthma OR TI Hepatitis OR TI Fatty Liver OR TI Kidney disease* OR TI Pain OR TI Fibromyalgia OR TI multiple sclerosis
S10	AB Lung Diseases OR AB respiratory disease* OR AB Alzheimer disease OR AB dementia OR AB psoriasis OR AB Asthma OR AB Hepatitis OR AB Fatty Liver OR AB

	Kidney disease* OR AB Pain OR AB Fibromyalgia OR AB multiple sclerosis
S11	AB Arthritis OR AB Osteoporosis OR TI Arthritis OR TI Osteoporosis
S12	S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11
S13	S4 AND S12 Filter: English, Human, Adult Items found: 108

For peer review only



## Supplementary file 2: Characteristics of studies included in this systematic review.

Authors Year Design	Population	Group	Sample Size (M/F) Age (years)	Key component of intervention		
				Content	Frame	Format/ Dose
Park <sup>32</sup> 2020 RCT	Diabetes	Gain- frame	26 (10/16) 65.65±10.61	Content pertaining to diabetic complications in diabetes.	Gain framing presented positive outcomes resulting from adherence to a diabetes care regimen, showing a patient success story about proper diabetes self-care.	Video 1
		Loss- frame	26 (6/20) 64.92±12.21		Loss framing presented undesirable consequences resulting from failure to comply with a diabetes care regimen, showing a story about a patient with diabetic complications caused by inadequate diabetes self-care.	
Paragas <sup>33</sup> 2019 Quasi- experim ental study	Diabetes	Gain- frame	55 (25/30) 58.95±10.25	Definition of diabetes, teachings about blood glucose monitoring; proper diet and exercise; oral hypoglycemic agents; recognition, treatment, and prevention of hypoglycemia and hyperglycemia.	Gain-framed video comprised 10 positive outcomes of adherence to diabetes self-care in the last scenes of videos, e.g. one statement was “If you maintain good control of your blood glucose, the acid in your blood will be normal, and being comatose will be prevented,” with a scene showing a healthy person.	Video/ Lecture 1
		Loss- frame	55 (25/30) 58.60±10.23		Loss-framed video contained 10 negative outcomes of non-adherence in the last scenes of videos, e. g. one version was “If you do not maintain good control of your blood glucose, the acid in your blood will be elevated that could lead to being comatose,” with a scene showing a comatose patient.	
		No- frame	55 (24/31) 58.96±9.74		Standard approach of providing health teachings about diabetes self-care, with no message framing.	
Keyworth <sup>34</sup> 2018 RCT	Psoriasis	Gain- frame	217(75/126) 41.23±14.31	Information about the effects of health behavior change on either psoriasis symptoms or CVD risk.	Gain-framed message addressed the positive outcomes for adherence to the health behaviors, e. g. “Research shows that risk factors for cardiovascular disease include smoking, having a poor diet, having insufficient physical activity, and drinking excessive amounts of alcohol. By making changes to your lifestyle, you [lower] your risk of cardiovascular disease.”	Sheet 1
		Loss- frame			Loss-framed message addressed the negative outcomes for not adherence to the health behaviors, e. g. “Research shows that risk factors for cardiovascular disease include smoking, having a poor diet, having insufficient physical activity, and drinking excessive amounts of alcohol. By [not] making changes to your lifestyle, you [increase] your risk of cardiovascular disease.”	
Li <sup>35</sup>	Diabetes	Gain-	211	The pamphlet included a brief	Gain-framed pamphlet contained the benefits of PA participation, including physical (11 items: e.g., improve	Pamphlet

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2017 RCT		frame	(101/110) 71.41±6.80	description of PA participation in Hong Kong, the recommended PA level.	muscle strength), psychological (8 items: e.g., improve mood), and social (4 items: expand social network) domains.	1
		Loss-frame			Loss-framed pamphlet contained the absence of benefits of PA participation. The contents of the benefits were identical between the gain- and loss-framed messages, with differences only in the framing of the messages.	
Hirschey <sup>36</sup> 2016 RCT	CRC	Gain-frame	78 (36/42) 64.3 (29.9–98.4)	Tips on how to become more physically active with examples of activities of MIPA; protective influence of PA on CRC co-morbid conditions; inverse relationship between PA and risk of cancer-specific mortality and all-cause mortality.	Gain-framed version addresses the benefits of being physically active.	Pamphlet / taken home to read
		Loss-frame	70 (35/35) 65.4 (43.2–88.5)		Loss-framed version addresses the disadvantages of not being physically active.	
Bassett <sup>37</sup> 2013 RCT	SCI	Gain-frame	94 (57/37) 45±12	Benefits or risks quotations from SCI experts and patients and research evidence.	Gain-framed messages outlined the benefits of engaging in regular LTPA (i.e. Adding LTPA to your day can help you manage your pain gain framed)	Online message 1
		Loss-frame			Loss-framed messages outlined the risks of not engaging in regular LTPA. (i.e., By not adding LTPA to your day you miss an opportunity to manage your pain)	
		No-frame			Usual care	
Zhao <sup>38</sup> 2012 RCT	Chronic diseases	Gain-frame	1108 (411/697)	Messages addressing perceived need and perceived concerns about medications, messages content was held the same across the two frames.	Gain-framed messages outlined the benefits of adherence to medication taking (i.e. You may wonder whether you really need your prescription medication. But taking your medicine as directed is very important even if you don't feel sick. It's the first step toward long-term health. Talk to your doctor about your medicine and changes you can make to your lifestyle to help manage your condition.)	Online message 1
		Loss-frame			40-85	

		No-frame		Usual care	The control group did not receive any additional information.	
Trupp <sup>39</sup> 2011 RCT	CVD with OSA	Gain-frame	26 (19/7) 29-74	A brief, about 50 seconds educational video about CPAP was provided.	Gain-framed video positively focused on the benefits associated with CPAP use.	Video 1
		Loss-frame	29 (17/12) 38-77		Loss-framed video negatively emphasized the negative consequences that may occur if CPAP was not worn as directed.	
Janke <sup>40</sup> 2011 RCT	Chronic pain	Gain-frame	62 (61/1) 50	Messages stressed the importance of the patient playing an active role in their pain care and techniques could use to help manage pain.	Gain-framed messages emphasized the gains patients would make if they engage in these behaviors.	Pamphlet 1
		Loss-frame			Loss-framed messages focused on the losses they would realize if they did not do these things.	
Grady <sup>23</sup> 2011 RCT	Diabetes	Gain-frame	155 (64 /91) 61.2±11.4	The video addressed topics about foot care such as cleaning procedures, toenail care, footwear use, and foot and footwear inspection procedures.	Gain-framed version offered the positive outcome that can accrue by appropriate foot care, e.g. “Good foot care can help you avoid the serious complications of nerve and blood vessel damage, and keep your feet healthy” (with a picture of healthy feet).	Video 1
		Loss-frame			Loss-framed version offered the negative outcome that can accrue if the desired behavior is not followed, e.g. “Poor foot care can lead to the serious complications of nerve and blood vessel damage, and unhealthy feet” (with a picture of a foot with an infected sore).	
McCall <sup>41</sup> 2004 RCT	CVD	Gain-frame	16 (15/1)	Statements regarding the effects of exercise in relation to CAD.	Gain-framed condition listed 10 gain-framed statements regarding the benefits of exercise in relation to the progression of CAD. (i.e., Regular exercise will help you maintain a healthy body weight.)	Sheet /taken home to read
		Loss-frame	13 (12/1)		Loss-framed condition with the same 10 statements phrased in a loss-framed manner. (i.e., By not exercising regularly, you decrease your chances of keeping a healthy body weight.)	
		No-frame	20 (19/1)	Usual care	The control group did not receive any additional information.	

Abbreviations: CAD: Coronary artery diseases; CRC: Colorectal cancer; CVD: Cardiovascular disease; LTPA: Leisure time physical activity; MIPA: Moderate intensity physical activity; NR:

Not report; OSA: Obstructive sleep apnea; PA: Physical activity; RCT: Randomized controlled trial; SCI: Spinal cord injury; T2D: Type 2 diabetes.

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**Supplementary file 3: Summary of findings of studies included in this systematic review.**

Authors Year	Outcome measures and collection time	Main findings	Mediators/Moderators
Park <sup>32</sup> 2020	Attitudes, perceived control and intentions for diabetes self-care behavior. All measured at post-intervention.	Attitudes: Loss-framed group improved more; Perceived control: Loss-framed group improved more; Intentions: Both conditions produced significant increases, but no group difference.	Significant indirect effect of message framing on intentions for diabetes self-care behavior mediated through attitudes and perceived control. No significant interaction effects were observed between health literacy level and message framing.
Paragas <sup>33</sup> 2019	Diabetes self-management knowledge and self-efficacy. All measured at pre- and post-intervention.	Knowledge: Both loss-framed and gain framed group improved more, but no difference between the two; Self-efficacy: Both loss- and gain- framed group improved, and gain framed group improved more.	NR
Keyworth <sup>34</sup> 2018	Self-care behavior intention. Measured at post-intervention.	Intention: Messages focused on short-term health risk, gain-framed messages more persuasive than loss-framed messages; messages about long-term health risk, loss-framed message more persuasive than gain-framed message	A significant frame by focus interaction was found for behavioral intention to reduce alcohol intake.
Li <sup>35</sup> 2017	PA. Measured at pre-intervention and 2-week follow up: PA.	PA: Loss-framed group improved more.	NR
Hirschey <sup>36</sup> 2016	PA, attitudes, subjective norms, perceived behavioral control, intention. PA and intention were measured at pre- and post-intervention, 1-and 12-months follow up; Attitudes, subjective norms and perceived behavioral control measured at pre-intervention and 1-month follow up.	PA: Both conditions produced significant increases in PA, with no differences between framing conditions; TPB constructs: Neither the gain- nor loss-framed brochures produced significant changes from baseline to the 1- and 12-months follow-up.	NR
Bassett <sup>37</sup> 2013	PA response efficacy and intention. All measured at pre- and post-intervention.	LTPA response efficacy: Loss-framed condition increased more than gain-framed and control conditions, no difference	NR

		between gain-framed and control conditions; Intention: Loss-framed condition increased more than gain-framed and control conditions, no difference between gain-framed and control conditions.	
Zhao <sup>38</sup> 2012	Medicine adherence intention and attitude. All measured at post-intervention.	Intention: Gain- and loss-framed messages improved more than control, no difference between gain- and loss-framed conditions; Attitude: Gain- and loss-framed messages improved more than control, no difference between gain- and loss-framed conditions.	Significant interaction between frames and CFC, among high-CFC patients, both gain- and loss-framed messages heightened intention and attitude with respect to the no-message control, gain frame showed a consistent superior to the loss frame. Message exposure had not effect on the two outcomes for low-and medium-CFC participants.
Trupp <sup>39</sup> 2011	Adherence to CPAP, self-efficacy. CPAP use was measured at post-intervention; Self-efficacy was measured at pre- and post-intervention.	CPAP use: Loss-framed group improved more; Self-efficacy: Both conditions improved, Loss-framed group improved more than gain-framed group.	NR
Janke <sup>40</sup> 2011	Knowledge, pain self-efficacy, pain readiness to change, pain self-management behavioral skills. Pain self-efficacy, pain readiness to change were measured at pre-intervention; Knowledge, pain self-management behavioral skills were measured at post-intervention.	Knowledge: Loss-framed group improved more; Confidence to practice relaxation: Loss-framed group improved more.	Pain self-efficacy, pain readiness to change and message frame independently influenced motivation to engage in relaxation. There were no observed interactions between message frame and either self-efficacy or readiness to change.
Grady <sup>23</sup> 2011	Knowledge, attitude, foot care behaviors. Knowledge and attitude were measured at pre- and post-intervention, 3- and 6-month follow-ups; Foot care behaviors were measured at pre-intervention, 3- and 6-month follow-ups.	Foot care behaviors: Gain-framed group improved more.	Attitude and framing are significant predictors of 6-months behavior, gain framing positively related to long-term behavior; knowledge affects attitudes, in turn, attitudes affect behavior.

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<p>McCall <sup>41</sup> 2004</p>	<p>Adherence to exercise, health belief cognitions (perceived susceptibility, benefits and barriers). Adherence to exercise was measured at 3-months follow-ups; Health belief cognitions were measured at post-intervention.</p>	<p>Adherence to exercise: Gain-framed condition attended more exercise sessions than control; loss-framed group attend more exercise, but no difference with control; Perceived susceptibility: Gain- and loss-framed conditions perceived more susceptibility than control; Perceived barriers: Loss-framed condition perceived grater barriers than gain-framed and control conditions; Perceived benefits: No difference among the three conditions.</p>	<p>HBM constructs did not mediate the effects of the educational messages.</p>
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Abbreviations: CFC: Consideration of future consequences; CPAP: Continuous positive airway pressure; HBM: Health belief model; LTPA: Leisure time physical activity; NR: Not report; PA: Physical activity; TPB: Theory of planned behavior.



# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1,2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	5
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5,6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	none
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I <sup>2</sup> ) for each meta-analysis.	none



# PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	none
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	none
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6,7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	7,8
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	8
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	8,9,10
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	none
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	none
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	9,10,11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	14

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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Page 2 of 2

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# BMJ Open

## The effects of health behaviors and beliefs based on message framing among patients with chronic diseases: A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055329.R2
Article Type:	Original research
Date Submitted by the Author:	20-Dec-2021
Complete List of Authors:	Gao, Ruitong; Jilin University, School of Nursing Guo, Hui; Eastern Division of the First Bethune Hospital of Jilin University, Department of endocrinology and metabolism Li, Fei; First Bethune Hospital of Jilin University, Department of endocrinology and metabolism Liu, Yandi; First Bethune Hospital of Jilin University, Department of endocrinology and metabolism Shen, Meidi; Jilin University Xu, Linqi; Jilin University Yu, Tianzhuo; Jilin University Li, Feng; Jilin University, School of Nursing
<b>Primary Subject Heading</b>:	Nursing
Secondary Subject Heading:	Nursing
Keywords:	EDUCATION & TRAINING (see Medical Education & Training), MEDICAL EDUCATION & TRAINING, DIABETES & ENDOCRINOLOGY

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4 **The effects of health behaviors and beliefs based on message framing among**  
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6 **patients with chronic diseases: a systematic review**  
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10 Short running title: Message Framing for Health Behaviors and Beliefs  
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## 16 **Abstract**

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18 **Objective:** The effectiveness of integrating message framing into educational  
19 interventions to promote the health behavior of patients with chronic diseases is still  
20 being debated in nursing research. The objective of this study was to assess the impact  
21 of educational interventions based on gain and loss frames on the health behaviors  
22 and beliefs of patients with chronic diseases and to identify the frame that achieves  
23 better outcomes.  
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27 **Design:** Systematic review was based on PRISMA guidelines for comprehensively  
28 searching, appraising, and synthesizing research evidence.  
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32 **Data sources:** We searched the PubMed, Web of Science, PsycINFO, and CINAHL  
33 databases for reports published from database inception until March 26, 2021.  
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37 **Eligibility criteria:** Intervention studies, published in English, with adult patients  
38 with chronic disease conditions, and with intervention contents involved in the  
39 implementation of message framing, were considered. The outcomes were health  
40 behaviors or beliefs, such as knowledge, self-efficacy, intention, or attitudes.  
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44 **Data extraction and synthesis:** Data extraction and entry were performed using a  
45 pre-designed data extraction form and assessed independently by two reviewers using  
46 the Cochrane Collaboration Risk of Bias I.  
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50 **Results:** A total of 11 intervention studies were included. We found that educational  
51 intervention based on both gain and loss frames could enhance the positive effects of  
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4 communication, promote healthy behaviors and beliefs in patients with chronic  
5 disease. Many of the studies we included here showed the advantage of loss framing  
6 messages, due to the limited number of articles included and without quantitative  
7 analysis, this result should be interpreted cautiously.  
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12 **Conclusions:** Integrating message framing into health education might be a promising  
13 strategy to motivate patients with chronic disease to improve their health behaviors  
14 and beliefs. More extensive and well-designed trials are needed to support the  
15 conclusions and discuss the effective framing, moderators and mediators of framing.  
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20 **PROSPERO registration number:** CRD42021250931.  
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23 **Key words:** message framing; chronic diseases; nursing; health behavior; health  
24 beliefs; systematic review  
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### 28 **Strengths and limitations of this study**

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30 ▶ This systematic review has extracted evidence from interventional studies, which  
31 provided a theoretical and evidence base for practice.  
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34 ▶ A limited number of randomised clinical trials were included, limiting the quality  
35 of the evidence.  
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39 ▶ Heterogeneity of different patient samples and health messages and the diversity of  
40 outcome measurements did not permit quantitative analysis.  
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## INTRODUCTION

Chronic diseases have become the leading cause of morbidity and mortality worldwide, accounting for 41 million deaths, more than 70% of all deaths, and 80% of total disabilities.<sup>1 2</sup> An aging population, lifestyle factors influencing diseases such as high-fat diets and low levels of physical activity indicate that this trend will continue to increase.<sup>3</sup> More than 300 million people in China have been diagnosed with chronic diseases since 2018.<sup>4</sup> The rising burden of various diseases has increased medical expenses; for example, diabetes, a common chronic disease, according to the International Diabetes Federation, diabetes-related direct medical expenditures amounted to approximately \$25 billion in China in 2017.<sup>5</sup> Hence, the treatment and care of chronic diseases pose a significant impact on individuals, their families, and societies, as well as a huge demand to healthcare systems.<sup>6 7</sup>

Providing health-related information and support to patients can encourage them to promote change and maintain their health behavior, improve their psychological and physiological outcomes,<sup>8</sup> which effectively prevent and reduce complications associated with chronic diseases, risk of death, and disease burden.<sup>9</sup> Nurses play a critical role in educating patients about how to improve their health. When it comes to health information, nurses are just as reliable as doctors, and patients prefer to get it from nurses because they are more accessible than doctors.<sup>8 10 11</sup> The number of people developing long-term conditions that in need of nursing care is increasing rapidly.<sup>12</sup> The number of health care professionals, especially registered nurses, is far from meeting the current and future demands.<sup>12 13</sup> Thus, we need to explore a more effective way to deliver messages to patients to maximize the effectiveness of health management education.

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4 The effectiveness of educational messages in promoting behavior change may  
5 depend on how the message is presented rather than the meaning of the content itself.  
6 Message framing is a message tailoring method that can influence an individual's  
7 behavioral decision by adjusting the presentation of a message without changing the  
8 meaning of the content, thereby promoting a particular behavior.<sup>14</sup> The most common  
9 method is to develop a message based on the gain (positive) or loss (negative) frame.  
10 The benefits of adopting the target behavior are typically emphasized in gain-framing  
11 messages, whereas the costs of not adopting the target behavior are stressed in  
12 loss-framing information.<sup>14</sup> In O'Keefe and Jensen's reviews, they found that  
13 positive frames were slightly better for disease prevention. However, when they  
14 classified disease prevention behaviors, only a slight advantage of positive framing  
15 was showed in dental hygiene behavior, while there was no difference between the  
16 two frames for other disease prevention behaviors such as diet/nutrition behaviors, or  
17 exercise behaviors.<sup>15 16.</sup>

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Reviewing the past literature, several studies on health-related behaviors such as smoking,<sup>17</sup> physical activity,<sup>18</sup> dental hygiene,<sup>19</sup> have emerged in message framing research. Notably, many studies are examined in messaging framing effect on health-related behaviors in the general population rather than representative samples of people suffering from various diseases or high risk groups, such as diabetes and cardiovascular diseases.<sup>20-22</sup> At the same time, the effects of message framing on chronic disease education are inconsistent. For example, Grady et al. found that a gain-framed foot care message was more effective in changing foot care behavior in patients with diabetes.<sup>23</sup> In contrast, Lee and Gu's study showed that loss-framed foot care message was more effective in activating attitudes and intentions to conduct foot care in patients with diabetes.<sup>24</sup>

There are many opportunities in nursing to provide patient health information in various settings, ranging from the distribution of written materials to teaching chronic disease self-management skills.<sup>12</sup> Meanwhile, patients feel more open and free to



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4 communicate with nurses.<sup>11</sup> Thus, nurses have significant opportunities to use  
5 message framing to provide health information. The primary purpose of this study  
6 was to review the impact of message framing educational interventions on the health  
7 behaviors and beliefs of patients with chronic disease, and to inform the design of  
8 future health information interventions.  
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## 13 14 **METHODS**

### 15 16 **Search strategy**

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19 This systematic review was carried out based on the PRISMA guidelines<sup>25</sup> and  
20 recommendations of the Cochrane Collaboration.<sup>26</sup> There was no need for ethical  
21 approval because the literature analyzed in this study was from previously published  
22 studies. The PROSPERO registration number is CRD42021250931.  
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28 We searched for studies published in PubMed, Web of Science, PsycINFO, and  
29 CINAHL from their inception to March 26, 2021. Terms related to message framing  
30 and chronic diseases used in this article were retrieved, including message framing,  
31 information framing, gain-framed, loss-framed, gain fram\*, loss fram\*, positive  
32 fram\*, negative fram\*, framing effect\*, noncommunicable diseases, comorbidity,  
33 multimorbidity, chronic disease, chronic illness, chronic condition, long term  
34 condition, long term illness. The search strategies of each database are available in the  
35 in the Supplementary file 1. The reference lists of included and relevant publications  
36 were manually screened for additional articles.  
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### 46 **Study selection**

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48 The inclusion criteria included adult patients aged 18 years or older with chronic  
49 diseases (persist and require care over time, such as cardiovascular conditions,  
50 diabetes, and cancer),<sup>27 28</sup> intervention contents involved in the application of  
51 message framing, including involving a comparison of a message framing  
52 intervention with either a control intervention or other message frames, and  
53 intervention studies (randomized controlled trials or quasi-experimental studies)  
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4 published as peer-reviewed full-text articles in the English language. Messages could  
5 be delivered in paper or electronic form, and there were no restrictions on who had  
6 delivered the intervention. These studies measured health behavior or beliefs such as  
7 knowledge, self-efficacy, intention, or attitude. Exclusion criteria included articles  
8 from patients with severe mental disorders or cognitive impairment.  
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14 The retrieval results were imported into Endnote X 20 for literature management.  
15 Following the removal of duplicates, two independent researchers (RG, YL) screened  
16 the title, abstract and full text based on the pre-established inclusion and exclusion  
17 criteria. If they found any disagreement, it was resolved by a third independent  
18 researcher (HG).  
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### 23 24 **Data extraction and analysis**

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26 Data extraction and entry were performed using a pre-designed data extraction form,  
27 including first author, year of publication, country, sample size, gender, age, key  
28 contents of intervention, outcome measures, and findings. Two independent  
29 researchers completed data extraction (RG, LX), and if there was any disagreement or  
30 uncertainty, it was arbitrated and resolved by a third independent researcher (FL).  
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37 Although our initial goal was to complete a systematic review and meta-analysis,  
38 quantitative analysis could not carry out due to the large statistical and clinical  
39 heterogeneity of the literature.  
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### 44 **Quality assessment**

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46 Two independent researchers (RG, MS) completed the quality assessment of the  
47 included articles using Cochrane Collaboration Risk of Bias I.<sup>29</sup> If they found any  
48 uncertainty or difference in opinion, it was resolved by a third independent researcher  
49 (TY). For quasi-experimental studies without randomization, the item of random  
50 sequence generation of selection bias was automatically identified as high risk.<sup>30 31</sup>  
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### 57 **Patient and public involvement**

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Neither patients nor the public were involved in this research.

## RESULT

### Literature search

After removing duplicate literature and screening the titles and abstracts, 2253 articles were systematically retrieved, with 42 articles were read the full text. A total of eleven studies were included, <sup>23 32-41</sup> ten randomized controlled trials (RCT), and one quasi-experimental study <sup>33</sup> based on previously established inclusion and exclusion criteria. Figure 1 illustrates the PRISMA flowchart of literature screening process.<sup>25</sup>

### Characteristics of the included studies

The included studies were published between 2004 and 2020 and came from Korea, Philippines, the United Kingdom, China, the United States and Canada. The number of participants ranged from 49 to 1,108, for a total of 2,216, with a mean age ranging from 40 to 71 and a male proportion of 43.7%.

Diabetes, cardiovascular disease, and cancer are the most common chronic diseases addressed in the included literature. <sup>23 32 33 35 36 41</sup> Seven studies were set up in two groups, with one receiving educational intervention based on gain frame, and the other group receiving educational intervention based on loss frame. <sup>23 32 34-36 39 40</sup> Only four studies were set up in three groups: a gain-framed group, a loss frame group, and a standard control group for providing usual care, with no message framing. <sup>33 37 38 41</sup> The gain framing condition highlighted the positive outcomes of completing or adhering to the healthy behavior, whereas the loss framing condition emphasized the undesirable consequences of failing to comply or adhere to the healthy behavior, which corresponded to the positive framing outcomes. Messages were delivered via video, pamphlet, and online message. Nine studies only once conducted intervention, <sup>23 32-35 37-40</sup> and two studies sent the pamphlet to patients to take home for further reading. <sup>36 41</sup> Supplementary file 2 presents specific information about the included studies.

## Quality assessment of the included studies

Regarding selection bias, two RCT described adequate random sequence generation<sup>32</sup>  
<sup>37</sup> and other eight RCT reported randomization but did not report a specific method.<sup>23</sup>  
<sup>34-36</sup> <sup>38-41</sup> One quasi-experimental study, non-randomized sampling was used;  
participants were just assigned to different groups in separate days for a single time,  
identified as high risk.<sup>33</sup> Only one studies reported adequate allocation concealment,  
<sup>32</sup> and the other ten were rated as having an unclear risk of bias due to insufficient  
information.<sup>23</sup> <sup>33-41</sup> Only two studies showed a low risk of performance bias.<sup>33</sup> <sup>39</sup> The  
risk of detection bias was rated as unclear risk as none of the eleven articles indicated  
whether the blind method was applied to the outcome assessment.<sup>23</sup> <sup>32-41</sup> Regarding  
attrition bias, eleven studies were rated as low risk bias.<sup>23</sup> <sup>32-41</sup> The report and other  
sources bias of the eleven studies were rated as having an unclear risk of bias due to  
insufficient information.<sup>23</sup> <sup>32-41</sup> Figures 2 and 3 summarize the quality assessment of  
the included studies.

## Main effects of framing

Several studies have reported effects on numerous outcomes. Six studies assessed  
outcomes immediately after the intervention,<sup>32-34</sup> <sup>37</sup> <sup>38</sup> <sup>40</sup> and five studies measured  
actual behavior from four weeks to 12 months of follow-up.<sup>23</sup> <sup>35</sup> <sup>36</sup> <sup>39</sup> <sup>41</sup> The content of  
message intervention primarily focused on healthy behaviors such as physical  
activity, medical adherence, and self-management for patients with chronic disease.  
However, the outcomes measured in the eleven studies were too diverse to analyze  
quantitatively. Supplementary file 3 presents a summary of findings from the studies  
included in this review.

Several studies reported significant main or interactive effects of framing.  
Among the included studies, five studies mainly explored the influence of educational  
intervention based on message framing on self-management behavior and related  
cognitive variables of patients with chronic disease.<sup>23</sup> <sup>32-34</sup> <sup>40</sup> Three of the five studies

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4 showed the advantage of loss framing messages.<sup>32 33 40</sup> Two studies found that  
5 loss-framed message was superior to gain-framed for improving the scores of  
6 intention, attitude, and knowledge of self-management behavior in patients with  
7 diabetes. However, the increase in intention and knowledge scores did not meet the  
8 criteria for statistical difference.<sup>32 33</sup> One study found that loss-framed messages  
9 contributed more knowledge gain than gain-framed patients with chronic pain.<sup>40</sup> On  
10 the other hand, one study found that a gain-framed was slightly superior to a  
11 loss-framed message in sustaining long-term foot care behavior change.<sup>23</sup> Another  
12 study of patients with psoriasis found that when messages focused on long-term  
13 health risk, loss-framed messages were more persuasive to improving in reducing  
14 alcohol intake intention, while messages focused on short-term health risk,  
15 gain-framed messages were more persuasive than loss-framed messages.<sup>34</sup>

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27 Four studies mainly explored the influence of educational intervention based on  
28 message framing on physical activity and related cognitive variables in patients with  
29 chronic disease.<sup>35-37 41</sup> Three of the four studies showed the advantage of loss framing  
30 messages.<sup>35-37</sup> One study found that loss-framed messages contributed more physical  
31 activity gain than gain-framed in patients with diabetes.<sup>35</sup> Furthermore, one study  
32 found that in patients with spinal cord injury, the loss-framed group increased their  
33 physical activity intention than the gain-framed group and the usual care group, while  
34 there was no significant difference between the physical activity intention in the  
35 gain-frame group and the usual care group.<sup>37</sup> One study reported that both gain and  
36 loss-framed messages resulted in more physical activity than at baseline, and  
37 increased more in the loss-framed group, but the difference between the two groups  
38 did not reach statistical significance; neither gain nor loss-framing elicited higher  
39 physical activity intention or attitude.<sup>36</sup> In contrast, one study found that a  
40 gain-framed was slightly superior to a loss-framed message in improving exercise  
41 adherence among patients with cardiovascular disease.<sup>41</sup>

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56 Two studies primarily explored the influence of educational intervention based  
57 on message framing on adherence to medicine and treatment therapy and related

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4 cognitive variables in patients with chronic disease.<sup>38 39</sup> One study reported that  
5 loss-framed messages increased adherence to treatment therapy and self-efficacy  
6 more than gain-framed in patients with cardiovascular disease.<sup>39</sup> Another study found  
7 that when compared to the usual care group, both gain- and loss-framed messages  
8 lead to higher medicine adherence intention and attitude, but without a difference  
9 between the two conditions.<sup>38</sup>

### 15 **Moderator and mediator variables of framing effects**

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18 Several studies focused on moderators and mediators of framing effects. In particular,  
19 Park et al. reported that message framing had a significant indirect impact on  
20 intentions for diabetes self-care behavior, mediated through attitudes and perceived  
21 control, but no significant differences between message framing groups.<sup>32</sup> Grady et  
22 al. performed regression analyses after the intervention. They found that changes in  
23 knowledge predicted changes in attitudes and that both framing and attitudes were  
24 predictors of long-term diabetes self-managemnt behavior.<sup>23</sup> Nevertheless, McCall's  
25 study observed no mediating effects between health belief model constructs and  
26 messages.<sup>41</sup>

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29 Zhao et al. investigated the interaction between frames and individual time  
30 perspective considering future consequences (CFC). They found a significant  
31 interaction between the two, which showed that among high-CFC patients, both gain-  
32 and loss-framed messages heightened medicine adherence intention and attitude  
33 toward no-message control. The message exposure did not affect the two outcomes in  
34 low- and medium-CFC participants.<sup>38</sup>

## 48 **DISCUSSION**

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51 Patients with chronic diseases need to maintain long-term health behaviors to avoid  
52 complications and improve their quality of life. It is necessary to explore the most  
53 effective method of conveying health educational information to patients to minimize  
54 the nurses' workload and improve patients' health behaviors. Message framing, as an

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4 effective message tailoring strategy, provides a new perspective for achieving this  
5 goal by increasing the persuasiveness in promotion of healthy behaviors. Hence, we  
6 summarized the research on the influence of educational interventions based on  
7 message framing on health behavior and related cognitive variables in patients with  
8 long-term illnesses. This research found that most studies showed educational  
9 message intervention based on the gain and loss frame that could effectively improve  
10 health behaviors and cognitive variables such as health behavior knowledge,  
11 intention, attitude, self-efficacy of patients with chronic diseases. Previous studies  
12 have suggested that gain framing is more effective for preventive behavior, but not  
13 concluded in this study. Many of the studies we included in this review showed the  
14 advantage of loss framing messages, but due to the limited number of included  
15 articles and lack of quantitative analysis, this result should be interpreted with caution.  
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28 The persuasion of gain and loss framing appeal seems to be more complicated  
29 than previously thought. Many patients with chronic disease may have low health  
30 awareness and health literacy.<sup>42 43</sup> The loss framing might be more efficacious if  
31 people do not intend to take action in the foreseeable future and are unaware of the  
32 issues related to their behavior.<sup>44</sup> Besides, individuals weigh the benefits of engaging  
33 in healthy behaviors (such as reducing symptoms and improving mood) against the  
34 potential costs (such as the time and effort spent learning a new skill).<sup>40</sup> Individuals  
35 suffering from chronic diseases, who typically have a long history of illness, may  
36 have had a learning history and outcome expectation (e.g., perceived importance) that  
37 may have resulted in an avoidance tendency toward health behavior.<sup>45</sup> Individuals  
38 with a dominant avoidance tendency typically respond more strongly to threat cues,<sup>46</sup>  
39 making them more receptive to loss-framing encouragement.<sup>47</sup> However, no relevant  
40 variables were assessed in this study; we only proposed a research hypothesis that  
41 requires further investigation.  
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55 Fewer studies have explored the potential mechanism of message frames, which  
56 is of great significance for designing and applying message intervention. These  
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4 studies found that attitudes and intentions may act as mediating factors of framing  
5 effect on behavior, consistent with the theory of planned behavior.<sup>23 32 48</sup> A negative  
6 frame may allow patients without behavior change awareness to develop attitudes and  
7 behavioral intentions, thereby promoting behavior. The interaction between message  
8 frame and individual time perspective also suggests that individual factors must be  
9 considered.<sup>38</sup> Matching frames with individual factors may have a greater framing  
10 effect and help to promote the occurrence or maintenance of healthy behaviors. This  
11 is consistent with the view raised by Latimer et al. that the effectiveness of the  
12 message frame may be dependent on the individual's thinking and feeling about  
13 behavior, rather than just the function or nature of the behavior itself.<sup>49 50</sup> Failing the  
14 influence of individual differences on message framing effects may suppress the true  
15 framing effect and underestimate the utility of gain and loss-framed appeals.<sup>49</sup>

### 27 **Limitations**

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30 This review offers critical insights into the impact of message-framed education on  
31 health behaviors of chronic disease patients; however, several limitations have to be  
32 considered. Although we retrieved a considerable amount of literature from the  
33 database, only 11 articles met the inclusion criteria used in the present study. In the  
34 analysis, heterogeneity of different patient samples and health messages, and the  
35 diversity of outcome measurements did not permit a quantitative analysis, limiting the  
36 reliability of conclusions. Furthermore, this review only included research reported in  
37 English, which may exclude some studies; language constraints are also associated  
38 with potential bias in this systematic reviews. Only five studies measured actual  
39 behavior changes, and only six studies just measured changes in cognitive variables  
40 immediately after the intervention. Of course, we know that there is still some  
41 distance between the initiation of behavioral intention to the occurrence and the  
42 maintenance of actual behavior. Hence, future research needs to determine the effects  
43 of message framing on actual behavior through long-term observation or objective  
44 measurement. Few studies have been explored the underlying mechanisms of the  
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3 influence of message framing on behavioral or cognitive variables. Future studies also  
4 need to explore the different effects of message framing according to the advocated  
5 behavior and consider participants' existing beliefs and perceptions about the  
6 behavior.<sup>50,51</sup> However, in general, the included studies have relatively high bias risk  
7 and low methodological quality, limiting the reliability of the results. Therefore, with  
8 these limitations of the present review, interpretation of the results should be made  
9 with caution.  
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### 17 **Implications for nursing**

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19 One of the primary goals of this research is to provide suggestions for nurses and  
20 other healthcare professionals, extend the message framing effect to chronic disease  
21 education interventions and improve patients' health, well-being, and quality of life.  
22 The present findings add to the growing evidence that the way health education  
23 messages are delivered and impacts more than the meaning of the content of  
24 messages. Proper design and delivery of messages can improve the persuasiveness of  
25 education, effectiveness, and efficiency, enabling patients with chronic disease to  
26 adopt and maintain health promotion behaviors. Furthermore, by empowering patients  
27 to be active decision-makers rather than passive nursing recipients, patients' role in  
28 managing health-related issues can be strengthened.  
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### 40 **CONCLUSION**

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42 Message framing can be an effective tool for encouraging health promotion  
43 information to promote health behaviors and beliefs in patients with chronic diseases.  
44 Besides, integration of message framing, especially loss framing into health education  
45 might be a promising strategy for motivating patients with chronic disease to improve  
46 health behaviors and related cognitive variables. However, no firm recommendation  
47 could be made of this study. The best framework for improving the actual health  
48 behavior of patients with chronic disease, as well as its potential moderators and  
49 mediators, need to be studied further and strengthened in to guide health education.  
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## Contributors

RG and FL performed the conception and design of the study, drafting the article or revising it critically for important intellectual content. RG, HG, FL, YL and LX performed the acquisition of data, or analysis and interpretation of data. RG, MS and TY performed the quality assessment. All authors read and final approval of the version to be submitted.

## Acknowledgments

The authors thank the reviewers for their assistance and support.

## Funding

This study was funded by Interdisciplinary Research Funding Program for Doctoral Postgraduates of Jilin University (No. 101832020DJX090).

**Competing interests** We declare no competing interests.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** No additional data are available.

**Ethical Approval Statement** Not applicable

## References

1 World Health Organization. Noncommunicable diseases: key fact. 2018. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Accessed 03/09/2020.

2 World Health Organization. Noncommunicable Diseases: Fact sheets on sustainable development goals: health targets. WHO, 2017.

1  
2  
3  
4 [www.euro.who.int/\\_data/assets/pdf\\_file/0007/350278/Fact-sheet-SDG-NCD-FINAL](http://www.euro.who.int/_data/assets/pdf_file/0007/350278/Fact-sheet-SDG-NCD-FINAL-25-10-17)  
5 [-25-10-17](http://www.euro.who.int/_data/assets/pdf_file/0007/350278/Fact-sheet-SDG-NCD-FINAL-25-10-17).  
6  
7

8 3 Li Y, Wang DD, Ley SH, et al. Time trends of dietary and lifestyle factors and their  
9 potential impact on diabetes burden in China. *Diabetes care*. 2017;40:1685–94.  
10  
11

12 4 Yiengprugsawan VS, Browning CJ. Non-communicable diseases and cognitive  
13 impairment: Pathways and shared behavioral risk factors among older Chinese. *Front*  
14 *Public Health*. 2019;7:296.  
15  
16  
17

18 5 International Diabetes Federation (IDF). IDF diabetes atlas (8<sup>th</sup> ed.), International  
19 Diabetes Federation, Brussels (2017). Available  
20 from:<http://www.diabetesatlas.org/resources/2017-atlas.html>. November 14th, 2017.  
21  
22  
23  
24

25 6 Roser M, Ritchie H. Burden of disease. *Our World in Data*. 2016.  
26 <https://ourworldindata.org/burden-of-disease>. Accessed 03/09/2020.  
27  
28  
29

30 7 Dennis SM, Zwar N, Griffiths R, et al. Chronic disease management in primary  
31 care: from evidence to policy. *Med J Aust* 2008; 188(S8):S53-6.  
32  
33

34 8 Koutsopoulou S, Papathanassoglou ED, Katapodi MC, et al. A critical review of the  
35 evidence for nurses as information providers to cancer patients. *J Clin Nurs*.  
36 2010;19(5-6):749-65.  
37  
38  
39

40 9 American Diabetes Association. Introduction: standards of medical care in  
41 diabetes-2018. *Diabetes Care*. 2018;41(S1):S1–2.  
42  
43  
44

45 10 Jones LW, Sinclair RC, Courneya KS. The effects of source credibility and  
46 message framing on exercise intentions, behaviors, and attitudes: an integration of the  
47 elaboration likelihood model and prospect theory. *Journal of Applied Social*  
48 *Psychology*. 2003;33(1):179–196.  
49  
50  
51  
52

53 11 Collins S. Explanations in consultations: the combined effectiveness of doctors'  
54 and nurses' communication with patients. *Med Educ*. 2005;39(8):785-96  
55  
56  
57  
58  
59

1  
2  
3  
4 12 Coster S, Norman I. Cochrane reviews of educational and self-management  
5 interventions to guide nursing practice: a review. *Int J Nurs Stud.* 2009;46(4):508-28.  
6  
7

8 13 American Association of Colleges of Nursing. Nursing shortage fact sheet. 2008.

9  
10 Accessed March 1, 2009 at

11  
12 <http://www.aacn.nche.edu/Media/FactSheets/NursingShortage.htm>.  
13

14 14 Rothman AJ, Salovey P. Shaping perceptions to motivate healthy behavior: the  
15 role of message framing. *Psychol Bull.* 1997;121(1):3-19  
16  
17

18  
19 15 O'Keefe DJ, Jensen JD. The Advantages of Compliance or the Disadvantages of  
20 Noncompliance? A Meta-Analytic Review of the Relative Persuasive Effectiveness of  
21 Gain-Framed and Loss-Framed Messages. *Annals of the International*  
22 *Communication Association.* 2006;30:1, 1-43.  
23  
24  
25

26  
27 16 O'Keefe DJ, Jensen JD. The Relative Persuasiveness of Gain-Framed Loss-Framed  
28 Messages for Encouraging Disease Prevention Behaviors: A Meta-Analytic Review. *J*  
29 *Health Commun.* 2007;12(7):623-44.  
30  
31  
32

33  
34 17 Kim HK, Lee TK. Conditional Effects of Gain–Loss-Framed Narratives among  
35 Current Smokers at Different Stages of Change. *J Health Commun.*  
36 2017;22(12):990-998.  
37  
38  
39

40  
41 18 Arora R, Stoner C, Arora A. Using framing and credibility to incorporate exercise  
42 and fitness in individuals' lifestyle. *Journal of Consumer Marketing.* 2006; 23:199–  
43 207.  
44  
45

46  
47 19 Gert-Jan de Bruijn. To frame or not to frame? Effects of message framing and risk  
48 priming on mouth rinse use and intention in an adult population-based sample. *J*  
49 *Behav Med.* 2019;42(2):300-314.  
50  
51  
52

53  
54 20 Myers RE. Promoting healthy behaviors: how do we get the message across? *Int J*  
55 *Nurs Stud.* 2010;47(4):500-12.  
56  
57

58 21 Robbins R, Niederdeppe J. Testing the Role of Narrative and Gain-Loss Framing  
59  
60

18

1  
2  
3  
4 in Messages to Promote Sleep Hygiene among High School Students. *J Health*  
5 *Commun.* 2019;24(1):84-93.  
6

7  
8 22 Bernstein MH, Wood MD, Erickson LR. The Effectiveness of Message Framing  
9 and Temporal Context on College Student Alcohol Use and Problems: A Selective  
10 E-Mail Intervention. *Alcohol Alcohol.* 2016;51(1):106-16.  
11  
12

13  
14 23 Grady JL, Entin EB, Entin EE, et al. Using message framing to achieve long-term  
15 behavioral changes in persons with diabetes. *Appl Nurs Res.* 2011;24(1):22-8.  
16  
17

18  
19 24 Lee BJ, Gu MO. Comparison of the effects between positive message and negative  
20 message in diabetes mellitus education. *Korean Diabetes J.* 2009;33:344-52.  
21  
22

23  
24 25 Moher D, Liberati A, Teztlaff J, et al. Preferred reporting items for systematic  
25 reviews and meta-analyses: the PRISMA statement. *Ann Intern Med.*  
26 2009;151(4):264–9.  
27  
28

29  
30 26 Higgins PT, Green S. *Cochrane handbook for systematic reviews of interventions.*  
31 Version 5.1.0 [updated March 2011]. The Cochrane Collaboration. Available at:  
32 <http://www.cochrane-handbook.org>  
33  
34

35  
36 27 Centers for Disease Control and Prevention (CDC), National Center for Chronic  
37 Disease Prevention and Health Promotion. (2019). About chronic diseases. Retrieved  
38 from <https://www.cdc.gov/chronicdisease/about/index.htm>  
39  
40  
41

42  
43 28 Stawnychy MA, Teitelman AM, Riegel B. Caregiver autonomy support: A  
44 systematic review of interventions for adults with chronic illness and their caregivers  
45 with narrative synthesis. *J Adv Nurs.* 2021;77(4):1667-1682.  
46  
47

48  
49 29 Higgins JP, Altman DG, Gøtzsche PC, et al. The Cochrane Collaboration's tool for  
50 assessing risk of bias in randomised trials. *BMJ.* 2011;343:d5928.  
51  
52

53  
54 30 Ryan R, Hill S, Prictor M, et al. *Study Quality Guide.* 2013. Available from:  
55 <http://cccrq.cochrane.org/author-resources>.  
56  
57

1  
2  
3  
4 31 Cunningham AT, Crittendon DR, White N, et al. The effect of diabetes  
5 self-management education on HbA1c and quality of life in African-Americans: a  
6 systematic review and meta-analysis. *BMC Health Serv Res.* 2018;18(1):367.  
7  
8

9  
10 32 Park J, Kim SH, Kim JG. Effects of message framing and health literacy on  
11 intention to perform diabetes self-care: A randomized controlled trial. *Diabetes Res*  
12 *Clin Pract.* 2020;161:108043.  
13  
14

15  
16 33 Paragas ED Jr, Barcelo TI. Effects of message-framed informational videos on  
17 diabetes management knowledge and self-efficacy. *Int J Nurs Pract.*  
18 2019;25(4):e12737  
19  
20  
21

22  
23 34 Keyworth C, Nelson PA, Bundy C, et al. Does message framing affect changes in  
24 behavioral intentions in people with psoriasis? A randomized exploratory study  
25 examining health risk communication. *Psychol Health Med.* 2018;23(7):763-778.  
26  
27  
28

29  
30 35 Li KK, Ng L, Cheng ST, et al. Reverse Message-Framing Effects on  
31 Accelerometer-Assessed Physical Activity Among Older Outpatients With Type 2  
32 Diabetes. *J Sport Exerc Psychol.* 2017;39(3):222-227.  
33  
34  
35

36 36 Hirschev R, Lipkus I, Jones L, et al. Message Framing and Physical Activity  
37 Promotion in Colorectal Cancer Survivors. *Oncol Nurs Forum.* 2016;43(6):697-705.  
38  
39

40  
41 37 Bassett-Gunter RL, Martin Ginis KA, Latimer-Cheung AE. Do You Want the  
42 Good News or the Bad News? Gain- Versus Loss-Framed Messages Following  
43 Health Risk Information: The Effects on Leisure Time Physical Activity Beliefs and  
44 Cognitions. *Health Psychol.* 2013;32(12):1188-98.  
45  
46  
47

48  
49 38 Zhao X, Villagran MM, Kreps GL, et al. Gain Versus Loss Framing in  
50 Adherence-Promoting Communication Targeting Patients With Chronic Diseases:  
51 The Moderating Effect of Individual Time Perspective. *Health Commun.*  
52 2012;27(1):75-85.  
53  
54  
55

56  
57 39 Trupp RJ, Corwin EJ, Ahijevych KL, et al. The Impact of Educational Message  
58  
59

60 20

1  
2  
3  
4 Framing on Adherence to Continuous Positive Airway Pressure Therapy. *Behav Sleep*  
5 *Med.* 2011;9(1):38-52.  
6

7  
8 40 Janke EA, Spring B, Weaver F. The effect of message framing on  
9 self-management of chronic pain: A new perspective on intervention? *Psychol Health.*  
10 2011;26(7):931-47.  
11  
12

13  
14 41 McCall LA, Martin Ginis KA. The Effects of Message Framing on Exercise  
15 Adherence and Health Beliefs Among Patients in a Cardiac Rehabilitation Program.  
16 *Journal of Applied Biobehavioral Research.* 2004;9(2):122-135.  
17  
18

19  
20 42 Kim SH, Song Y, Park J, Utz S. Patients' Experiences of Diabetes  
21 Self-Management Education According to Health-Literacy Levels. *Clin Nurs Res.*  
22 2020; 29(5):285-292.  
23  
24

25  
26 43 Coskun S, Bagcivan G. Associated factors with treatment adherence of patients  
27 diagnosed with chronic disease: Relationship with health literacy. *Appl Nurs Res.*  
28 2021;57:151368.  
29  
30

31  
32 44 Prochaska JO, Redding CA, Evers KE. The transtheoretical model and stages of  
33 change. In: *Heal. Behav. Heal. Educ. Theory, Res. Pract.* 4th ed., San Francisco, CA,  
34 US: Jossey-Bass; 2008, p. 97-121.  
35  
36

37  
38 45 Leeuw M, Goossens M, Linton S, et al. The fear-avoidance model of  
39 musculoskeletal pain: Current state of scientific evidence. *Journal of Behavioral*  
40 *Medicine.* 2007;30: 77-94.  
41  
42

43  
44 46 Carver CS, Sutton SK, Scheier MF. Action, emotion, and personality: Emerging  
45 conceptual integration. *Personality and Social Psychology Bulletin.* 2000;26(6): 741–  
46 751.  
47  
48

49  
50 47 Mann T, Sherman D, Updegraff J. Dispositional motivations and message framing:  
51 A test of the congruency hypothesis in college students. *Health Psychol.*  
52 2004;23(3):330-4.  
53  
54

55  
56  
57  
58  
59  
60 21

1  
2  
3  
4 48 Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*  
5 1991;50:179–211.  
6

7  
8 49 Latimer AE, Brawley LR, Bassett RL. A systematic review of three approaches for  
9 constructing physical activity messages: What messages work and what  
10 improvements are needed? *Int J Behav Nutr Phys Act.* 2010;7:36.  
11  
12

13  
14 50 Werrij MQ, Ruiters RA, Van 't Riet J, et al. Self-efficacy as a potential moderator  
15 of the effects of framed health messages. *J Health Psychol.* 2011;16(2):199-207.  
16  
17

18  
19 51 Lee AY, Aaker JL. Bringing the frame into focus: the influence of regulatory fit on  
20 processing fluency and persuasion. *J Pers Soc Psychol.* 2004;86(2):205-18.  
21  
22

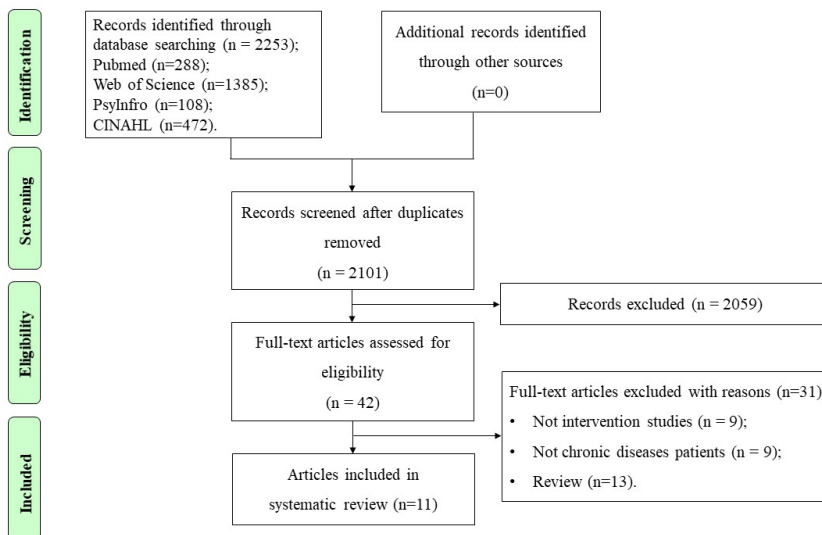
## 23 24 25 26 **Figure legends**

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29 **Figure 1: PRISMA flowchart<sup>25</sup>**

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32 **Figure 2: Risk of bias assessment**

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35 **Figure 3: Risk of bias summary**





7 Figure 1 Flowchart of the literature search

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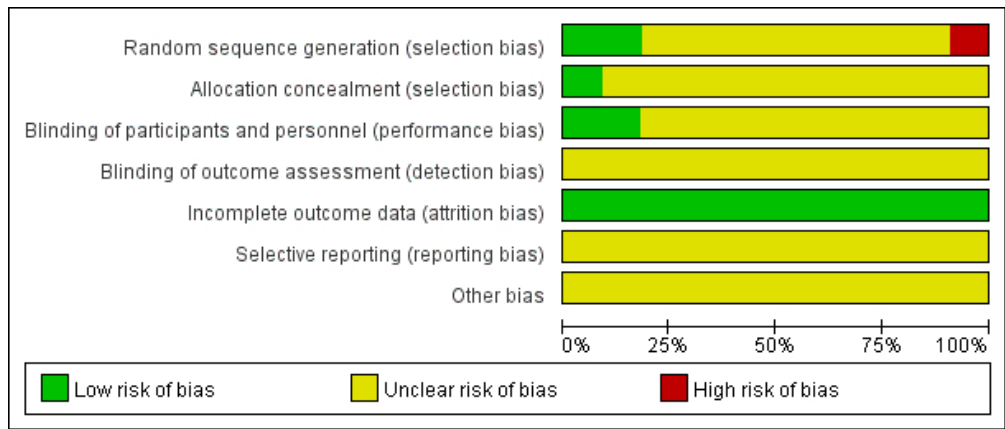


Figure 2 Risk of bias assessment

213x90mm (72 x 72 DPI)

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Bassett 2013	+	?	?	?	+	?	?
Grady 2011	?	?	?	?	+	?	?
Hirschey 2016	?	?	?	?	+	?	?
Janke 2011	?	?	?	?	+	?	?
Keyworth 2018	?	?	?	?	+	?	?
Li 2017	?	?	?	?	+	?	?
McCall 2004	?	?	?	?	+	?	?
Paragas 2019	-	?	+	?	+	?	?
Park 2020	+	+	?	?	+	?	?
Trupp 2011	?	?	+	?	+	?	?
Zhao 2012	?	?	?	?	+	?	?

Figure 3 Risk of bias summary

111x236mm (72 x 72 DPI)

**Supplementary file 1: Search strategy**

This Supplementary file provides the search strategy details, performed March 26, 2021.

1. Pubmed	
#1	Search: (((((((((((message framing[Title/Abstract]) OR (message fram*[Title/Abstract])) OR (information framing[Title/Abstract])) OR (information fram*[Title/Abstract])) OR (gain-framed[Title/Abstract])) OR (loss-framed[Title/Abstract])) OR (gain fram*[Title/Abstract])) OR (loss fram*[Title/Abstract])) OR (positive frame[Title/Abstract])) OR (positive fram*[Title/Abstract])) OR (negative frame[Title/Abstract])) OR (negative fram*[Title/Abstract])) OR (goal fram*[Title/Abstract])) OR (framing effect*[Title/Abstract])
#2	Search: (((((((((((((((((((((((Heart disease[MeSH]) OR (Cardiovascular disease[MeSH])) OR (Heart Failure[MeSH])) OR (Hypertension[MeSH])) OR (Stroke[MeSH])) OR (Diabetes Mellitus[MeSH])) OR (Metabolic syndrome[MeSH])) OR (Neoplasms[MeSH])) OR (Pulmonary Disease, Chronic Obstructive[MeSH])) OR (Lung Diseases[MeSH])) OR (Alzheimer disease[MeSH])) OR (Dementia[MeSH])) OR (Asthma[MeSH])) OR (Hepatitis[MeSH])) OR (Fatty Liver[MeSH])) OR (Kidney diseases[MeSH])) OR (Pain[MeSH])) OR (Psoriasis[MeSH])) OR (Fibromyalgia[MeSH])) OR (Multiple Sclerosis[MeSH])) OR (Arthritis[MeSH])) OR (Osteoporosis[MeSH])) OR (((Noncommunicable Diseases[MeSH]) OR (Comorbidity[MeSH])) OR (Multimorbidity[MeSH])) OR (Chronic disease[MeSH])) OR (Chronic illness[MeSH]))
#3	Search: (((((((((((((((((((((((((((((((((((non communicable[Title/Abstract]) OR (noncommunicable[Title/Abstract])) OR (NCD[Title/Abstract])) OR (comorbidity[Title/Abstract])) OR (multimorbidity[Title/Abstract])) OR (chronic disease[Title/Abstract])) OR (chronic condition[Title/Abstract])) OR (chronic illness[Title/Abstract])) OR (long term condition[Title/Abstract])) OR (long term ill[Title/Abstract])) OR (cardi*[Title/Abstract])) OR (heart disease[Title/Abstract])) OR (cardiovascular disease[Title/Abstract])) OR (Heart Failure[Title/Abstract])) OR (high blood pressure[Title/Abstract])) OR (hypertension[Title/Abstract])) OR (Stroke[Title/Abstract])) OR (diabet*[Title/Abstract])) OR (Diabetes[Title/Abstract])) OR (metabolic syndrome[Title/Abstract])) OR (cancer[Title/Abstract])) OR (neoplasm[Title/Abstract])) OR (chronic obstructive pulmonary disease[Title/Abstract])) OR (chronic respir*[Title/Abstract])) OR (Lung Diseases[Title/Abstract])) OR (respiratory disease*[Title/Abstract])) OR (Alzheimer disease[Title/Abstract])) OR (dementia[Title/Abstract])) OR (psoriasis[Title/Abstract])) OR (Asthma[Title/Abstract])) OR (Hepatitis[Title/Abstract])) OR (Fatty Liver[Title/Abstract])) OR (Kidney disease*[Title/Abstract])) OR (Pain[Title/Abstract])) OR (Fibromyalgia[Title/Abstract])) OR (multiple sclerosis[Title/Abstract])) OR (Arthritis[Title/Abstract])) OR (Osteoporosis[Title/Abstract])
#4	#2 OR #3
#5	#1 AND #4 Filters: English

	Items found: 288
<b>2. Web of Science</b>	
#1	message framing (TS) or message fram* (TS) or information framing (TS) or information fram* (TS) or gain-framed (TS) or loss-framed (TS) or gain fram* (TS) or loss fram* (TS) or positive frame (TS) or positive fram* (TS) or negative frame (TS) or negative fram* (TS) or goal fram* (TS) or framing effect* (TS)
#2	non communicable (TS) or noncommunicable (TS) or NCD (TS) or comorbidity (TS) or multimorbidity (TS) or chronic disease (TS) or chronic condition (TS) or chronic illness (TS) or long term condition (TS) or long term ill (TS) or cardi* (TS) or heart disease (TS) or cardiovascular disease (TS) or Heart Failure (TS) or high blood pressure (TS) or hypertension (TS) or Stroke (TS) or diabet* (TS) or Diabetes (TS) or metabolic syndrome (TS) or cancer (TS) or neoplasm (TS) or chronic obstructive pulmonary disease (TS) or chronic respir* (TS) or Lung Diseases (TS) or respiratory disease* (TS) or Alzheimer disease (TS) or dementia (TS) or psoriasis (TS) or Asthma (TS) or Hepatitis (TS) or Fatty Liver (TS) or Kidney disease* (TS) or Pain (TS) or Fibromyalgia (TS) or multiple sclerosis (TS) or Arthritis (TS) or Osteoporosis (TS)
#3	#1 AND #2 Filters: English; Not conference abstract/review Items found: 1385
<b>3. CINAHL</b>	
S1	TI message framing OR TI negative fram* OR TI negative frame OR TI information framing OR TI message fram* OR TI information fram* OR TI loss-framed OR TI gain fram* OR TI gain-framed
S2	TI loss fram* OR TI positive frame OR TI positive fram* OR TI goal fram* OR TI framing effect*
S3	AB message framing OR AB message fram* OR AB information framing OR AB gain-framed OR AB information fram* OR AB loss-framed OR AB gain fram* OR AB loss fram*
S4	AB positive frame OR AB positive fram* OR AB negative fram* OR AB negative frame OR AB goal fram* OR AB framing effect*
S5	S1 OR S2 OR S3 OR S4
S6	TI non communicable OR TI noncommunicable OR TI NCD OR TI comorbidity OR TI multimorbidity OR TI chronic illness OR TI long term ill OR TI chronic disease OR TI long term condition OR TI chronic condition OR TI cardi* OR TI heart disease
S7	AB non communicable OR AB NCD OR AB noncommunicable OR AB comorbidity OR AB multimorbidity OR AB chronic illness OR AB chronic disease OR AB chronic condition OR AB long term condition OR AB long term ill OR AB cardi* OR AB heart disease
S8	TI cardiovascular disease OR TI high blood pressure OR TI hypertension OR TI Heart Failure OR TI Stroke OR TI diabet* OR TI Diabetes OR TI metabolic syndrome OR TI chronic obstructive pulmonary disease OR TI chronic respir* OR TI cancer OR TI neoplasm
S9	AB cardiovascular disease OR AB Heart Failure OR AB high blood pressure OR AB hypertension OR AB Stroke OR AB diabet* OR AB Diabetes OR AB metabolic

	syndrome OR AB cancer OR AB neoplasm OR AB chronic obstructive pulmonary disease OR AB chronic respir*
S10	TI Lung Diseases OR TI respiratory disease* OR TI Alzheimer disease OR TI dementia OR TI psoriasis OR TI Asthma OR TI Hepatitis OR TI Fatty Liver OR TI Kidney disease* OR TI Pain OR TI Fibromyalgia OR TI multiple sclerosis
S11	AB Lung Diseases OR AB respiratory disease* OR AB Asthma OR AB Kidney disease* OR AB Alzheimer disease OR AB dementia OR AB psoriasis OR AB Hepatitis OR AB Fatty Liver OR AB Pain OR AB Fibromyalgia OR AB multiple sclerosis
S12	TI Arthritis OR TI Osteoporosis OR AB Arthritis OR AB Osteoporosis
S13	S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12
S14	S5 AND S13 Filter: English, Human, Adult Items found: 472
<b>4. PsycINFO</b>	
S1	TI message framing OR TI message fram* OR TI information framing OR TI information fram* OR TI loss-framed OR TI gain-framed OR TI gain fram* OR TI loss fram* OR TI positive frame OR TI positive fram* OR TI negative frame OR TI negative fram*
S2	AB message framing OR AB message fram* OR AB information framing OR AB information fram* OR AB loss-framed OR AB gain-framed OR AB gain fram* OR AB loss fram* OR AB positive frame OR AB positive fram* OR AB negative frame OR AB negative fram*
S3	AB goal fram* OR AB framing effect* OR TI goal fram* OR TI framing effect*
S4	S1 OR S2 OR S3
S5	TI non communicable OR TI noncommunicable OR TI NCD OR TI comorbidity OR TI multimorbidity OR TI chronic disease OR TI long term condition OR TI chronic condition OR TI chronic illness OR TI long term ill OR TI cardi* OR TI heart disease
S6	AB non communicable OR AB noncommunicable OR AB NCD OR AB comorbidity OR AB multimorbidity OR AB chronic disease OR AB long term condition OR AB chronic condition OR AB chronic illness OR AB long term ill OR AB cardi* OR AB heart disease
S7	AB cardiovascular disease OR AB Heart Failure OR AB high blood pressure OR AB hypertension OR AB Stroke OR AB diabet* OR AB Diabetes OR AB metabolic syndrome OR AB cancer OR AB neoplasm OR AB chronic obstructive pulmonary disease OR AB chronic respir*
S8	TI cardiovascular disease OR TI Heart Failure OR TI high blood pressure OR TI hypertension OR TI Stroke OR TI diabet* OR TI Diabetes OR TI metabolic syndrome OR TI cancer OR TI neoplasm OR TI chronic obstructive pulmonary disease OR TI chronic respir*
S9	TI Lung Diseases OR TI respiratory disease* OR TI Alzheimer disease OR TI dementia OR TI psoriasis OR TI Asthma OR TI Hepatitis OR TI Fatty Liver OR TI Kidney disease* OR TI Pain OR TI Fibromyalgia OR TI multiple sclerosis
S10	AB Lung Diseases OR AB respiratory disease* OR AB Alzheimer disease OR AB dementia OR AB psoriasis OR AB Asthma OR AB Hepatitis OR AB Fatty Liver OR AB

	Kidney disease* OR AB Pain OR AB Fibromyalgia OR AB multiple sclerosis
S11	AB Arthritis OR AB Osteoporosis OR TI Arthritis OR TI Osteoporosis
S12	S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11
S13	S4 AND S12 Filter: English, Human, Adult Items found: 108

For peer review only

## Supplementary file 2: Characteristics of studies included in this systematic review.

Authors Year Design	Population	Group	Sample Size (M/F) Age (years)	Key component of intervention		
				Content	Frame	Format/ Dose
Park <sup>32</sup> 2020 RCT	Diabetes	Gain- frame	26 (10/16) 65.65±10.61	Content pertaining to diabetic complications in diabetes.	Gain framing presented positive outcomes resulting from adherence to a diabetes care regimen, showing a patient success story about proper diabetes self-care.	Video 1
		Loss- frame	26 (6/20) 64.92±12.21		Loss framing presented undesirable consequences resulting from failure to comply with a diabetes care regimen, showing a story about a patient with diabetic complications caused by inadequate diabetes self-care.	
Paragas <sup>33</sup> 2019 Quasi- experim ental study	Diabetes	Gain- frame	55 (25/30) 58.95±10.25	Definition of diabetes, teachings about blood glucose monitoring; proper diet and exercise; oral hypoglycemic agents; recognition, treatment, and prevention of hypoglycemia and hyperglycemia.	Gain-framed video comprised 10 positive outcomes of adherence to diabetes self-care in the last scenes of videos, e.g. one statement was “If you maintain good control of your blood glucose, the acid in your blood will be normal, and being comatose will be prevented,” with a scene showing a healthy person.	Video/ Lecture 1
		Loss- frame	55 (25/30) 58.60±10.23		Loss-framed video contained 10 negative outcomes of non-adherence in the last scenes of videos, e. g. one version was “If you do not maintain good control of your blood glucose, the acid in your blood will be elevated that could lead to being comatose,” with a scene showing a comatose patient.	
		No- frame	55 (24/31) 58.96±9.74		Standard approach of providing health teachings about diabetes self-care, with no message framing.	
Keyworth <sup>34</sup> 2018 RCT	Psoriasis	Gain- frame	217(75/126) 41.23±14.31	Information about the effects of health behavior change on either psoriasis symptoms or CVD risk.	Gain-framed message addressed the positive outcomes for adherence to the health behaviors, e. g. “Research shows that risk factors for cardiovascular disease include smoking, having a poor diet, having insufficient physical activity, and drinking excessive amounts of alcohol. By making changes to your lifestyle, you [lower] your risk of cardiovascular disease.”	Sheet 1
		Loss- frame			Loss-framed message addressed the negative outcomes for not adherence to the health behaviors, e. g. “Research shows that risk factors for cardiovascular disease include smoking, having a poor diet, having insufficient physical activity, and drinking excessive amounts of alcohol. By [not] making changes to your lifestyle, you [increase] your risk of cardiovascular disease.”	
Li <sup>35</sup>	Diabetes	Gain-	211	The pamphlet included a brief	Gain-framed pamphlet contained the benefits of PA participation, including physical (11 items: e.g., improve	Pamphlet



2017 RCT		frame	(101/110) 71.41±6.80	description of PA participation in Hong Kong, the recommended PA level.	muscle strength), psychological (8 items: e.g., improve mood), and social (4 items: expand social network) domains.	1
		Loss-frame			Loss-framed pamphlet contained the absence of benefits of PA participation. The contents of the benefits were identical between the gain- and loss-framed messages, with differences only in the framing of the messages.	
Hirschey <sup>36</sup> 2016 RCT	CRC	Gain-frame	78 (36/42) 64.3 (29.9–98.4)	Tips on how to become more physically active with examples of activities of MIPA; protective influence of PA on CRC co-morbid conditions; inverse relationship between PA and risk of cancer-specific mortality and all-cause mortality.	Gain-framed version addresses the benefits of being physically active.	Pamphlet / taken home to read
		Loss-frame	70 (35/35) 65.4 (43.2–88.5)		Loss-framed version addresses the disadvantages of not being physically active.	
Bassett <sup>37</sup> 2013 RCT	SCI	Gain-frame	94 (57/37) 45±12	Benefits or risks quotations from SCI experts and patients and research evidence.	Gain-framed messages outlined the benefits of engaging in regular LTPA (i.e. Adding LTPA to your day can help you manage your pain gain framed)	Online message 1
		Loss-frame			Loss-framed messages outlined the risks of not engaging in regular LTPA. (i.e., By not adding LTPA to your day you miss an opportunity to manage your pain)	
		No-frame		Usual care	The control group did not receive any additional information.	
Zhao <sup>38</sup> 2012 RCT	Chronic diseases	Gain-frame	1108 (411/697)	Messages addressing perceived need and perceived concerns about medications, messages content was held the same across the two frames.	Gain-framed messages outlined the benefits of adherence to medication taking (i.e. You may wonder whether you really need your prescription medication. But taking your medicine as directed is very important even if you don't feel sick. It's the first step toward long-term health. Talk to your doctor about your medicine and changes you can make to your lifestyle to help manage your condition.)	Online message 1
		Loss-frame			40-85	

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		No-frame		Usual care	The control group did not receive any additional information.	
Trupp <sup>39</sup> 2011 RCT	CVD with OSA	Gain-frame	26 (19/7) 29-74	A brief, about 50 seconds educational video about CPAP was provided.	Gain-framed video positively focused on the benefits associated with CPAP use.	Video 1
		Loss-frame	29 (17/12) 38-77		Loss-framed video negatively emphasized the negative consequences that may occur if CPAP was not worn as directed.	
Janke <sup>40</sup> 2011 RCT	Chronic pain	Gain-frame	62 (61/1) 50	Messages stressed the importance of the patient playing an active role in their pain care and techniques could use to help manage pain.	Gain-framed messages emphasized the gains patients would make if they engage in these behaviors.	Pamphlet 1
		Loss-frame			Loss-framed messages focused on the losses they would realize if they did not do these things.	
Grady <sup>23</sup> 2011 RCT	Diabetes	Gain-frame	155 (64 /91) 61.2±11.4	The video addressed topics about foot care such as cleaning procedures, toenail care, footwear use, and foot and footwear inspection procedures.	Gain-framed version offered the positive outcome that can accrue by appropriate foot care, e.g. “Good foot care can help you avoid the serious complications of nerve and blood vessel damage, and keep your feet healthy” (with a picture of healthy feet).	Video 1
		Loss-frame			Loss-framed version offered the negative outcome that can accrue if the desired behavior is not followed, e.g. “Poor foot care can lead to the serious complications of nerve and blood vessel damage, and unhealthy feet” (with a picture of a foot with an infected sore).	
McCall <sup>41</sup> 2004 RCT	CVD	Gain-frame	16 (15/1)	Statements regarding the effects of exercise in relation to CAD.	Gain-framed condition listed 10 gain-framed statements regarding the benefits of exercise in relation to the progression of CAD. (i.e., Regular exercise will help you maintain a healthy body weight.)	Sheet /taken home to read
		Loss-frame	13 (12/1)		Loss-framed condition with the same 10 statements phrased in a loss-framed manner. (i.e., By not exercising regularly, you decrease your chances of keeping a healthy body weight.)	
		No-frame	20 (19/1)	Usual care	The control group did not receive any additional information.	

Abbreviations: CAD: Coronary artery diseases; CRC: Colorectal cancer; CVD: Cardiovascular disease; LTPA: Leisure time physical activity; MIPA: Moderate intensity physical activity; NR: Not report; OSA: Obstructive sleep apnea; PA: Physical activity; RCT: Randomized controlled trial; SCI: Spinal cord injury; T2D: Type 2 diabetes.

**Supplementary file 3: Summary of findings of studies included in this systematic review.**

Authors Year	Outcome measures and collection time	Main findings	Mediators/Moderators
Park <sup>32</sup> 2020	Attitudes, perceived control and intentions for diabetes self-care behavior. All measured at post-intervention.	Attitudes: Loss-framed group improved more; Perceived control: Loss-framed group improved more; Intentions: Both conditions produced significant increases, but no group difference.	Significant indirect effect of message framing on intentions for diabetes self-care behavior mediated through attitudes and perceived control. No significant interaction effects were observed between health literacy level and message framing.
Paragas <sup>33</sup> 2019	Diabetes self-management knowledge and self-efficacy. All measured at pre- and post-intervention.	Knowledge: Both loss-framed and gain framed group improved more, but no difference between the two; Self-efficacy: Both loss- and gain- framed group improved, and gain framed group improved more.	NR
Keyworth <sup>34</sup> 2018	Self-care behavior intention. Measured at post-intervention.	Intention: Messages focused on short-term health risk, gain-framed messages more persuasive than loss-framed messages; messages about long-term health risk, loss-framed message more persuasive than gain-framed message	A significant frame by focus interaction was found for behavioral intention to reduce alcohol intake.
Li <sup>35</sup> 2017	PA. Measured at pre-intervention and 2-week follow up: PA.	PA: Loss-framed group improved more.	NR
Hirschey <sup>36</sup> 2016	PA, attitudes, subjective norms, perceived behavioral control, intention. PA and intention were measured at pre- and post-intervention, 1-and 12-months follow up; Attitudes, subjective norms and perceived behavioral control measured at pre-intervention and 1-month follow up.	PA: Both conditions produced significant increases in PA, with no differences between framing conditions; TPB constructs: Neither the gain- nor loss-framed brochures produced significant changes from baseline to the 1- and 12-months follow-up.	NR
Bassett <sup>37</sup> 2013	PA response efficacy and intention. All measured at pre- and post-intervention.	LTPA response efficacy: Loss-framed condition increased more than gain-framed and control conditions, no difference	NR

		between gain-framed and control conditions; Intention: Loss-framed condition increased more than gain-framed and control conditions, no difference between gain-framed and control conditions.	
Zhao <sup>38</sup> 2012	Medicine adherence intention and attitude. All measured at post-intervention.	Intention: Gain- and loss-framed messages improved more than control, no difference between gain- and loss-framed conditions; Attitude: Gain- and loss-framed messages improved more than control, no difference between gain- and loss-framed conditions.	Significant interaction between frames and CFC, among high-CFC patients, both gain- and loss-framed messages heightened intention and attitude with respect to the no-message control, gain frame showed a consistent superior to the loss frame. Message exposure had not effect on the two outcomes for low-and medium-CFC participants.
Trupp <sup>39</sup> 2011	Adherence to CPAP, self-efficacy. CPAP use was measured at post-intervention; Self-efficacy was measured at pre- and post-intervention.	CPAP use: Loss-framed group improved more; Self-efficacy: Both conditions improved, Loss-framed group improved more than gain-framed group.	NR
Janke <sup>40</sup> 2011	Knowledge, pain self-efficacy, pain readiness to change, pain self-management behavioral skills. Pain self-efficacy, pain readiness to change were measured at pre-intervention; Knowledge, pain self-management behavioral skills were measured at post-intervention.	Knowledge: Loss-framed group improved more; Confidence to practice relaxation: Loss-framed group improved more.	Pain self-efficacy, pain readiness to change and message frame independently influenced motivation to engage in relaxation. There were no observed interactions between message frame and either self-efficacy or readiness to change.
Grady <sup>23</sup> 2011	Knowledge, attitude, foot care behaviors. Knowledge and attitude were measured at pre- and post-intervention, 3- and 6-month follow-ups; Foot care behaviors were measured at pre-intervention, 3- and 6-month follow-ups.	Foot care behaviors: Gain-framed group improved more.	Attitude and framing are significant predictors of 6-months behavior, gain framing positively related to long-term behavior; knowledge affects attitudes, in turn, attitudes affect behavior.

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15</p> <p>McCall <sup>41</sup> 2004</p>	<p>Adherence to exercise, health belief cognitions (perceived susceptibility, benefits and barriers). Adherence to exercise was measured at 3-months follow-ups; Health belief cognitions were measured at post-intervention.</p>	<p>Adherence to exercise: Gain-framed condition attended more exercise sessions than control; loss-framed group attend more exercise, but no difference with control; Perceived susceptibility: Gain- and loss-framed conditions perceived more susceptibility than control; Perceived barriers: Loss-framed condition perceived greater barriers than gain-framed and control conditions; Perceived benefits: No difference among the three conditions.</p>	<p>HBM constructs did not mediate the effects of the educational messages.</p>
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Abbreviations: CFC: Consideration of future consequences; CPAP: Continuous positive airway pressure; HBM: Health belief model; LTPA: Leisure time physical activity; NR: Not report; PA: Physical activity; TPB: Theory of planned behavior.



# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1,2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	5
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5,6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	none
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I <sup>2</sup> ) for each meta-analysis.	none



# PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	none
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	none
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6,7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	7,8
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	8
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	8,9,10
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	none
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	none
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	9,10,11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	14

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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Page 2 of 2

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