

### **Abstract**

**Purpose:** Increasing evidence suggests that various health behaviours are amenable to change following the induction of cognitive dissonance. This systematic review sought to evaluate the effectiveness and methodological quality of dissonance-based health behaviour interventions, and to explore identified sources of heterogeneity in intervention effects.

**Methods:** Bibliographic databases were searched for relevant articles from inception to March 2012. Only studies targeting non-clinical health behaviour in non-clinical populations were included in the review. One author extracted data and assessed quality of evidence and a second author verified all content.

**Results:** Reports of 20 studies were included. A variety of health behaviours and outcome measures were addressed across studies. Most studies produced one or more significant effects on measures of behaviour, attitude, or intention. Across studies, methodological risk for bias was frequently high, particularly for selection bias. Gender and self-esteem were identified as potential moderator variables.

**Conclusions:** The evidence for the effectiveness of dissonance-based interventions was generally positive. The hypocrisy paradigm was found to be the most commonly applied research paradigm and was most effective at inciting change across a range of health behaviours. There was no observable link between type of target behaviour and positive outcomes. Researchers are encouraged to minimise potential for bias in future studies and explore moderators of the dissonance effect.

## Dissonance-based Interventions for Health Behaviour Change:

### A Systematic Review

The induction of cognitive dissonance has been identified as a technique designed to induce positive behaviour change (Abraham, Kok, Schaalma, & Luszczynska, 2010).

Cognitive dissonance refers to a state of psychological discomfort that arises from conflicting attitudes or beliefs (Festinger, 1957). In the classic dissonance paradigm individuals experiencing cognitive dissonance are motivated to reduce or eliminate it via adaptation of their cognitions or behaviour to restore a state of internal consistency. Indeed, research indicates that in order to reduce the psychological discomfort brought about by dissonance, individuals may change their attitudes (Elliot & Devine, 1994) and/or behaviours (Draycott & Dabbs, 1998).

### **Dissonance-based interventions**

Cognitive dissonance based interventions often involve creation of a discrepancy between an individual's beliefs and their current behaviour, following one of several experimental paradigms. In the *belief-disconfirmation paradigm* (Festinger, Riecken, & Schnachter, 1956) it is hypothesised that dissonance is aroused when participants are provided information inconsistent with their existing beliefs. If unable to change their beliefs, participants may reject or deny the conflicting information, or seek others sharing similar beliefs to restore a state of consistency.

In the *free choice paradigm* (Brehm, 1956), participants are asked to decide between two or more alternatives. It is predicted that, after making the decision, thinking about the positive features of the rejected alternative or the negative features of the chosen alternative arouses dissonance. This may be reduced if participants view the chosen alternative more positively and the rejected alternative more negatively than they did before their decision.

In the *effort justification paradigm* (Aronson & Mills, 1959) participants freely engage in an effortful task for seemingly little purpose. It is hypothesised that the dissonance created from this inconsistency may be reduced if participants justify their actions to be worthwhile.

In the *induced compliance paradigm* (Festinger & Carlsmith, 1959), participants act contrary to an existing attitude and if provided little reasoning for doing so, are hypothesised to experience dissonance. This dissonance may be reduced by changing future behaviour or attitudes. Counterattitudinal advocacy is a frequently applied task within induced compliance experiments and plays a primary role in eliciting cognitive and behavioural changes (Roehrig, Thompson, Brannick, & van den Berg, 2006). It involves a participant voluntarily arguing for a position contrary to his or her existing beliefs, often via exercises such as role-play (Becker, Smith, & Ciao, 2005; McMillan, Stice, & Rohde, 2011a; Perez, Becker, & Ramirez, 2010), essay writing (Green, Scott, Diyankova, & Gasser, 2005), or speech delivery (Simmons & Brandon, 2007; Simmons, Webb, & Brandon, 2004).

In the *hypocrisy paradigm* (Aronson, Fried, & Stone, 1991) participants make a pro-social statement about the value of a particular behaviour and are then made mindful of their own past failures regarding that behaviour. The inconsistency between the participant's present attitudes and past transgressions leads to the arousal of dissonance. In this paradigm the primary method of dissonance reduction is behaviour change rather than attitude change.

### **Existing evidence**

Increasing evidence indicates that various health, environmental, and social behaviours are responsive to dissonance-based interventions, including water conservation (Dickerson, Thibodeau, Aronson, & Miller, 1992), energy conservation (Pallak, Cook, & Sullivan, 1980), smoking (Stice, Mazotti, Weibel, & Agras, 2000), racism (Son Hing, Li, & Zanna, 2002), and generosity (McKimmie et al., 2003). The most compelling evidence for the

efficacy of dissonance-based interventions to date has been reported by Stice and colleagues (e.g., Stice, Marti, Spoor, Presnell, & Shaw, 2008a; Stice, Rohde, Gau, & Shaw, 2009) and Becker and colleagues (e.g., Becker, Smith, & Ciao, 2006; Becker et al., 2010) in their extensive research on eating disorder prevention. These studies often involve a multi-session, standardised induced compliance procedure with additional self-affirmation and strategic self-presentation components. A meta-analysis examining 16 such dissonance-based trials has shown that relative to controls, dissonance conditions produce greater reductions in eating disorder risk factors and symptoms, risk for onset of threshold or sub-threshold eating disorders, risk for obesity onset, and mental health utilisation, with certain effects remaining at three-year follow-up (Stice, Shaw, Becker, & Rohde, 2008c). Thus, there is strong evidence for the efficacy of dissonance-based interventions for prevention of disordered eating behaviour. However, it is currently unclear whether such outcomes are generalisable to interventions targeting non-clinical health behaviours. This issue was first raised by Stice and colleagues (2008c), who suggested that dissonance-based interventions be considered for prevention of other health problems including smoking and substance abuse.

Two recent literature reviews (Stone & Fernandez, 2008; Stone & Focella, 2011) have evaluated the effects of dissonance inducted via the hypocrisy paradigm within non-clinical health behaviours. These reviews concluded that the greatest effects occur when people publicly advocate the value of a target behaviour and are privately reminded of their own recent personal failures to perform that behaviour. Further, it was concluded that participants with higher self-esteem are more likely to make positive changes, and that more change occurs when participants self-generate a persuasive message about the target behaviour. While these reviews were an important addition to the literature, both evaluated hypocrisy interventions only and neither was conducted using a systematic search methodology. In light of the limitations of existing reviews in this area, there is a clear need for a systematic

evaluation of cognitive dissonance interventions across a range of experimental paradigms in order to evaluate the strength of evidence for the use of this behaviour change technique for non-clinical health behaviours. The present review is the first systematic review of this nature to date.

### **Objective**

The aims were to: (1) determine whether dissonance-based interventions are effective in changing health behaviour, attitude, or intention when compared with control conditions; (2) assess the methodological quality associated with such interventions; and (3) explore any identified sources of heterogeneity, including whether some health behaviours are more amenable to change than others.

### **Method**

A systematic review of the literature was undertaken in accordance with the guidelines of the PRISMA Statement (Liberati et al., 2009).

### **Search strategy**

Studies were identified through electronic database searches of PsychINFO, Medline, Web of Science, Embase, and CINAHL. Searches covered literature dated from database inception to March 2012. Additional papers were sought via the Dissertations & Theses: Full Text database and Google Scholar. Search terms included *dissonance*, *hypocrisy*, *cognitive dissonance*, *health*, *behavio(u)r*, *lifestyle* and *prevention* (see Supplementary Material for full search strategy). Searches were restricted to English-language papers. Manual searches of reference lists of identified papers and of reviews in relevant areas were also conducted.

### **Eligibility criteria**

**Types of studies.** All quantitative studies of comparative or pre-test/post-test design that reported a health behaviour intervention were considered. Peer-reviewed journal articles, conference proceedings and unpublished dissertations were eligible for inclusion.

**Types of participants.** The participants of interest were children and adults from non-clinical populations. Studies involving infant (< 2 years) and elderly ( $\geq$  65 years) participants were ineligible for inclusion.

**Types of intervention.** Health behaviour interventions described as dissonance-based were considered. Interventions primarily based on related discrepancy-arousing techniques such as motivational interviewing or strategic self-presentation were deemed ineligible as these were considered to be discrete paradigms that draw from, but are not limited to dissonance theory. No restrictions were imposed on the intensity or duration of interventions.

**Types of outcome measures.** The outcome measures of interest were self-reported or observed changes in health behaviour, attitude, and intention. Studies that failed to include at least one of these measures were ineligible. Studies with outcome measures that examined pathological behaviour such as eating disorder symptomatology were excluded as they were considered unrepresentative of non-clinical health behaviour. Further, the efficacy of dissonance-based eating disorder prevention programs has already been established in the clinical literature.

### **Study selection**

Relevant studies were identified during title and abstract screening, conducted by one reviewer (TF). Studies that failed to meet the selection criteria were rejected. Those that remained were subject to full-text screening and a final decision (see Figure 1). A relevance tool, devised during development of the research protocol, was used to systematise the full-text screening phase and ensure inclusion criteria were met. Eligibility of questionable papers was resolved through consultation among the authors.

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### **Data extraction**

A data extraction form (adapted from Hedin & Källestål, 2004) was devised and piloted in advance as a part of the review protocol. The form addressed study design, intervention description, theory base, timeframe, outcome measures, participant characteristics, results, and statistical analyses. One author (TF) extracted data from included studies and a second author (EK) verified extracted data. On several occasions, authors of included articles were contacted directly to assist in further provision of study data.

### **Assessment of risk of bias**

In accordance with the PRISMA Statement (Liberati et al., 2009), analysis of study ‘quality’ will be hereafter viewed in terms of ‘risk of bias’. Risk of bias assessments aim to appraise internal validity and quality of the underlying research rather than the quality of reporting. Each study was assessed using the Cochrane Collaboration’s tool for appraisal of methodological risk of bias (Higgins & Altman, 2008) which addresses selection bias (randomisation and concealment of allocation), performance bias (blinding of participants to the intervention), detection bias (blinding of study personnel and assessors), attrition bias (loss of participants), and reporting bias (selective outcome reporting).

### **Data synthesis**

Owing to a wide variation in outcome measures, intervention durations, settings and quality of data reporting, it was not considered statistically appropriate to conduct a meta-analysis. Consequently, a qualitative synthesis was conducted.

## **Results**

The search strategy yielded 18 articles that met criteria for inclusion. As two papers (Peterson, Haynes, & Olson, 2008; Stone, Wiegand, Cooper, & Aronson, 1997) each reported two studies, a total of 20 studies were included in the present review.

### **Study characteristics**

The key details of each study are presented in Table 1. Within the sample of included articles there were three unpublished dissertations (Baker, 1994) [4], (Chait, 2010) [6], (Hammons, 2010) [10]; one conference presentation (Bator & Bryan, 2007) [5], and 16 peer-reviewed journal articles (Ager, Parquet, & Kreutzinger, 2008) [1], (Aronson et al., 1991) [2], (Axsom & Cooper, 1985) [3], (Eitel & Friend, 1999) [7], (Fointiat, 2004) [8], (Hafstad et al., 1997) [9], (Morrongiello & Mark, 2008) [11], (Peterson et al., 2008) [12a, 12b], (Simmons & Brandon, 2007) [13], (Simmons et al., 2004) [14], (Stone, Aronson, Crain, Winslow, & Fried, 1994) [15], (Stone & Fernandez, 2011) [16], (Stone et al., 1997) [17a, 17b], (Thompson, Kyle, Swan, Craig, & Vrungos, 2002) [18].

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A variety of health behaviours were targeted, including sexual risk behaviours [2, 4, 7, 15, 17a, 17b, 18], smoking [9, 12a, 13, 14], sun protection [6, 16], drug use [1], weight loss [3], exercise [5], driving behaviour [8] alcohol use [10], playground risk behaviour [11], and healthy lifestyle behaviours [12b]. In broad terms, six health risk behaviours and four health protective behaviours were addressed. Thirteen of 20 included studies implemented a pre-test measure to ascertain whether participants regularly engaged in relevant behaviours [2, 3, 6, 7, 10, 12a, 12b, 13-17b].

Three studies were conducted on children or adolescents [1, 9, 11] and the remainder on adults. Overall, a disproportionate number of participants were female, with 17 of 20 studies reporting majority-female samples. Five of these 17 studies recruited an exclusively female sample [3, 6, 8, 16, 17b]. Few studies reported a sample size calculation based on statistical power [4, 6, 13].

**Outcome measures.** Generally measurement of behaviour, attitude, and intention was addressed selectively. Only two studies measured all three of these aspects [7, 18]. Some studies applied other measures such as social desirability [7, 10], affect [11], or self-esteem [12a, 12b]. Few studies discussed the reliability and/or validity of included measures of behaviour, attitude, or intention [4, 6, 10, 13, 14].

The majority of studies collected self-report data, via questionnaire [1, 4, 6, 9, 10, 12a, 12b, 14, 16, 18], interview [2, 8], or both [5, 7, 11, 13, 15]. A self-report ‘dissonance thermometer’ (Devine, Tauer, Barron, Elliot, & Vance, 1999; Elliot & Devine, 1994) was implemented in several studies as a manipulation check on the amount of dissonance induced [6, 10, 13, 14]. This 14-item questionnaire aims to measure the affective discomfort experienced during cognitive dissonance. Several studies incorporated objective measures of behaviour such as body weight [3], condom purchases [7, 15, 17a, 17b], sunscreen coupons [16], fitness centre attendance [5], or acquisition of anti-smoking [13] or HIV-risk [15] educational pamphlets.

**Experimental paradigms.** Of the 20 included studies, one was based on the effort justification paradigm [3], one on belief disconfirmation [9], four on induced compliance [1, 6, 13, 14], and 14 on hypocrisy [2, 4, 5, 7, 8, 10-12, 15-18]. The induction of hypocrisy was consistent across studies adopting this paradigm, generally via the process established by Aronson and colleagues [2]. In contrast, studies adopting the induced compliance approach reported a variety of dissonance arousing techniques (described in Table 1).

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## **Evidence for effectiveness**

The majority of studies reported positive changes in one or more of participants' health behaviour, attitude or intention (see Table 2). One study reported significant effects on all three measures [18]. Within studies, changes in attitude and intention were generally consistent with changes in behaviour. Granted, this may be an overestimation of consistency since some studies may have measured, but not reported, all outcomes.

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### **Assessment of methodological risk of bias**

Between studies there were varying levels of risk of bias (see Table 3), and across the sample several trends were observed. Selection bias was largely unaddressed, as the majority of studies provided inadequate detail about methods of randomisation and concealment of allocation from participants and investigators. Of the studies that did report such details, a high risk of bias was generally incurred. Overall, few studies reported consent rate ( $n = 5$ ), and those that did reported rates of 41% [13] to 100% [4].

The range for loss to follow-up was 0.005% [13] to 54% [18]. One study incurred a high risk of attrition bias due to uneven dropout rates across groups [6]. This may indicate confounding differences between participants who left the study and those who remained. Most other studies had evenly spread dropout across groups and sufficient reporting of reasons for dropout.

Reporting bias was high for studies that did not provide adequate quantitative outcome data. In these cases, results were presented graphically only [2, 12a, 12b], or pre-test and post-test means were not provided for every experimental measure [4] or group [6].

There was low risk for performance bias as participant blinding was routinely conducted. Risk of detection bias was rated to be minimal across studies as neither study

outcomes nor outcome measurement were likely to have been influenced by a lack of such blinding.

Various additional threats to internal validity were observed (see Table 3). Ceiling effects occurred once when all groups expressed strong intentions to use condoms in the future [2], and again when attitudes and behaviour associated with drug avoidance were highly favourable to begin with, and therefore could not improve further [1].

Several potential threats to external validity were noted. The majority of interventions were conducted on college students ( $n = 14$ ), and as this group are unrepresentative of wider target populations, generalisability of findings may be limited. Likewise, as most experiments were conducted in the laboratory ( $n = 15$ ), results may not apply well to field settings. It should be noted however, that considerable evidence exists for the successful application of dissonance-based interventions in the field, including those targeting energy conservation (Kantola, Syme, & Campbell, 1984), water conservation (Dickerson et al., 1992), and road safety (Fointiat, Morisot, & Pakuszewski, 2008), although these studies lie beyond the scope of this review. Self-report data, which is limited by social desirability bias and recall bias, was collected in 17 of 20 studies. The studies that assessed risky personal behaviours such as drug use, sexual habits, alcohol use, or smoking may have been especially prone to socially desirable responses from participants. Studies that collected data via interview ( $n = 7$ ) may have been particularly susceptible to response modification from participants owing to lack of anonymity (Huang, Liao, & Chang, 1998).

### **Sources of heterogeneity**

There was no evidence to suggest that intervention effects were influenced by type of target health behaviour (see Table 2) or incidence of methodological risk of bias. However, comparison of experimental paradigms with outcomes revealed a noteworthy pattern. The effort justification and belief disconfirmation paradigms produced positive effects in the

single studies that applied them, and the hypocrisy paradigm produced positive effects on all measures in 10 of 14 studies. In contrast, studies based on the induced compliance paradigm produced null or mixed results.

The use of validated measures did not appear to influence outcomes, nor did the use of a dissonance thermometer. However, the latter may have provided some insight into why certain studies failed to produce positive effects. Three studies that employed a dissonance thermometer measured substantial dissonance among control group participants and this may have contributed to the studies' mixed [13, 14] or null [10] results. One study reported a decrease in dissonance from pre-test to post-test [6], which may indicate that dissonance was not properly induced, that the process of dissonance reduction may have undermined motivation for attitude or behaviour change, or that the dissonance thermometer may have failed to accurately capture participants' psychological discomfort.

### **Discussion**

This review sought to evaluate the effectiveness and methodological quality of dissonance-based health behaviour interventions, and to explore sources of variability in intervention effects.

#### **Evidence for effectiveness**

The evidence regarding effectiveness of the reviewed dissonance-based studies was generally positive. In most instances changes were achieved in one or more measures of participants' behaviour, attitude or intention. The finding that within studies changes in behaviour were generally consistent with changes in attitude and intention was consistent with prior research (Draycott & Dabbs, 1998) and supportive of the key tenet of dissonance theory—that individuals experiencing dissonance feel impelled to reduce psychological discomfort by altering their cognitions and/or behaviour (Festinger, 1957). However this finding is limited as the majority of data were collected via self-report and are therefore

subject to bias. As consistent with earlier suggestions [15], it is recommended that future studies employ an objective measure of behaviour as an optimal way to measure the intention-behaviour translation.

Long-term effects were difficult to determine as only half the included studies implemented a follow-up measure. Of those that did, some drew non-significant [4, 10] or inconclusive [2, 6, 9, 13, 15] results at follow-up. Given that interventions in this topic area generally address habitual lifestyle behaviours, it is important to monitor the amount of sustained change over time. It has been suggested that the dissonant state lasts for only a few minutes, although effects may persist for up to two weeks (Draycott & Dabbs, 1998). Still, once dissonance is reduced and behaviour change occurs there is a risk behaviour may revert back to its previous pattern (Olson & Stone, 2005). Stone and Fernandez (2008) advise that although long-term effects remain unclear, the induction of cognitive dissonance may be a useful way to initiate or maintain new behaviours at each stage of existing behaviour change models such as the theory of planned behaviour (Ajzen, 1991) or transtheoretical model (Prochaska, DiClemente, & Norcross, 1992). However, these suggestions appear incongruous with the dissonance-based eating disorder prevention literature, which reports sustained effects at three years post-intervention (Stice et al., 2008a). Clearly, further exploration of the long-term effects of dissonance-based interventions targeting non-clinical behaviours is needed.

### **Quality of the evidence**

Among the reviewed studies methodological risk of bias was variable and frequently high (see Table 3). Common problems were inadequately described or conducted methods of randomisation and allocation concealment, and inadequate reporting of data for all groups and outcomes at each time point.

It was observed that null results may have arisen from recruitment procedures. In certain studies, at pre-intervention 27% [4] to 100% [1] of participants reported favourable levels of the target health behaviour and hence had limited potential for gain. According to Stone and Fernandez (2008), participants most likely to benefit from hypocrisy inductions are knowledgeable about the benefits of the behaviour and hold positive attitudes towards it, but currently do not perform the behaviour in line with prescribed standards. However, only 13 of 20 included studies implemented a pre-test measure to ascertain level of engagement in the target behaviour. In future, researchers should implement pre-test measures to ensure recruitment of participants who would benefit from the intervention.

### **Sources of heterogeneity**

Intervention effects were not ostensibly related to type of target health behaviour (see Table 2). Rather, the primary source of variation in outcomes was paradigmatic underpinning of studies, with 10 of 14 hypocrisy-based studies producing positive effects on all measures. The standardised hypocrisy induction procedure therefore appears to most reliably lead to changes in attitude, intention, or behaviour. On the other hand, studies based on the induced compliance paradigm produced mixed findings at best. The wide variation in dissonance induction methods between studies and lack of a standardised procedure may have hindered experimental outcomes. The absence of positive effects in these induced compliance-based studies is incongruent with strong evidence that this paradigm is effective for eating disorder prevention in a range of contexts (Stice et al., 2008a). However the eating disorder prevention studies have been replicated and fine-tuned for over a decade. It may be necessary for induced compliance-based interventions targeting non-clinical health behaviours to be undertaken with similar structure and attention if they are to produce similar outcomes.

In the past, various moderators of dissonance outcomes have been considered. For instance, participants who write counter-attitudinal statements report more discomfort under

high- than low -choice conditions (Elliot & Devine, 1994; Harmon-Jones, 2000), and perceived responsibility for transgressions regarding a target behaviour may influence the amount of dissonance induced (Stone & Fernandez, 2008). The present review indicates that self-esteem and gender may moderate the dissonance effect. Two studies [12a, 12b] reported that individuals high in self-esteem experienced more dissonance than those low in self-esteem. This accords with the self-consistency revision of dissonance theory (Aronson, 1968; Thibodeau & Aronson, 1992) which predicts that individuals with low self-esteem are less likely to experience dissonance as they more readily accept inconsistencies within themselves than those with high self-esteem; and with Stone and Cooper's (2001) model that identifies self-standards as an effect parameter for dissonance reduction.

Gender appeared to act as a moderator in several studies [9, 13, 15], where female participants demonstrated significantly more positive change in one or more outcomes than male participants. Thus it appears females may be more responsive than males to dissonance interventions targeting health behaviour. It should be noted that this potential gender effect may influence outcomes in studies that recruit majority-female samples. When exploring why gender differences may exist, several possibilities arise. Simmons and Brandon [13] suggest that women are more likely to self-disclose (Arliss, 1991) and be interpersonally and socially oriented toward group-based intervention tasks (Markus & Oyserman, 1989). This means they may be more engaged in intervention tasks than their male counterparts. Another possible explanation concerns the relationship between gender and attitude. It has been shown that when compared with males, typically, females hold more positive attitudes toward preventive health measures (e.g., Cottrell, McClamroch, & Bernard, 2005; Weissfeld, Kirscht, & Brock, 1990), and engage in less risk behaviour and more health protective behaviour (e.g., Nathanson, 1977; Wardle et al., 2004). Hence it may be that female participants in hypocrisy inductions experience greater dissonance because their pre-existing

attitudes toward the target health behaviour are usually positive and geared toward health protection. The dissonance brought about via hypocrisy induction is usually reduced through direct behavioural change. In the case of induced compliance-based interventions, participants usually hold negative pre-existing attitudes toward the target health behaviour and dissonance is experienced if they advocate the behaviour under conditions of high choice. Because an alternative (positive) attitude is made salient during the intervention, females may be more likely to adopt this route to dissonance reduction. Gender differences in response to dissonance-based health behaviour interventions may therefore reflect pre-existing gender differences in attitudes toward a health topic rather than differences in response to dissonance per se. Likewise, this review indicates that ethnicity may also act as a proxy for pre-existing attitudes, as in one study Caucasian participants demonstrated more health-protective behaviour than Hispanic participants [17a]. Investigation of the mediation of dissonance interventions through attitude is needed to clarify these possibilities.

### **Strengths and limitations**

The present review was the first to systematically identify and evaluate the effectiveness of dissonance-based interventions targeting non-clinical health behaviours. Bias was minimised via the development of a study protocol, relevance tool for screening phases, and data extraction template; and use of a sourced methodological risk for bias tool. However, as the review principally relied upon bibliographic database searches it may be subject to publication bias. In addition, relevant studies published in languages other than English may not have been included. It should also be noted that the analysis of intervention effects relied upon statistical p-values which are likely to be influenced by study sample sizes. Unfortunately, the large degree of heterogeneity in the reviewed papers meant that meta-analytic techniques that would have corrected for this bias were not appropriate in the present context.

### **Implications for future research**

This review highlights the need for more dissonance-based research targeting non-clinical health behaviours. The lack of studies evaluating behaviours such as exercise, healthy eating and alcohol use implies there is much to be learned about the effectiveness of dissonance in these areas and whether interventions best serve risk behaviours (e.g., alcohol use) or protective behaviours (e.g., fruit and vegetable intake) or both. At this stage no pattern can be discerned from the limited available research. The present results reaffirm the existing observation that there are large gaps in our understanding of the processes that underlie dissonance induction (Stone & Fernandez, 2008). In particular, efforts should be made toward evaluating the factors that moderate dissonance-induced health behaviour change. Studies that have included measures such as self-esteem and perceived responsibility for transgressions have begun to contribute to this line of inquiry. Readiness for change has been identified as a moderator in other contexts (Stice, Marti, Shaw, & O'Neil, 2008b) and may apply to interventions targeting non-clinical health behaviour. Whether gender and ethnicity represent proxies for pre-existing attitudes is also a noteworthy issue that deserves clarification.

Future dissonance-based interventions may be improved in several ways. When targeting non-clinical health behaviours the hypocrisy paradigm appears the most reliable procedure. There is potential for further development of the effort justification, belief disconfirmation and induced compliance paradigms, provided care is taken to strengthen the quality of research. Irrespective of chosen paradigm, researchers should ensure full reporting of demographic variables, selection and randomisation procedures, attrition rates, and all outcomes for all groups at pre-test, post-test and follow-up. Use of a social desirability scale during collection of self-report data on health-related items is recommended to help detect

and control for bias (Van de Mortel, 2008). Such a scale was used in only two included studies [7, 10] and it is advised that more researchers follow suit.

One area that needs further attention is the measurement of induced dissonance in each comparison group. Dissonance is most commonly measured indirectly through changes in individuals' attitudes or behaviour. Such changes indicate that dissonance reduction has occurred, and hence dissonance was experienced. The amount of dissonance an individual experiences may be inferred from the magnitude of observed change in their attitude or behaviour. The dissonance thermometer (Elliot & Devine, 1994) aims to provide a more direct measure of dissonance rather than the inference of dissonance as is typical. However data derived from this instrument should be interpreted with caution as it is limited by self-report bias. Further, limited use of the dissonance thermometer across included studies and a lack of positive effects in the studies that used it prevent the drawing of further conclusions about whether this instrument is indeed a strong indicator of elicited dissonance. It is advised researchers include this measure and report relevant outcomes so reliability and validity can be fully established. Comparison of the magnitude of change in attitude and behaviour with dissonance thermometer scores may also prove useful.

Finally, of key importance is the inconsistency between the amount and quality of research found in this review versus that of the clinical literature on dissonance-based interventions. Indeed, many of the discussed methodological limitations and recommendations have already been addressed in the context of eating disorder prevention such as use of objective outcome data (e.g., body mass index), long-term follow-up (Stice et al., 2008a; Stice, Rohde, Shaw, & Gau, 2011), ethnicity comparisons (Rodriguez, Marchand, Ng, & Stice, 2008), and analysis of moderators (Stice et al., 2008b) and mediators of intervention effects (Seidel, Presnell, & Rosenfield, 2009; Stice, Marti, Rohde, & Shaw, 2011; Stice, Presnell, Gau, & Shaw, 2007). Moreover, inquiry into the mechanisms of

dissonance-based eating disorder prevention programs has been conducted via comparison of high- and low-level dissonance interventions (Green et al., 2005; McMillan, Stice, & Rohde, 2011b). It is clear that dissonance-based interventions certainly work in other contexts. However the lack of strong research means it is unclear whether these effects hold in non-clinical contexts. Researchers working in this domain should seek to model their research on the clinical literature in order to provide a stronger basis for evaluating intervention effectiveness.

The present review provides substantial evidence for the effectiveness of dissonance-based interventions in promoting health behaviour change. The majority of studies produced significant effects on at least one measure of behaviour, attitude or intention. The hypocrisy paradigm was found to be the most commonly applied research paradigm and was most effective in inducing change across a range of behaviours. Unlike previous findings in the clinical literature, the induced compliance paradigm did not produce notable changes. Yet, there is potential for interventions based on this approach to be strengthened considerably. Numerous methodological issues were raised, which limit the drawing of further conclusions due to potential for bias across studies. Researchers are encouraged to take care when designing interventions so as to increase the quality of studies conducted in this area, and where possible, explore moderators of the dissonance effect.

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*Note:* References marked with an asterisk indicate studies included in the present review.

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**Table 1**  
*Summary of Study Characteristics*

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
1	Ager et al. (2008) USA One group pre-post	Drug use	<i>N</i> = 7 High-risk youth; aged 10-12 years.	<ul style="list-style-type: none"> <li>• Intervention: Participants created a substance abuse prevention video over the course of 10 sessions.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, there were no changes in participants' drug attitudes or drug use (<i>ns</i>).</li> </ul>
2	Aronson et al. (1991) USA Factorial RCT	Sexual risk behaviour	<i>N</i> = 80 Sexually active college students; age unreported.	<ul style="list-style-type: none"> <li>• Hypocrisy: Participants described recent situations where they failed to use condoms then prepared and filmed a speech advocating condom use.</li> <li>• Preach-only: Participants composed and filmed a speech advocating condom use.</li> <li>• Mindful-only: Participants composed and rehearsed a speech that was not filmed.</li> <li>• Control: Participants received information only.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, hypocrisy condition more likely to admit failure to use condoms in the past (<i>p</i> unreported) than any other condition.</li> <li>• At post-test, the hypocrisy condition showed greatest improvement between past use and intent for future condom use (<i>p</i> unreported).</li> <li>• At three-month follow-up, the hypocrisy condition reported greatest condom use (64%), compared with preach-only (56%), mindful only (26%) and low mindful no preach (51%) (<i>ps</i> unreported) conditions.</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
3	Axsom and Cooper (1985) USA Factorial RCT	Weight loss	<i>N</i> = 52 Overweight females; aged 18 years and older.	<ul style="list-style-type: none"> <li>• High effort, high choice: Participants completed a variety of stress-inducing cognitive tasks over five sessions. They were warned about potential effort and anxiety and reassured they could stop any time.</li> <li>• High effort, low choice: As above except no option to withdraw.</li> <li>• Low effort, high choice: Participants completed a variety of simple cognitive tasks over five sessions. They were warned about potential effort and anxiety and reassured they could stop any time.</li> <li>• Low effort, low choice: As above except no option to withdraw.</li> <li>• Control: Participants were weighed at each of five sessions</li> </ul>	<ul style="list-style-type: none"> <li>• There was no effect for the perceived choice manipulation. Therefore, results were interpreted by examining high effort vs. low effort.</li> <li>• At post-test, the high-effort condition lost significantly more weight than the low-effort and control conditions (<math>p &lt; .02</math>). This difference was maintained at 6-month (<math>p &lt; .001</math>) and one-year (<math>p &lt; .02</math>). follow-up</li> </ul>
4	Baker (1994) USA Factorial RCT	Sexual risk behaviour	<i>N</i> = 171 College students; mean age 18.7 years.	<ul style="list-style-type: none"> <li>• Endorsement + high awareness: Participants wrote and filmed a short speech advocating safe sex, then wrote about their own failures to practise safe sex.</li> <li>• No endorsement + high awareness control: As above except the speech was not filmed.</li> <li>• Endorsement + low awareness control: Filmed speech only.</li> <li>• No endorsement + low awareness control: Unfilmed speech only.</li> </ul>	<ul style="list-style-type: none"> <li>• At one-month follow-up there were no associations between sexual risk taking behaviour and any of the experimental conditions (<i>ns</i>).</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
5	Bator and Bryan (2007) USA Factorial RCT	Exercise	<i>N</i> = 127 College fitness centre patrons; mean age 20.3 years.	<ul style="list-style-type: none"> <li>• Mindful-only: Participants were asked to respond verbally to four questions about their exercise habits.</li> <li>• Commitment only: Participants were asked to print their name on a flyer that strongly endorsed exercise.</li> <li>• Hypocrisy: Mindful-only + commitment-only manipulations.</li> <li>• Control: Baseline questionnaire only.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, the hypocrisy condition had stronger intention to exercise in future compared with all other conditions combined (<math>p &lt; .05</math>), but not when compared to each condition individually (<i>ns</i>).</li> <li>• After the intervention, a greater proportion of the hypocrisy condition had high exercise rates than the other conditions during the first two weeks of university semester (<math>p &lt; .05</math>).</li> </ul>
6	Chait (2010) USA Parallel-group RCT	Sun protection	<i>N</i> = 225 College students; aged 18-25 years.	<ul style="list-style-type: none"> <li>• Dissonance tanning: Participants discussed the tan-ideal and examples from society, and performed in a filmed role-play.</li> <li>• Dissonance healthy lifestyle control: As above, except the target behaviour was healthy eating and exercise.</li> <li>• Control: Participants watched a presentation on the consequences of UV exposure and strategies for UV protection.</li> </ul>	<ul style="list-style-type: none"> <li>• The dissonance tanning condition was no different from the psychoeducational control condition on any of the outcome measures (<i>ns</i>) at both post-test and one-month follow-up.</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
7	Eitel and Friend (1999) USA Parallel-group RCT	Sexual risk behaviour	N = 150 College students; mean age 18.7 years.	<ul style="list-style-type: none"> <li>• Motivational (dissonance): Participants prepared and filmed a speech on the importance of safe sex for prevention of STDs and AIDS, then listed their own failures regarding safe sex.</li> <li>• Cognitive: Participants were given a fact sheet about HIV and asked to answer five questions about the frequency of their risk behaviours.</li> <li>• Control: Dependent measures questionnaire only.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, dissonance condition had lower levels of denial than cognitive condition (<math>p &lt; .06</math>) and lower levels than the control condition (<math>p &lt; .05</math>); and greater intent to use condoms than the cognitive (<math>p &lt; .03</math>) and control (<math>p &lt; .02</math>) conditions.</li> <li>• At post-test, no difference between groups for condoms bought.</li> <li>• At two-month follow-up, motivational group reported less STD risk behaviour than cognitive (<math>p &lt; .001</math>) and controls (<math>p &lt; .03</math>).</li> </ul>
8	Fointiat (2004) France Parallel-group RCT	Driving behaviour	N = 144 Shopping centre patrons; aged 18-60 years.	<ul style="list-style-type: none"> <li>• Standard dissonance: Participants were invited to sign a flyer promoting safe speed limits, answered questions about past transgressions concerning speed limits, and were asked if they wanted to install a recording tachometer in their car.</li> <li>• Self-integrity threatening: Standard dissonance + experimenter suggested that participant had violated speed limits in the past.</li> <li>• Self-integrity strengthening: Standard dissonance + experimenter suggested that the participant had not violated speed limits in past.</li> <li>• Control: Invitation to sign flyer and then to install a tachometer.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, participants in the three dissonance conditions were more likely to intend to install a tachometer than those in the control condition (<math>p = .007</math>).</li> <li>• At post-test, there was no difference between the standard dissonance condition and the integrity strengthening condition (<math>p &gt; .05</math>) or the integrity threatening condition (<math>p = .14</math>).</li> <li>• At post-test, more participants from the integrity threatening condition intended to install a tachometer than those in the integrity strengthening condition (<math>p = .02</math>).</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
9	Hafstad et al. (1997) Norway Cohort analytic	Smoking	<i>N</i> = 11 033 Adolescents; aged 14-15 years at baseline.	<ul style="list-style-type: none"> <li>• Intervention county: Mass media campaign involving 3 different newspaper advertisements, one poster, and one TV/cinema advertisement from 1992-1995. Media messages clearly pointed out inconsistencies between the act of smoking and attitudes which were believed to be held among the target population.</li> <li>• Control county: Baseline survey and post-campaign survey only.</li> </ul>	<ul style="list-style-type: none"> <li>• At one-year follow-up, the intervention county showed a decrease in uptake of smoking (<math>p &gt; .05</math>), and lower intentions for future smoking than control county (<math>p &lt; .01</math>). The increase in daily smokers was also lower in the intervention county than the control county among girls (<math>p &lt; .01</math>), but not boys (<i>ns</i>).</li> <li>• Among those who were smokers at baseline, more girls stopped in intervention county at one-year follow-up than the control county (<math>p &lt; .05</math>). There were no differences for boys (<i>ns</i>).</li> </ul>
10	Hammons (2010) USA. Parallel-group RCT	Alcohol use	<i>N</i> = 53 College students; aged 18-26 years.	<ul style="list-style-type: none"> <li>• Hypocrisy: Participants prepared and filmed a speech about responsible alcohol use then listed instances where they had consumed alcohol in a risky manner.</li> <li>• Control: Participants completed a psychoeducational computer program about the risks of alcohol consumption.</li> </ul>	<ul style="list-style-type: none"> <li>• The hypocrisy condition was no different than the control condition on any of the outcome measure (<math>ps &gt; .05</math>) at both post-test and one-month follow-up.</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
11	Morrongiello and Mark (2008) Canada Cluster non-randomised trial	Playground risk behaviour	<i>N</i> = 239 School students; aged 7-13 years.	<ul style="list-style-type: none"> <li>• Dissonance: Participants created posters about what they “would” and “would not” do regarding risky playground behaviours. Participants generated a list of risky playground behaviours, signed a “safe play” poster, and made a safe play “radio commercial”.</li> <li>• Control: Participants created posters about what they “would” and “would not” do regarding risky playground behaviours.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, participants in the dissonance condition reported a decrease in intentions to risk take; and increases in danger ratings, vulnerability ratings, and severity ratings compared with participants in the control condition (<i>ps</i> &lt; .01).</li> </ul>
12a	Peterson et al. (2008), Study 1 Canada Parallel-group RCT	Smoking	<i>N</i> = 61 College students; mean age 19.1 years.	<ul style="list-style-type: none"> <li>• Hypocrisy: Participants prepared and filmed a speech on the dangers of smoking from a list of facts about smoking, then completed a questionnaire on their own past smoking behaviour.</li> <li>• Control: Participants examined a list of facts about smoking risks.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, participants in the hypocrisy condition with high self-esteem had higher intentions to quit smoking than those with low self-esteem (<i>p</i> &lt; .05). There was an effect for self-esteem and an interaction between self-esteem and hypocrisy (<i>ps</i> &lt; .05), but no effect for hypocrisy (<i>ns</i>).</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
12b	Peterson et al. (2008), Study 2 Canada Parallel-group RCT	Healthy lifestyle behaviours	<i>N</i> = 88 College students; mean age 19.1 years.	<ul style="list-style-type: none"> <li>• Hypocrisy: Participants wrote a passage on the importance of a healthy lifestyle and answered questions about past behaviours.</li> <li>• Control: Participants wrote a passage on the importance of a healthy lifestyle and were told content would be kept confidential.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, participants in the hypocrisy condition with high self-esteem had higher intentions to quit smoking than those with low self-esteem (<math>p &lt; .01</math>). There was an effect for self-esteem (<math>p &lt; .01</math>) and an interaction between self-esteem and hypocrisy (<math>p &lt; .05</math>), but no effect for hypocrisy (<i>ns</i>).</li> </ul>
13	Simmons and Brandon (2007) USA. Parallel-group RCT	Smoking	<i>N</i> = 215 College student smokers; mean age 20.2 years.	<ul style="list-style-type: none"> <li>• Dissonance smoking: Participants discussed smoking-related topics and then prepared and filmed an anti-smoking speech.</li> <li>• Nutrition control: As for dissonance smoking condition except the group discussed and made a nutrition-related video.</li> <li>• Didactic smoking control: Participants were shown an anti-smoking video, followed by a question and answer session with the experimenter.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, dissonance smoking group had higher intentions to quit smoking than nutrition (<math>p &lt; .001</math>), and smoking controls (<math>p = .04</math>). Females in the dissonance smoking group showed greater intention to quit than other two groups (<math>p = .003</math>).</li> <li>• At post-test, more dissonance group participants had taken anti-smoking educational pamphlets than smoking control (<math>p = .039</math>) or nutrition control (<math>p = .006</math>) participants.</li> <li>• At one-month follow-up, participants in both smoking groups had higher intentions to quit than nutrition group (<math>ps &lt; .001</math>).</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
14	Simmons et al. (2004) USA. Factorial RCT	Smoking	N = 144 College student smokers; mean age 22.1 years.	<ul style="list-style-type: none"> <li>• Dissonance smoking-risk + feasibility: Participants were given information about smoking risks and feasibility of quitting and prepared and filmed an anti-smoking message.</li> <li>• Dissonance smoking-risk: As above except information was restricted to smoking risks.</li> <li>• Dissonance feasibility: As for smoking risk + feasibility condition except information was restricted to feasibility of quitting.</li> <li>• Non-dissonance control: Participants filmed an anti-smoking message without smoking risk information.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, participants who were provided information about smoking risks (<math>p = .058</math>) or feasibility of quitting (<math>p = .005</math>) reported increased intentions to quit compared with controls. Although, there were no differences between the smoking risk + feasibility condition and controls (<math>ns</math>).</li> <li>• At post-test, participants in smoking-risk conditions had higher perceptions of risk than those in control condition (<math>p = .010</math>).</li> <li>• There was no effect of condition on addiction beliefs (<math>ns</math>).</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
15	Stone et al. (1994) USA Factorial RCT	Sexual risk behaviour	<i>N</i> = 72 Sexually active college students, untested for HIV; mean age 19.2 years.	<ul style="list-style-type: none"> <li>• Hypocrisy: Participants prepared and filmed a persuasive message against sexual risk taking, read a list of circumstances that may make safe sex difficult, then listed instances of their own past failures to use condoms.</li> <li>• Commitment-only control: Participants developed and filmed a persuasive message against sexual risk taking.</li> <li>• Mindful-only control: Participants read a list of circumstances that may make adherence to safe sex difficult and listed instances of their own past failures to use condoms.</li> <li>• Information-only control: Participants developed a persuasive message against sexual risk taking that was not filmed.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, more participants in the hypocrisy condition bought condoms compared with commitment-only (<math>p &lt; .01</math>), mindful-only (<math>p &lt; .05</math>), and information-only conditions (<math>p &lt; .01</math>).</li> <li>• At post-test, participants in the hypocrisy condition bought more condoms than commitment-only (<math>p &lt; .04</math>) and mindful-only conditions (<math>p &lt; .05</math>), but not information-only (<i>ns</i>).</li> <li>• At post-test, the hypocrisy condition had higher intentions for future condom use than mindful-only (<math>p &lt; .03</math>) and information-only (<math>p &lt; .01</math>) conditions, but not commitment-only condition (<i>ns</i>).</li> <li>• At three-month follow-up, the use of condoms by the hypocrisy group was higher than commitment-only (<math>p &lt; .05</math>), but for no other group (<i>ns</i>).</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
16	Stone and Fernandez (2011) USA Factorial RCT	Sun protection	N = 90 College students; age unreported.	<ul style="list-style-type: none"> <li>• High elaboration + high recall: Participants wrote statements advocating use of sunscreen then completed an “important” survey including recall of 8 past failures to use sunscreen.</li> <li>• High elaboration + low recall: As above except only 2 past failures</li> <li>• Low elaboration + high recall: As for high + high group except participants were told that thousands would be completing survey.</li> <li>• Low elaboration + low recall: As for high + high condition except only 2 past failures were recalled and participants were told that thousands would be completing survey.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, more of the high elaboration participants acquired sunscreen coupons when they recalled 2 past failures compared with 8 past failures (<math>p = .04</math>). The high elaboration + low recall condition acquired the most sunscreen of all groups.</li> <li>• At post-test, more low elaboration participants acquired sunscreen coupons when they recalled 8 past failures compared with 2 past failures (<math>p = .054</math>). The low elaboration + low recall group acquired the least sunscreen of all groups.</li> <li>• At post-test, no changes in attitude in any condition (<math>ns</math>).</li> </ul>
17a	Stone et al. (1997), Study 1 USA RCT	Sexual risk behaviour	N = 112 Sexually active college students; aged 18-25 years.	<ul style="list-style-type: none"> <li>• Hypocrisy: Participants developed and filmed an AIDS prevention speech, then listed personal failures to practise safe sex.</li> <li>• Normative reasons: As for hypocrisy condition, except participants chose reasons for failures that applied to other people.</li> <li>• Personal-reasons-only control: As for hypocrisy condition but the speech was not filmed.</li> <li>• Advocacy-only control: Filmed speech only.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, more participants in the hypocrisy group had purchased condoms than those in each of the other three conditions (<math>ps &lt; .05</math>).</li> <li>There were no effects of gender on condom purchase (<math>ns</math>) but there was a main effect of ethnicity, with Caucasian participants purchasing more condoms than Hispanic participants (<math>p &lt; .05</math>).</li> </ul>

ID	Reference, country and study design	Health behaviour	Sample	Comparison group manipulations	Relevant results
17b	Stone et al. (1997): Study 2 USA Randomised trial	Sexual risk behaviour (targeted indirectly)	<i>N</i> = 27 Female college students not volunteering in community; age unreported.	<ul style="list-style-type: none"> <li>• Indirect-only: Participants developed and filmed a persuasive speech about volunteering in the community and listed activities that prevented them volunteering. An opportunity for condom purchase was offered.</li> <li>• Direct-only: As above, except an opportunity for donation to the homeless was offered.</li> <li>• Indirect-versus-direct-only: As for indirect-only, plus an opportunity for donation to the homeless was offered.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, 67% of participants donated money when it was the only option available, whereas 44% of participants purchased condoms when it was the only option available (<i>ns</i>).</li> <li>• When the two options were offered together, 67% donated and 11% purchased condoms (<math>p &lt; .05</math>).</li> </ul>
18	Thompson et al. (2002) USA Parallel-group RCT	Sexual risk behaviour	<i>N</i> = 128 Sexually active college students; mean age 20.4 years.	<ul style="list-style-type: none"> <li>• Hypocrisy: Participants wrote about a circumstance in which they failed to practise safe sex, rate HIV status of photographed people, and wrote an appeal for condom use.</li> <li>• Control: Participants watched a 20-minu video advocating safe sex.</li> </ul>	<ul style="list-style-type: none"> <li>• At post-test, the hypocrisy condition had a higher intention to use condoms, and a stronger perception of personal HIV risk than the control condition (<math>ps &lt; .01</math>).</li> <li>• At three-month follow-up, the hypocrisy condition reported higher condom use than the control condition (<math>p &lt; .05</math>).</li> </ul>

**Table 2**  
***Intervention Effects***

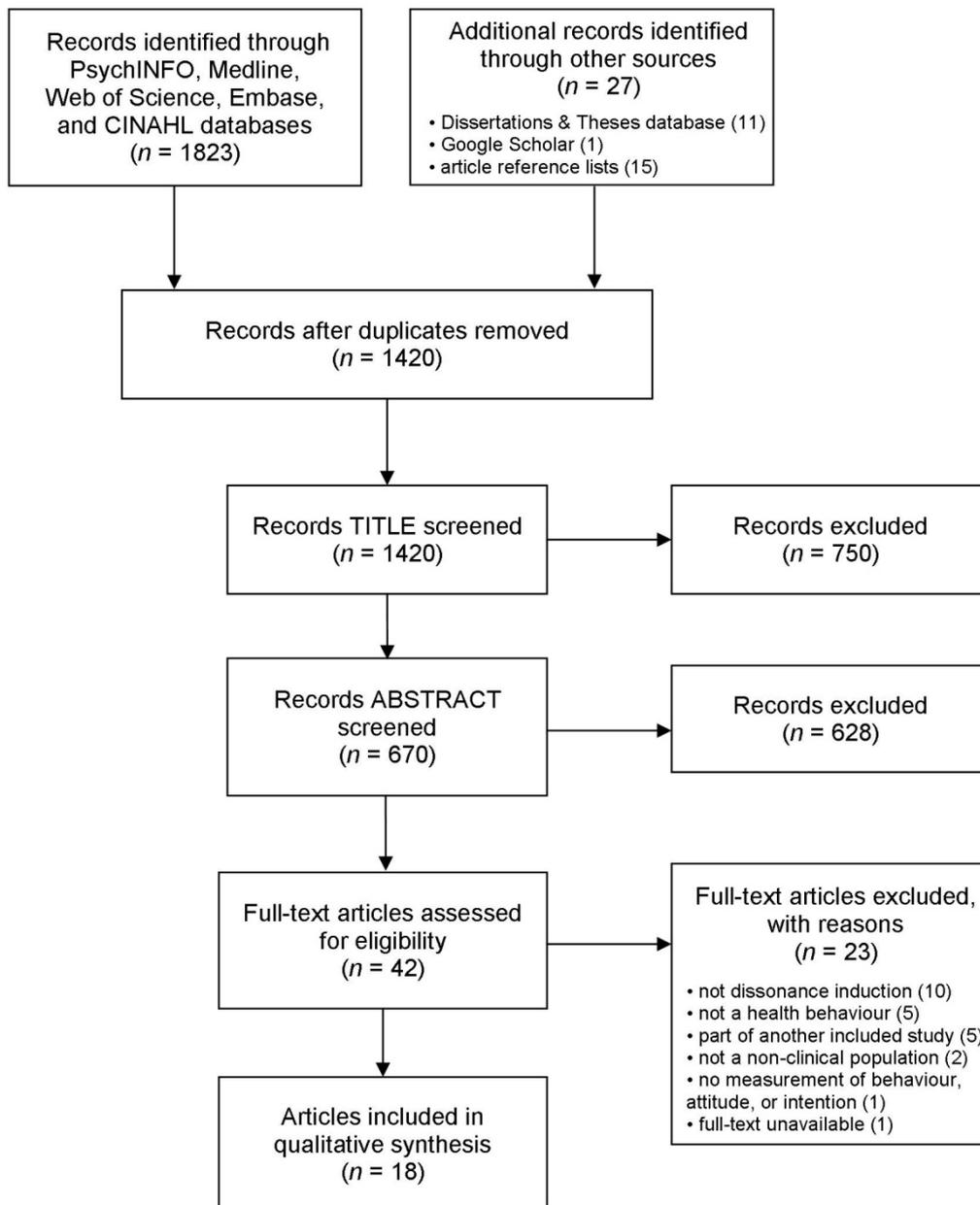
Health behaviour	ID	Reference	Statistically significant changes* in:			
			Behaviour	Attitude	Intention	Paradigm
<i>Drug use</i>	1	Ager et al. (2008)	— <sup>a</sup>	— <sup>a</sup>	.	IC
<i>Weight loss</i>	3	Axsom and Cooper (1985)	+	.	.	EJ
<i>Alcohol use</i>	10	Hammons (2010)	—	.	.	H
<i>Exercise</i>	5	Bator and Bryan (2007)	+	.	+	H
<i>Driver safety</i>	8	Fointiat (2004)	.	.	+	H.
<i>Playground risk behaviour</i>	11	Morrongiello and Mark (2008)	.	+	+	H.
<i>Healthy lifestyle behaviours</i>	12b	Peterson et al. (2008), Study 2	.	.	+	H
<i>Sun protection</i>	6	Chait (2010)	—	.	—	IC
	16	Stone and Fernandez (2011)	+	—	.	H
<i>Smoking</i>	9	Hafstad et al. (1997)	+	.	+	BD
	12a	Peterson et al. (2008), Study 1	.	.	+	H
	13	Simmons and Brandon (2007)	+/-	.	+/-	IC
	14	Simmons et al. (2004)	.	+/-	+	IC
<i>Sexual risk behaviour</i>	2	Aronson et al. (1991)	+ <sup>b</sup>	.	+ <sup>b</sup>	H
	4	Baker (1994)	—	.	.	H
	7	Etiel and Friend (1999)	+/-	+	+	H
	15	Stone et al. (1994)	+	.	+	H
	17a	Stone et al. (1997), Study 1	+	.	.	H
	17b	Stone et al. (1997), Study 2	— <sup>a</sup>	.	.	H
	18	Thompson et al. (2002)	+	+	+	H

*Note:* \* relative to no-intervention control, + = yes, - = no, +/- = mixed results, ? = unreported, . = not applicable, <sup>a</sup> relative to baseline as there was no control group, <sup>b</sup> based on group means as statistical analyses were not conducted, IC = induced compliance, EJ = effort justification, H = hypocrisy, BD = belief disconfirmation.

**Table 3**  
*Assessment of Risk of Bias*

ID	Reference	Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	Other bias
		Adequate sequence generation	Allocation concealment	Blinding of participants	Blinding of personnel/ assessors	Incomplete outcome data addressed	Free of selective reporting	Free from threats to internal validity
1	Ager et al. (2008)	—	.	?	+	+	+	— <sup>a</sup>
2	Aronson et al. (1991)	?	?	+	+	+	—	— <sup>b</sup>
3	Axsom and Cooper (1985)	?	?	+	+	+	+	— <sup>c</sup>
4	Baker (1994)	—	—	+	+	+	—	— <sup>d</sup>
5	Bator and Bryan (2007)	—	?	+	+	+	+	+
6	Chait (2010)	—	—	+	+	—	—	—
7	Eitel and Friend (1999)	?	?	+	+	?	+	+
8	Fointiat (2004)	?	?	+	+	+	+	— <sup>b,c</sup>
9	Hafstad et al. (1997)	—	.	.	+	+	+	— <sup>a,c</sup>
10	Hammons (2010)	?	?	+	+	?	+	+
11	Morrongiello and Mark (2008)	—	—	?	+	+	+	— <sup>a</sup>
12a	Peterson et al. (2008), Study 1	?	?	+	+	+	—	— <sup>c</sup>
12b	Peterson et al. (2008), Study 2	?	?	+	+	+	—	— <sup>c</sup>
13	Simmons and Brandon (2007)	—	+	+	+	+	+	+
14	Simmons et al. (2004)	?	?	+	+	+	+	+
15	Stone et al. (1994)	?	?	+	+	+	+	— <sup>b</sup>
16	Stone and Fernandez (2011)	?	?	+	+	+	+	— <sup>b</sup>
17a	Stone et al. (1997), Study 1	?	?	+	+	+	+	— <sup>b</sup>
17b	Stone et al. (1997), Study 2	?	?	+	+	+	+	— <sup>b</sup>
18	Thompson et al. (2002)	?	?	+	+	+	+	+

Note: + = yes (low risk of bias), — = no (high risk of bias), ? = unclear (insufficient information to discern risk of bias), . = not applicable, <sup>a</sup> non-randomised design, <sup>b</sup> no baseline measurement, <sup>c</sup> demographic characteristics between groups unreported, <sup>d</sup> marked baseline imbalance between groups.



**Figure 1.**

*Flow diagram of study selection.* Adapted from PRISMA flow diagram (Liberati et al., 2009)