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SPORTS & EXERCISE | REVIEW ARTICLE

The effects of message framing characteristics on physical activity education: A systematic review

Jayde Williams^{1*}, Melissa Saken¹, Suzanne Gough¹ and Wayne Hing¹

Abstract: Physical activity is important to prevent chronic disease and improve mental health. Physical activity education needs to be delivered in an efficient, effective and persuasive way by health professionals to increase participation. Message framing can be used to influence health decision-making and motivate behavior change. This systematic review investigates the influence of different message framing characteristics on potential physical activity participation. A search of relevant databases, reference lists and grey literature was performed. Systematic review was performed. Thirteen studies met the inclusion criteria. The majority of participants were healthy adults with the exception of one study who included overweight people. All studies investigated gain and loss as well as at least one other message framing characteristic and how this influenced physical activity participation. The other characteristics included: source credibility (n = 4), presentation of affect (n = 1), number of arguments (n = 1), type of activity (n = 1), narrative versus statistical (n = 3), intrinsic versus extrinsic motivation (n = 1), social endorsement (n = 1), kernel type (n = 1) and ease of imagination (n = 2). There is no consistent consensus for the best message frame to increase physical activity participation. Further research is needed.

ABOUT THE AUTHOR

Jayde Williams is a recent Doctor of Physiotherapy graduate from Bond University. Prior to this she studied a Bachelor of Exercise and Sport Science at Bond University. In addition to this review, Jayde has also investigated whether appearance or health-based message framing motivates physical activity participation. She has a passion for educating the public on the benefits of physical activity to improve participation.

PUBLIC INTEREST STATEMENT

Participating in exercise is an important activity to maintain good physical and mental health. As a result, health professionals such as doctors, physiotherapists and exercise physiologists attempt to educate the public about the benefits of exercise to increase participation. This review investigates the way education is delivered and whether there is different ways education can be framed to influence a person to increase their exercise participation. Positive education was found to be more effective than negative education. Other important factors were the credibility of the person delivering the education and the amount of education delivered at once. Interestingly, the amount of effort required for the type of exercise being promoted made a difference, as well as the type of background picture used for written education. Despite this, more research is needed in this area to formulate a clear guideline for health professionals so assist them with exercise education.

Subjects: Sports and Leisure; Sport and Exercise Science; Exercise Psychology; Exercise Therapy; Educational Psychology; Physiotherapy and Sports Medicine; Preventative Medicine; Behavioral Medicine; Health Communication; Health Education and Promotion

Keywords: Physical activity; message framing; gain and loss; behavior; characteristic; psychology; health; communication; exercise; education

1. Introduction

Physical activity is an important behavior used to prevent chronic disease (Cardinal, Park, Kim, & Cardinal, 2015) and improve mental health (Wright & Zhao, 2018). Health professionals play an important role in providing education about lifestyle modifications (Cardinal et al., 2015). However, the way the education is presented determines the impact it has on behavior change. Informative messages need to be framed appropriately to influence decision-making and maximize their impact (Rothman & Salovey, 1997).

Physical inactivity has become a global issue whereby the World Health Organisation (WHO; World Health Organisation [WHO], 2018) has urged action to occur at a global, regional and local level in order to increase participation in physical activity by all ages. According to the Australian Institute of Health and Welfare (AIHW; Australian Institute of Health and Welfare [AIHW], 2018), only 19% of adults between the ages of 18 and 64 met both the physical activity and strength guidelines in 2014–15. The continuous trend towards physical inactivity has been attributed to decreased exercise participation during leisure time, increased sedentary behavior and powered transportation (WHO, 2018).

Physical activity is considered a preventative behavior with many benefits including: improved fitness and bone health, reduced risk of hypertension, cardiovascular disease, diabetes, stroke, depression, cancer and falls as well as maintaining a healthy weight (WHO, 2018). The WHO (2018) recommends raising awareness of the benefits of physical activity through the use of mass media. Whether education is being communicated using mass media or by local health professionals, it is important that the information is being delivered in an efficient, effective and persuasive way in order to affect behavior change.

Message framing can be used to influence health decision-making and motivate behavior change (Rothman & Salovey, 1997). Health messages can be gain-framed outlining the benefits of engagement (i.e. regular physical activity will decrease the risk of heart disease) or loss-framed outlining the consequences of failing to engage (i.e. not participating in regular physical activity will increase the risk of heart disease) in certain behaviors.

The type of behavior being targeted in the message determines the most appropriate frame to use. For behaviors which are preventative (e.g. sunscreen application, flossing, smoking cessation and physical activity) gain-framed messages are found to be more effective whilst behaviors which are detective (i.e. mammograms, skin checks, colorectal cancer screening and HIV testing) loss framed messages are more effective (Salovey, Schneider & Apanovitch, 2002).

This “prevention-detection distinction” is based on risk or perceived uncertainty (Salovey et al., 2002). Prevention behaviors are considered low risk as they deter health problems and detection behaviors are considered high risk because they screen for potential health problems (Salovey et al., 2002).

How a message is framed in terms of gains and losses is not the only characteristic which may impact how the reader is influenced. There are many different behavioral theories which can be used to help facilitate the design of an exercise message including: transtheoretical model (Prochaska & Velicer, 1997), protection motivation theory (Robberson & Rogers, 1988), social cognitive theory (Bandura, 1986), theory of planned behavior (Ajzen, 1991), prospect theory

(Tversky & Kahneman, 1992), regulatory focus theory (Higgins, 1997; Higgins & Silberman, 1998), persuasion theory and elaboration likelihood model of persuasion effects (Petty & Cacioppo, 1986).

In addition to gain and loss message framing the literature has attempted to determine other message design elements and their influence on physical activity intentions. These include: source credibility (Arora, Stoner, & Arora, 2006; Borah & Xiao, 2018; Jones, Sinclair, & Courneya, 2003; Jones, Sinclair, Rhodes, & Courneya, 2004) presentation of affect, number of arguments (McCormick & McElroy, 2009), type of activity (Hsu & Vlaev, 2014), narrative versus statistical (Gray & Harrington, 2011; Jacks & Lancaster, 2015; Wirtz & Kulpavaropas, 2014) intrinsic versus extrinsic motivation (Gallagher & Updegraff, 2011), social endorsement (Borah & Xiao, 2018), kernel type (De Bruijn, Out, & Rhodes, 2014) and ease of imagination (Berry & Carson, 2010; Broemer, 2004).

As a health professional, it is difficult to determine the most important elements of message framing to positively impact physical activity participation. The aim of this review is to determine the influence of different message framing characteristics on potential physical activity participation.

2. Materials and methods

2.1. Search strategy

To determine relevant studies, a multi-step search was completed in August 2018 from the following databases: PubMed, SPORTDiscus, EconLit, PsycINFO and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Additionally, hand searches were conducted to identify additional studies from reference lists and Google Scholar. A broad search strategy was completed using the concepts “loss aversion” and “message framing” for all databases and additional concepts “health”, “behaviour” and “psychology” for EconLit as it is not a health database.

2.2. Eligibility criteria

2.2.1. Types of participants

This review considered studies with human participants aged 16 years and older with both healthy and unhealthy backgrounds because physical activity is important for both prevention and treatment of disease (Booth, Roberts, & Laye, 2012; Thornton et al., 2016). These studies included participants with a varying degree of physical activity backgrounds.

2.2.2. Types of interventions/methods

Pre-test/post-test, post-test follow up and post-test only studies measuring the effectiveness of physical activity messages were included. This review included studies which compared gain and loss with another set of message framing characteristics (e.g. credibility of source). Comparisons with a personal trait (e.g. self-efficacy) were excluded, despite the importance of these factors on how a message may be interpreted, this review focused on the message itself.

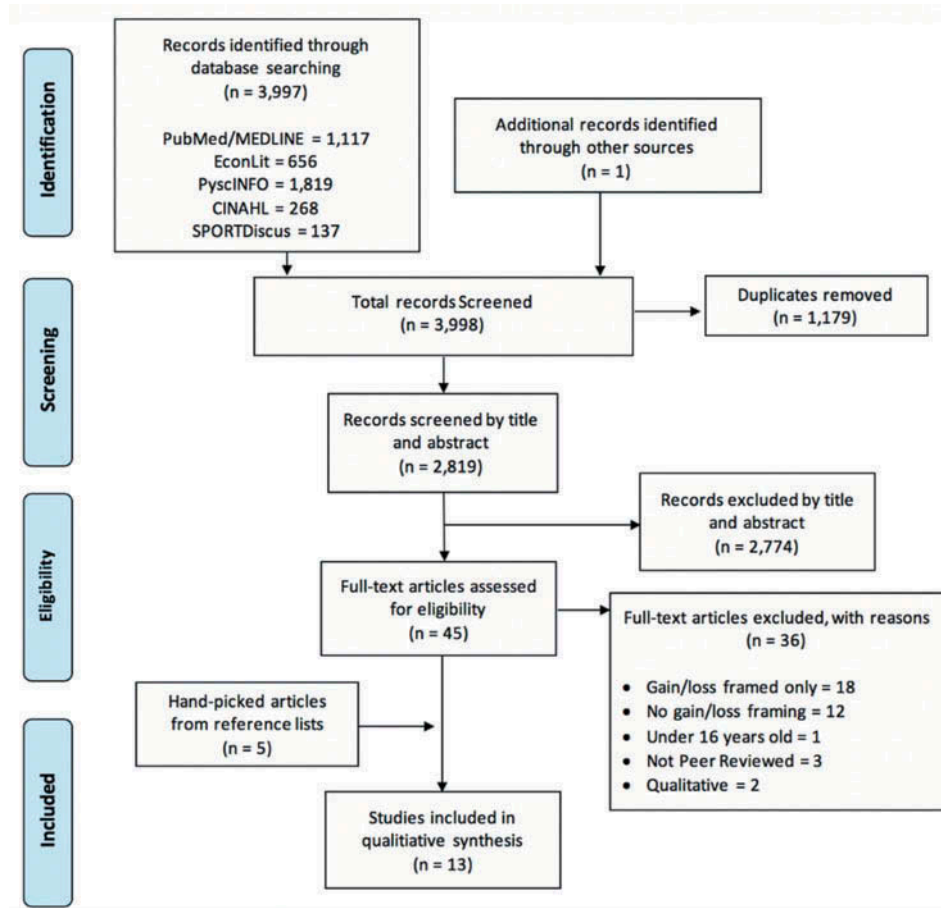
2.2.3. Types of studies

This review considered all studies which were published, and peer reviewed with full text available online including randomised controlled trials and randomised clinical trials using a between-patient and/or between group method. Unpublished dissertations were excluded from analysis.

2.3. Data collection

Reference management software (EndNote [computer program], 2018) was used to collate all search results for analysis. Two reviewers (J.W and M.S) screened the articles by title and abstract individually after duplicates were removed. Any disagreements were discussed between reviewers based on eligibility criteria outlined above and consensus was reached. Discrepancies between reviewers were resolved through discussion and reasons for exclusion were agreed upon and documented (Figure 1). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram was used to record the screening and selection process (Figure 1).

Figure 1. PRISMA flow diagram (Moher et al., 2009).



2.4. Data extraction

All data was extracted by the primary reviewer (J.W) and cross checked for accuracy by the second reviewer. For each study, data was extracted and tabulated including author, location, population, message design, comparisons, outcome measures, findings, study design and quality.

2.5. Study quality

Two reviewers (J.W. and M.S) individually appraised all included articles using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Randomised Controlled Trials (RCT; Joanna Briggs Institute [JBI], 2017). The JBI was chosen as it has been used by Kourbelis et al. (2018) who also looked at physical activity behavior change. Whilst some studies are Randomised Clinical Trials (RT), for the purpose of this review the standard was set at RCT and thus the JBI-RCT (JBI, 2017) allowed comparison of all studies.

The level of agreement between reviewers was assessed using a Cohen's Kappa (k) analysis of all scores. For final scores, any disagreements between the two reviewers were discussed and consensus was reached. Access to a third reviewer was available but not required.

The JBI-RCT (JBI, 2017) is comprised of 13-items, which allow for rapid identification of study quality against RCT criteria. Criteria includes true randomization, concealment, similarity of groups at baseline, if participants, those delivering treatment and outcome assessors were blinded, identical treatment of all groups, completion of follow up, analysis of randomised groups, reliable outcome

measures, appropriate statistical analysis and trial design (JBI, 2017). For this review, a conservative approach was taken when completing the JBI assessment. Information was not assumed if a study did not explicitly mention it in their methods. True randomization was achieved only if the study explained the randomization procedure beyond “the subjects were randomly assigned” as per the JBI explanation (Tufanaru, Munn, Aromataris, Campbell, & Hopp, 2017). Despite the nature of some studies being online surveys, if blinding and concealment were not reported, it was not assumed. Risk of bias was calculated using the percentage of “yes” scores where <49% was a high risk of bias, 50–69% moderate risk of bias and >70% low risk of bias (Lima et al., 2018).

3. Results

3.1. Search, screening and selection results

The database search revealed 3,997 articles, with one additional article identified by one of the authors (S.G.). After duplicate removal, 2,819 articles remained to be screened by title and abstract against the eligibility criteria removing 2,774 irrelevant articles. 45 articles remained to be assessed for eligibility in full text. Five articles were identified via a hand search of eligible articles reference lists. 13 articles met the eligibility criteria and were included in this review. Results from the search, screening and inclusion processes are summarized in a PRISMA flow diagram (Figure 1; Moher, Liberati, Tetzlaff, & Altman, 2009).

3.2. Description of included studies

Of the 13 included studies two are RCTs and 11 RTs. All studies included gain and loss message framing plus at least one other message characteristic (Figure 2). Four studies accessed source credibility (Arora et al., 2006; Borah & Xiao, 2018; Jones et al., 2003, 2004) and two studies compared narrative with statistical (Gray & Harrington, 2011; Wirtz & Kulpavaropas, 2014). The remaining characteristics were each assessed by one study including eager versus vigilant delivery (Jacks & Lancaster, 2015), presentation of affect, number of arguments (McCormick & McElroy, 2009), type of activity (Hsu & Vlaev, 2014), intrinsic versus extrinsic motivation (Gallagher &

Figure 2. Message characteristics explored in studies.

	Gain	Loss	Credibility of source	Narrative/statistical	Eager/Vigilant delivery	Intrinsic/extrinsic	Symptom imagination	Social endorsement	Kernel type	Discounting Activity	Arguments	Affect
Arora et al (2006)	✓	✓	✓	×	×	×	×	×	×	×	×	×
Berry & Carson (2010)	✓	✓	×	×	×	×	✓	×	×	×	×	×
Borah & Xiao (2018)	✓	✓	✓	×	×	×	×	✓	×	×	×	×
Broemer (2004)	✓	✓	×	×	×	×	✓	×	×	×	×	×
De Bruijn et al (2014)	✓	✓	×	×	×	×	×	×	✓	×	×	×
Gallagher & Updegraff (2011)	✓	✓	×	×	×	✓	×	×	×	×	×	×
Gray & Harrington (2011)	✓	✓	×	✓	×	×	×	×	×	×	×	×
Hsu & Vlaev (2014)	✓	✓	×	×	×	×	×	×	×	✓	×	×
Jacks & Lancaster (2015)	✓	✓	×	×	✓	×	×	×	×	×	×	×
Jones et al (2003)	✓	✓	✓	×	×	×	×	×	×	×	×	×
Jones et al (2004)	✓	✓	✓	×	×	×	×	×	×	×	×	×
McCormick & McElroy (2009)	✓	✓	×	×	×	×	×	×	×	×	✓	✓
Wirtz & Kulpavaropas (2014)	✓	✓	×	✓	×	×	×	×	×	×	×	×

✓ Included in study
 × Not included in study

Updegraff, 2011), social endorsement (Borah & Xiao, 2018), kernel type (De Bruijn et al., 2014) and ease of imagination (Berry & Carson, 2010; Broemer, 2004).

Most participants from these studies were healthy adults with the exception of one study (Hsu & Vlaev, 2014) including overweight participants (Table 1). The majority of studies recruited varying physical activity levels whilst Gallagher and Updegraff (2011) only recruited students who were sedentary for six months preceding the study. The studies recruited participants from numerous different combinations of populations including university students ($n = 7$), students and community adults ($n = 1$), students and community adults ($n = 1$), students and university ($n = 1$). The remaining ($n = 3$) recruited adults from the general public with one specifically looking at Hispanic adults ($n = 1$). All studies were published in English. The studies were conducted in the United States of America (USA; $n = 8$), Canada ($n = 3$), Germany ($n = 1$) and Canada and the Netherlands ($n = 1$). Numerous outcomes were assessed by each study, however, exercise intention ($n = 7$), exercise attitudes ($n = 7$) and exercise behavior ($n = 6$) were the most common. Three experimental designs were identified, pre-test/post-test ($n = 1$), post-test only ($n = 9$) and post-test follow up ($n = 3$).

3.3. Assessment of methodological quality

The JBI-RCT results are presented in Table 2. The Interrater reliability indicated “almost perfect” agreement ($k = 0.988$; Landis & Koch, 1977). Most studies scored poorly for items 1–6. Only four studies reported their randomization protocol (Table 2; Item 1). No studies reported concealment, similarity of groups at baseline and blinding of participants (Table 2; Items 2–4). Only one study reported blinding of those delivering treatment and outcome assessors (Table 2; Items 5 & 6).

The majority of studies scored “yes” for items 7–12. All studies used appropriate statistical analysis and the majority of studies treated their groups identically, measured their outcomes reliably and in the same way. Four studies did not complete follow up or did not describe the reasons for attrition (Table 2; Item 8). Seven studies did not analyze their participants in the groups to which they were randomised which was most often due to failure to fulfil the intention to treat and excluded those lost to attrition (Table 2; Item 9). Ten studies are considered to have a high risk of bias and three a moderate risk of bias (Table 2). Overall, there is a mean score of 5.5/13 which represents a high risk of bias for the studies in this review (Table 2).

3.4. Message characteristics

3.4.1. Credibility of source/social endorsement

Credibility of source was assessed by four studies directly (Arora et al., 2006; Borah & Xiao, 2018; Jones et al., 2003, 2004) and a fifth study (Jacks & Lancaster, 2015) (Figure 2) as an additional measure. Arora et al. (2006) reported that exercise attitudes and intention are most affected by high credibility, loss framed messages. However, if the message is gain framed, either high or low source credibility is acceptable.

Borah and Xiao (2018) demonstrated gain-framed messages are more credible than loss framed messages ($p < 0.001$). They showed that participants found a gain-framed Facebook™ post with a high number of likes (social endorsement), written by an expert to be the most credible message ($p < 0.05$). Despite this three-way interaction, there was no two-way interaction between social endorsement and credibility. Messages with a high number of likes were not perceived as more credible unless it was written by an expert ($p < 0.01$).

In 2003, Jones et al. found participants in the credible/gain-framed group recalled the most information, engaged in elaboration, had the highest exercise frequency (post-test) and most positive intentions ($p < 0.05$). In comparison, the credible/loss-framed group recalled the least information, did not engage in elaboration, had the lowest exercise frequencies (post-test) and moderate exercise intentions ($p < 0.05$). The non-credible groups showed moderate exercise frequency and information recall, whilst non-credible/loss showed moderate exercise intentions ($p < 0.05$).

Table 1. Study details

Study ID + Location	Participants			Message framing design (intervention)	Comparisons	Outcome measures	Findings	Study design
	N	Age Gender	Population					
Arora et al. (2006) USA	136	49% between 24–34yrs $\sigma = 61$ $\varphi = 75$	Adults	2 (frame: gain/loss) x 2 (credibility: low/high) Newsletters Post-test only	1. Gain framed x high credibility 2. Gain framed x low credibility 3. Loss framed x high credibility 4. Loss framed x low credibility	<ul style="list-style-type: none"> Exercise attitude Exercise intention + friend recommendation Lifestyle Involvement 	Loss: credible > non-credible Gain: credible = non-credible Exercise intention: credible + loss framed	RT
Berry and Carson (2010) Canada	175	Students: 19.7(2.67)yrs Community: 72 (8.07)yrs $\sigma = 45$ $\varphi = 130$	Undergrad Psychology Students = 118 & Community adults (>55yrs) = 57	2 (gain/loss) x 2 (ease/hard imagination symptoms) Pre and post-test (N = 117; only 7 >55yrs); 7–10 days apart Post-test only (N = 58)	(1) Easy to imagine/gain (N = 45) (2) Hard to imagine/gain (N = 45) (3) Easy to imagine/loss (N = 42) (4) Hard to imagine/loss (N = 43)	<ul style="list-style-type: none"> Exercise frequency Attitude Convincingness Manipulation check 	Loss = Gain (p > 0.05) Easy = better exercise attitudes then hard to imagine Frame + imagination = \square interaction (p > 0.05) Attitudes = \square framing effect (p > 0.05) Lowest attitudes = lowest exercise freq. + hard to imagine	RT

(Continued)

Table 1. (Continued)

Study ID + Location	Participants		Message framing design (intervention)	Comparisons	Outcome measures	Findings	Study design
	N	Age Gender					
Borah and Xiao (2018) Study 1 USA	340	\bar{x} = 19.8yrs σ = 115 ϕ = 225	Students	(1) Gain/expert/credible (2) Gain/non-expert/credible (3) Gain/expert/non-credible (4) Gain/non-expert/non-credible (5) Loss/expert/credible (6) Loss/non-expert/credible (7) Loss/expert/non-credible (8) Loss/non-expert/non-credible	<ul style="list-style-type: none"> Social media use Information relevance Message credibility 	Gain = > credibility ($p < 0.001$) Expert = > credibility ($p < 0.01$) Expert + high = > credibility ($p < 0.01$) Expert + high + gain = most credibility ($p < 0.05$)	RT
Broemer (2004) Germany	60	\bar{x} = 23.5yrs σ = 60 ϕ = 0	Students	1. Positive/easy to imagine 2. Positive/hard to imagine 3. Negative/easy to imagine 4. Negative/hard to imagine	<ul style="list-style-type: none"> Exercise + diet attitude 	Negative + easy to imagine = > persuasion ($p < 0.05$)	RT

(Continued)

Table 1. (Continued)

Study ID + Location	Participants			Message framing design (intervention)	Comparisons	Outcome measures	Findings	Study design
	N	Age	Gender					
		Population						
De Bruijn et al. (2014) Netherlands + Canada	317	\bar{x} = 32.38 (13.22)yrs σ^2 = 121 ϕ = 196		General public	(1) Gain/desirable/no (N = 42) (2) Gain/undesirable/no (N = 48) (3) Loss/desirable/no (N = 46) (4) Loss/undesirable/no (N = 56) (5) Gain/desirable/yes (N = 41) (6) Gain/undesirable/yes (N = 30) (7) Loss/desirable/yes (N = 30) (8) Loss/undesirable/yes (N = 24)	<p>Before exposure:</p> <ul style="list-style-type: none"> • IPAQ • Risk perception <p>During exposure:</p> <ul style="list-style-type: none"> • Time spent on leaflet message <p>After exposure:</p> <ul style="list-style-type: none"> • Intention • Resolve • Manipulation check 	<p>Intention = \square effects of frame (p = 0.429) or kernel state (p = 0.940) or frame x kernel state x exercise adherence (p = 0.162)</p> <p>Resolve = \square effect of kernel state (p = 0.429), small effect of frame (p = 0.035) and frame x kernel state x exercise adherence (p = 0.015).</p>	RT

(Continued)

Table 1. (Continued)

Study ID + Location	Participants		Message framing design (intervention)	Comparisons	Outcome measures	Findings	Study design
	N	Age Gender					
Gallagher and Updegraff (2011) USA	192	16–35yrs (M =19.0, SD =1.91) σ = 33 φ = 143	Undergrad Students	(1) Gain-framed /intrinsic (n = 46) (2) Gain-framed /extrinsic (n = 42) (3) Loss-framed /intrinsic (n = 44) (4) Loss-framed /extrinsic (n =44) “Fit” messages: Gain + intrinsic Loss + extrinsic “Non-fit” messages Gain + extrinsic Loss + intrinsic	<p>Personality questionnaire</p> <ul style="list-style-type: none"> • Need for cognition (NC) • Past exercise behavior (GLTEQ) <p>After exposure</p> <ul style="list-style-type: none"> • Attitudes about exercise • Describe ways to incorporate exercise • Exercise behavior 	<p>Non-fit > exercise in low NC cf fit (p < 0.01) Low NC/non-fit = 2x strenuous exercise episodes cf fit (p = 0.13). Fit > exercise attitudes in high NC cf non-fit (p = 0.01). Effect of fit x NC on strenuous PA freq. was sig. mediated by attitudes (95% CI = 0.01–0.13) Promotion-related view = Intrinsic > extrinsic</p>	RT
Gray and Harrington (2011) USA	345	18–29yrs (91.9% ≤ 20yrs) σ = 116 φ = 229	Communication college Students	(1) Gain framed/narrative (2) Gain framed/statistical (3) Loss framed/narrative (4) Loss framed/statistical (5) Control: financial	<ul style="list-style-type: none"> • Exercise attitude • Perceived behavioral control • Exercise intention • Perceived message effectiveness • Past exercise behavior 	<p>Gain frame > loss frame (p < 0.001) except attitude (p = 0.79) Narrative = statistical (p > 0.05)</p>	RCT

(Continued)

Table 1. (Continued)

Study ID + Location	Participants		Message framing design (intervention)	Comparisons	Outcome measures	Findings	Study design
	N	Age Gender					
Hsu and Vlaev (2014) USA	160	18–70yrs (\bar{x} = 31) σ = 78 φ = 82	Overweight (N = 84), Mean BMI = 26.6 (6.6) Non-overweight (n = 76) Recruited online from Amazon Mechanical Turk	2 (gain/loss) x 3 (activity: walking, standing, sitting) Online survey Post-test only	(1) Loss/activity (2) Gain/activity	<ul style="list-style-type: none"> BMI Annual income Satisfaction with time for enjoyable activities, overall health and energy 	Higher income = > loss aversion (p = 0.001) Lower income: gain = loss for discounting. Females = > loss aversion Males: gain = loss Physical effort \uparrow = \uparrow discounting (p < 0.0001). Discounting: gain > loss (p = 0.0011) = loss aversion; RT
Jacks and Lancaster (2015) USA	108	18–61 (29.65) yrs σ = 40 φ = 66 Other = 2 (NA)	College students and staff at University campus	2 (gain/loss) x 2 (Delivery style: eager/vigilant) Delivery = Video on computer individually Post-test only	1. Gain framed/eager 2. Gain framed/vigilant 3. Loss framed/eager 4. Loss framed/vigilant	<ul style="list-style-type: none"> Perceived message effectiveness Ease of message processing Mood Personal importance of topic Source credibility Cognitive responses 	Eager/gain-framed and vigilant/loss-framed = more effective. Match body language to message. Women respond to prevention focus = vigilant and/or loss (p < 0.05) Men respond to promotion focus = eager and/or gain framed RT

(Continued)

Table 1. (Continued)

Study ID + Location	Participants		Message framing design (intervention)	Comparisons	Outcome measures	Findings	Study design
	N	Age Gender					
Jones et al. (2003) Canada	192	\bar{x} = 19.81 (4.05) yrs σ^2 = 53 ϕ = 139	Psychology Students	1. Positive/credible 2. Positive/non-credible 3. Negative/credible 4. Negative/non-credible 33–36 females + 12–15 males per group	<ul style="list-style-type: none"> Exercise attitudes Exercise intentions Exercise behaviors Thought content Impressions of the source 	Credible/+ve = Highest exercise frequency & most +ve intentions ($p < 0.05$) Credible/+ve recall most info ($p < 0.05$) Credible/-ve = Lowest exercise frequency ($p < 0.05$)	RT
Jones et al. (2004) Canada	450	\bar{x} = 20.02 yrs σ^2 = 136 ϕ = 314	Psychology Students	1. Positive/credible (n = 67) 2. Positive/non-credible (n = 65) 3. Positive/control (n = 78) 4. Negative/credible (n = 69) 5. Negative/non-credible (n = 69) 6. Negative/control (n = 65)	<ul style="list-style-type: none"> Behavioral beliefs Exercise attitudes Subjective norm Perceived behavioral control Exercise intentions Pre-Exercise behavior Thought content Source expertise 	+ve > -ve for prevention behavior (i.e. exercise; $p < 0.044$) Non-credible = > +ve belief of credible for “improve general health” belief ($p = 0.037$)	RCT
McCormick and McElroy (2009) USA	450	Age: NR σ^2 = 155 ϕ = 279 NR = 16	Undergraduate Psychology Students	NR	Behavioral intention	↑ no. arguments + gain + -ve picture = ↑ BI ($p = 0.0001$).	RT

(Continued)

Table 1. (Continued)

Study ID + Location	Participants		Message framing design (intervention)	Comparisons	Outcome measures	Findings	Study design
	N	Age Gender					
Wirtz and Kulpavaropas (2014) USA	72	\bar{x} = 40.6yrs σ = 25 φ = 47	Hispanic adults	1. Gain framed/narrative 2. Gain framed/non-narrative 3. Loss framed/narrative 4. Loss framed/non-narrative	<ul style="list-style-type: none"> • Message engagement • Message relevance • Attitude toward message • Healthy eating intention • PA intention 	Narrative = non-narrative ($p > 0.40$) Gain = more positive Loss = more engaging, higher and engage in regular PA ($p = 0.003$).	RT

φ = female; σ = male; NR = not reported; BI = behavioral intention; PA = physical activity; NA = not analysed; \bar{x} = mean; \square = no; cf = compared to; \uparrow increase; \downarrow decrease; yrs = years; p = probability; + = plus; x = mean; p = probability.

Table 2. Methodological quality assessment by question number and study

Study ID	JBI – RCT Question Number													Total	%	Bias Risk
	1	2	3	4	5	6	7	8	9	10	11	12	13			
Arora et al (2006)	0	0	0	0	0	0	0	1	1	1	1	1	0	5	38.46	High
Berry & Carson (2010)	1	0	0	0	0	0	1	0	0	1	1	1	0	5	38.46	High
Borah & Xiao (2018)	1	0	0	0	0	0	1	1	0	0	0	1	0	4	30.77	High
Broemer (2004)	0	0	0	0	0	0	1	1	1	1	1	1	0	6	46.15	High
De Bruijn et al (2014)	1	0	0	0	0	0	1	1	1	1	1	1	0	7	53.85	Moderate
Gallagher & Updegraff (2011)	0	0	0	0	0	0	1	0	0	1	1	1	0	4	30.77	High
Gray & Harrington (2011)	1	0	0	0	0	0	1	1	1	1	1	1	1	8	61.54	Moderate
Hsu & Vlaev (2014)	0	0	0	0	0	0	1	1	0	1	1	1	0	5	38.46	High
Jacks & Lancaster (2015)	0	0	0	0	0	0	1	1	0	1	1	1	0	5	38.46	High
Jones et al (2003)	0	0	0	0	0	0	1	0	0	1	1	1	0	4	30.77	High
Jones et al (2004)	0	0	0	0	0	0	1	0	0	1	1	1	1	5	38.46	High
McCormick & McElroy (2009)	0	0	0	0	1	1	1	1	1	1	1	1	0	8	61.54	Moderate
Wirtz & Kulpavaropas (2014)	0	0	0	0	0	0	1	1	1	1	1	1	0	6	38.46	High
	Mean Score													5.5		

0 = yes; 1 = no, unclear; Risk of bias: >70% = low, 50 – 68% = moderate, <49% = high 1 yes 0 No 0 unclear

Jones et al. completed a similar study in 2004 which found participants who read a gain-framed message had significantly ($p = 0.019$) more positive beliefs (“feel better and improve my well-being” and “maintain my optimal weight”). In contrast to their earlier study, they found participants reading a non-credible source reported significantly ($p = 0.037$) more positive beliefs than those in the credible or control group for the “improve my general health” belief.

Jacks and Lancaster (2015) explored delivery style (eager/vigilant) in conjunction with loss and gain framed, however they measured participants perception of the source credibility for each group. These authors found that a vigilant delivery style was more credible for women, while, an eager delivery style was more credible for men ($p = 0.035$).

3.4.2. Narrative versus non-narrative

Two studies in this review assessed the effect of narrative versus statistically framed messages (Gray & Harrington, 2011; Wirtz & Kulpavaropas, 2014) (Figure 2). Gray and Harrington (2011) found that gain framed messages significantly affected exercise control beliefs and intentions when compared to loss framed messages and were perceived as more effective ($p < 0.0001$). However, there was no difference between gain and loss for exercise attitudes ($p = .79$). The authors did report attitude means were positive overall, which may have resulted in a ceiling effect. Gray and Harrington also reported there was no significant differences between narrative and statistical messages for exercise control beliefs ($p = 0.20$), intentions ($p = 0.16$) and perception of effectiveness ($p = 0.53$).

In agreeance, Wirtz and Kulpavaropas (2014) found no significant difference between narrative and non-narrative for message engagement, relevance, attitude or intention ($p = 0.41$). Whilst the authors found gain-framed messages to be more positive, loss-framed messages were identified as being more engaging, resulting in higher intentions to participate in regular physical activity ($p = 0.003$).

3.4.3. Eager versus vigilant delivery

One study assessed the response to eager versus vigilant delivery style using video (Figure 2; Jacks & Lancaster, 2015). Jacks and Lancaster (2015) determined that men found an eager delivery style more effective whilst women found a vigilant delivery style more effective ($p = 0.008$). This conclusion suggests men “fit” a promotion focus (eager and/or gain framed) whilst women “fit” a prevention focus (vigilant and/or loss framed). The authors reported eager/gain-framed messages and vigilant/loss-framed messages to be more effective than their “non-fit” equivalents. Another finding was people delivering messages should fit their body language to the message type.

3.4.4. *Intrinsic versus extrinsic exercise outcomes*

One study explored the effects of intrinsic versus extrinsic exercise outcomes (Figure 2; Gallagher & Updegraff, 2011). Gallagher and Updegraff (2011) reported that “fit” messages were intrinsic/loss-framed and extrinsic/gain-framed whilst extrinsic/loss-framed and intrinsic/gain-framed were “non-fit” messages. These authors found participants with a low need for cognition (lower message processing) reported higher levels of physical activity after reading the “non-fit” messages ($p < 0.01$). Whilst participants with a high need for cognition (higher message processing) reported higher levels of physical activity ($p = 0.21$) and more favourable attitudes ($p = 0.01$) after reading the “fit” messages. It was concluded that the most effective messages for promoting physical activity depend less on the actual behavior (i.e. prevention-behavior) and more on how the message “fits” their motivations associated with the behavior. However, the authors also mentioned that intrinsic outcomes were viewed in a promotion focus more so than extrinsic outcomes.

3.4.5. *Symptom imagination*

Two studies investigated the effects of symptom imagination (Figure 2; Berry & Carson, 2010; Broemer, 2004). Berry and Carson (2010) reported easy to imagine symptoms resulted in greater exercise attitudes than hard to imagine symptoms. Participants in the hard to imagine group with the lowest exercise frequency resulted in the lowest attitudes. These authors found no interaction between loss/gain framed and symptom imagination or exercise attitudes ($p > 0.05$). In contrast, Broemer (2004) found that those in the loss-framed group had more positive attitudes when the symptoms were easy to imagine ($p < 0.05$). The author reported that participants in the gain-framed group had more positive attitudes when the symptoms were hard to imagine, however, this was not a significant finding ($p < 0.10$). Broemer (2004) did, however, find that there was a significant correlation between perceived severity and attitudes ($p < 0.05$).

3.4.6. *Kernel state*

One study examined attained (favourable) versus avoided (unfavorable) outcomes (kernel states; Figure 2; De Bruijn et al., 2014). De Bruijn et al. (2014) found no effects of type of kernel state ($p = 0.940$) and type of frame (gain/loss; $p = 0.429$) for exercise intention. There was no interaction between type of frame, kernel state or adherence to exercise ($p > 0.05$). These authors reported a significant relationship for resolve, concluding participants with a higher resolve had higher risk perception ($p < 0.001$), were older in age ($p < 0.001$) and spent shorter periods looking at the message ($p = 0.016$). De Bruijn et al. (2014) found no effect on resolve for type of kernel state, kernel state/type of frame relationship and type of frame/adherence relationship. However, there was a small effect for type of frame ($p = 0.035$) in favor of loss-framed messages. The authors concluded that with regards to kernel state/framing relationship, loss-framed was the most persuasive when grouped with attained (favourable) outcomes.

3.4.7. *Discounting activity*

One study examined discounting for activities requiring different levels of physical exertion (Figure 2; Hsu & Vlaev, 2014). Hsu and Vlaev (2014) found that those with a higher income showed loss aversion (less discounting for loss compared to gain) whilst those with lower income did not discount differently for gain or loss frames. Females showed loss aversion, but males did not. The authors reported that activities with a higher physical effort are discounted more ($p < .0001$). Walking was the most discounted, then standing in line followed lastly by sitting. A significant effect was found for framing with participants discounting gain frames more than loss frames ($p = .0011$). Thus, participants were more willing to participate in activities to prevent a loss than to receive a gain.

3.4.8. *Arguments and affect*

One study assessed the influence of the number of arguments presented and the effect of the message (i.e. background picture; Figure 2; McCormick & McElroy, 2009). McCormick and McElroy (2009) reported that the highest level of exercise intention resulted from a gain framed message

with six arguments and a negative background picture ($p = .0001$). This was the only condition which showed a significant framing effect.

4. Discussion

The aim of this review was to determine the influence of different message framing characteristics on potential physical activity participation. Thirteen studies were reviewed. To the best of our knowledge, this is the first systematic review addressing this topic. The main finding of the present review is that the combination of characteristics influences which characteristics are most effective when influencing physical activity participation. All studies explored different characteristics in addition to gain and loss making it difficult to recommend one set of characteristics which should be used. The importance of this review lies in the fact that health/fitness professionals trying to influence physical activity behavior change should be able to use message framing to increase their effectiveness.

The findings of this review were consistent with the findings of the systematic review conducted by Latimer, Brawley, and Bassett (2010) which investigated the effects of three message approaches (tailored, framed and self-efficacy change messages) to accompany physical activity guidelines (Latimer et al., 2010). The review concluded that there was insufficient evidence (Latimer et al., 2010). The current review focused on message framing alone but also concluded that there is no strong evidence to recommend the ideal combination of message framing characteristics to influence physical activity participation. The use of message framing to influence behavior change is an emerging body of literature. The number of characteristics explored in the thirteen studies demonstrates the complexity of influencing behavior change. Health professionals have a difficult job trying to combat physical inactivity and the negative consequences that result.

The prevention focused nature of physical activity as a health behavior demonstrates that gain framed messages are more influential than loss-framed messages (Salovey et al., 2002). Overall, the studies explored in this review confirmed this, however, there were certain combinations of characteristics which have been found to be exceptions. It was found that loss-framed/vigilant delivery represented a prevention focus and were most effective for women whilst gain-framed fit more appropriately with eager delivery for men which was more promotion focused (Jacks & Lancaster, 2015). This demonstrates that whilst gain-framed alone is considered to be more appropriate for physical activity information, combining loss and gain with other characteristics can influence whether or not they are considered to “fit” together. Gallagher and Updegraff (2011) also discussed the “fit” principle combining intrinsic/loss-framed and extrinsic-gain-framed. Gallagher and Updegraff (2011) investigated need for cognition and matched them to their “fit” messages. These studies highlighted the importance of not only the individual characteristics (e.g. gain versus loss) but also their interaction (e.g. intrinsic/loss-framed and extrinsic/gain-frame) as well as the target population demographics (e.g. male versus female). Overall, gain framed messages are most appropriate when individually compared with loss-framed messages. However, it is important to consider the interaction between gain/loss-framed messages with other characteristics and how this may change what message frame is more appropriate whilst also considering the population.

4.1. Message characteristics

The studies identified by this review investigated how message framing can influence physical activity participation and will be discussed under the following headings: source credibility/social endorsement, narrative versus non-narrative, eager versus vigilant delivery, intrinsic versus extrinsic exercise outcomes, symptom imagination, kernel state, discounting activity and arguments and affect.

4.1.1. Credibility of source/social endorsement

The credibility of a source has been discussed in the literature for decades. If a source's credibility is low the arguments in their message are more likely to be discounted (Arora et al., 2006; Eagly & Chaiken, 1975). In addition, if a spokesperson has a high credibility, they are more likely to affect greater attitude change than those who have a low credibility (Arora et al., 2006; Sternthal,

Dholakia, & Leavitt, 1978). In order to represent increased credibility to the reader the message must contain information about the professional's qualifications and competencies (Arora et al., 2006; Tripp, 1997). This was consistent with the findings of the studies in this review. Borah and Xiao (2018) found that a gain-framed Facebook post with a high number of likes (social endorsement), written by an expert is the most credible message. Similarly, Jones et al. (2003) found that the credible/gain framed message had the highest exercise frequency (post-test) and most positive intentions.

4.1.2. Narrative versus non-narrative

It has been suggested that health information written as a narrative may be more persuasive when the characters are relatable, issues are important and the information is presented in a vivid way (Gray & Harrington, 2011). Interestingly both studies which investigated narrative versus non-narrative found no differences between narrative and statistical messages (Gray & Harrington, 2011; Wirtz & Kulpavaropas, 2014).

4.1.3. Eager versus vigilant delivery

Jacks and Lancaster (2015) is the only study to investigate message framing with non-verbal delivery style (eager versus vigilant). Eager delivery style non-verbal cues included a forward lean and reaching, upward and open hand movements whilst using an excited tone of voice. In comparison, vigilant delivery style involved a backwards lean and downward closed hand movements whilst using a somber, staid tone of voice (Jacks & Lancaster, 2015). Consistent with a fit principle they found eager/gain framed to be promotion focused and influence men whilst vigilant/loss framed to be prevention focused and influence women. This reiterates the importance of understanding how different message delivery interact with each other and with the target population.

4.1.4. Intrinsic versus extrinsic exercise outcomes

Gallagher and Updegraff (2011) was the only study to explore intrinsic (satisfaction, enjoyment) and extrinsic (appearance, health) exercise outcomes as motivators to participate in physical activity. Also, using the fit principle, they determined that extrinsic/gain-framed and intrinsic/loss framed were "fit" messages, whilst the alternatives—*intrinsic/gain-framed* and *extrinsic/loss-framed* were "non-fit" messages. Interestingly they found an interaction between a person's need for cognition and which messages ("fit" or "non-fit") effected physical activity participation. Need for cognition refers to an individual's tendency to engage in effortful cognitive tasks (Cacioppo & Petty, 1982; Petty & Cacioppo, 1986). "Fit" messages were most appropriate for high need for cognition (higher message processing) and "non-fit" messages were more effective for those with a low need for cognition (lower message processing). In order to appropriately use this approach, it would be important to understand the populations level of cognitive processing. This may be particularly appropriate for a population where this could be estimated. For example, it may be concluded that university students would have a higher need for cognition as they are opting to participate in effortful cognitive tasks.

4.1.5. Symptom imagination

Ease of imagination refers to the degree to which a symptom or health condition is easy to experience or visualize. The two studies which investigated physical activity participation, symptom imagination and message framing both found that the easy to imagine group had more positive exercise attitudes than the hard to imagine group (Berry & Carson, 2010; Broemer, 2004). However, Broemer (2004) found that it was only those in the loss framed/easy to imagine group which showed significant positive attitudes. In contrast, Berry and Carson (2010) found no interaction between loss and gain with symptom imagination. As a result of this inconsistency, until future research is conducted, it can be concluded that easy to imagine messages are more effective than hard to imagine messages irrespective of loss/gain framing.

4.1.6. Kernel state

A message's kernel state refers to the description of a behavior's consequence (O'Keefe & Jensen, 2006) which can be represented as either attained (favourable) or avoided (unfavourable). For

example, an attained outcome would be: “if you exercise you will obtain a healthy weight” whilst an avoided outcome would be: “if you exercise you will prevent chronic disease” (De Bruijn et al., 2014). The one study which has investigated this characteristic found a very small effect for loss-framed messages concluding that loss-framed was the most persuasive when grouped with attained outcomes. However, there was no interaction between type of frame, kernel type or adherence to exercise. This characteristic currently does not have sufficient evidence to support its use when influencing physical activity participation.

4.1.7. *Discounting activity*

Decreased exercise participation during leisure time and increased sedentary behavior has led to increased physical inactivity (WHO, 2018). One of the main causes of obesity is a lack of physical exertion whilst completing every day activities, also known as, non-exercise thermogenesis (NEAT; Hsu & Vlaev, 2014; Levine, Eberhardt, & Jensen, 1999). As society becomes busier and everyone begins to look for efficient ways to do things questions such as: “Is it worth walking an extra 10 minutes to get the same item on sale?” are more commonly asked (Hsu & Vlaev, 2014). Hsu and Vlaev (2014) found that activities with a higher physical effort are discounted more. This means that the longer an activity is engaged in will decrease in value more if the effort of the activity is higher. For example, the subjective value of sitting at a desk will decrease with time but the subjective value of walking will decrease more with time because walking requires more effort. In addition, it was found that gain-frames were discounted more thus participants were more willing to participate in activities to prevent a loss than to receive a gain. As a result, if presenting information with respect to participating in specific activities people will put more value and time into activities which requires less exertion in order to prevent losing something (e.g. quality of life).

4.1.8. *Arguments and affect*

McCormick and McElroy (2009) investigated whether the number of arguments presented influences the messages persuasion. It was suggested that persuasiveness should increase with the number of arguments presented, however, McCormick and McElroy (2009) were interested in the interaction between the number of arguments, gain/loss framing and the message affect (background picture). Literature suggests that a negative affect encourages people to seek further information because it withdraws from their usually positive state and in turn catches their attention increasing involvement (Schwarz & Clore, 1983). In contrast, a positive affect informs people that there is no problem and they do not need to act on the information presented (McCormick & McElroy, 2009). McCormick and McElroy concluded that the highest level of exercise intention occurred when the message was gain-framed with six arguments and a negative background picture.

4.1.9. *Evidence quality*

Overall, there is a high risk of bias for the studies in this review. Only two studies were randomised controlled trials (Gray & Harrington; Jones et al., 2004) and the remaining eleven were randomised clinical trials without a control group. Future research with higher methodological quality is needed to strengthen this area of literature.

4.1.10. *Limitations*

This systematic review has multiple limitations. The studies included in this review were limited to those published in English. The low quality of available studies assessing message framing characteristics in this review means that the results should be interpreted with caution.

The majority of studies included recruited young university students, so more research is needed for each characteristic to broaden the populations investigated.

5. Conclusion

This systematic review reveals a need for continued research in the area with improved method quality and consistency across message characteristics. In order to draw conclusions about what message characteristics are most appropriate, there needs to be more research conducted of

a higher quality. However, important characteristics to consider when formulating a message to influence physical activity participation include source credibility, number of arguments, background picture and the effort of an activity being promoted. In addition, it is important to consider that the most appropriate part of a characteristic (e.g. gain versus loss) can change depending on the characteristic matched with it and the demographics of target population.

This review is, however, consistent with gain and loss literature concluding that gain-framed messages alone are most effective compared to loss-framed to influence physical activity behavior. When combined with other characteristics this may change. Future research is planned comparing gain and loss with intrinsic (health) and extrinsic (appearance) motivation in this area. Future research should continue to strengthen the evidence for the other characteristics of message framing and broaden the populations recruited.

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