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# The Impact of Positive Affect on Health Cognitions and Behaviours: A Meta-Analysis of the Experimental Evidence

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**Abstract**

Several reviews suggest that positive affect is associated with improved longevity, fewer physical symptoms, and biological indicators of good health. It is possible that positive affect could influence these outcomes by promoting healthful cognitions and behaviours. The present review identified conceptual pathways from positive affect to health cognitions and behaviour, and used random effects meta-analysis to quantify the impact of positive affect inductions (versus neutral affect conditions) on these outcomes. Literature searches located 54 independent tests that could be included in the review. Across all studies, the findings revealed no reliable effects on intentions ($d_+$ = -.12, 95% CI = -.32 to .08, k = 15) or behaviour ($d_+$ = .15, 95% CI = -.03 to .33, k = 23). There were four reliable effects involving specific cognitions and behaviours, but little clear evidence for generalised benefits or adverse effects of positive emotions on health-related cognitions or actions. Conclusions must be cautious given the paucity of tests available for analysis. The review offers suggestions about research designs that might profitably be deployed in future studies, and calls for additional tests of the impact of discrete positive emotions on health cognitions and behaviour.

Keywords: positive affect, health behaviour, cognition, motivation, positive psychology

**The Impact of Positive Affect on Health Cognitions and Behaviours:**

**A Meta-Analysis of the Experimental Evidence**

Although most psychological research on affect has concerned negative affect (see Mayne, 1999; Steptoe, 2006, for reviews), research has increasingly examined the impact of positive affect on physical health. For instance, people who score highly on measures of dispositional positive affect report fewer physical symptoms and exhibit lower morbidity rates (reviews by Consedine & Moskowitz, 2007; Pressman & Cohen, 2005), and indices of positive affect are associated with biological markers of health (immune system response, cortisol profiles, and cardiovascular function; see, e.g., Dockray & Steptoe, 2010; Howell, Kern & Lyubomirsky, 2007; Steptoe, Dockray, & Wardle, 2009, for reviews) and longevity (Howell et al., 2007). Positive affect may influence health not only via a biological route (e.g., by modifying immune function) but also via behaviour – by influencing the extent to which people engage in health-protective (e.g. physical activity) or health-risk (e.g., smoking) behaviours (Pressman & Cohen, 2005). Although a literature has developed that explores the impact of positive affect inductions on health-related cognitions and behaviours, at present, there is no clear answer to the question: 'Does positive affect promote healthful cognitions and behaviour?' In this paper we seek to answer this question by collating and meta-analysing relevant experimental evidence.

Positive affect (PA) involves both pleasant feeling states and good moods (Estrada, Isen, & Young, 1994) and is conceptually distinct from negative affect; PA does not merely reflect an absence of negative feelings (Diener & Emmons, 1984). According to Fredrickson (2013), ten 'representative' positive emotions are joy, gratitude, serenity, interest, hope, pride, amusement, inspiration, awe, and love (see also Argyle & Crossland, 1987; Ferdenzi et al., 2011). Correlational evidence generally is consistent with the idea that dispositional positive affect may influence health outcomes (Cohen & Pressman, 2005; Dockray & Steptoe, 2010; Howell et al., 2007; Pressman & Cohen, 2005; Steptoe et al., 2009). However, correlational

data cannot confirm the direction of effects. For instance, reporting healthful cognitions could make people feel better about themselves (Gollwitzer, Sheeran, Michalski, & Seifert, 2009), and engaging in healthful behaviours can engender positive affect (Kwan, Bryan, & Sheeran, 2012). Correlational data also cannot rule out the possibility that a third variable (e.g., social support, optimism) is responsible for the observed associations. To guard against such alternative explanations, the present review focuses exclusively on experimental studies that manipulated positive affect and subsequently assessed health cognitions and behaviours. Because comparisons of positive versus negative mood inductions cannot distinguish between effects due to the presence of positive mood and effects due to the absence of negative mood, our review is restricted to comparisons involving a positive affect induction and a neutral affect condition.

**Paths from Positive Affect to Health Cognitions and Behaviours**

A key conceptual framework that describes the psychological benefits of positive affect is Frederickson's (2001, 2013) Broaden and Build Model (BBM). The BBM proposes that positive affect confers specific and measurable benefits for cognition and thought-action repertoires across a range of domains. In terms of broadening, positive affect widens an individual's attentional scope (Frederickson, 2004), encouraging the development of connections across concepts and promoting more global information processing. In terms of building, positive affect is thought to develop individuals' resilience (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009) and to enhance resources both in terms of coping (Frederickson & Joiner, 2002) and social relationships (Waugh & Fredrickson, 2006). There are complementary theoretical analyses of positive affect's advantages for decision making (Isen, 2008) and self-regulation (Aspinwall, 1998). In addition, several theoretical frameworks concerned with the impact of mood on cognition and behaviour more generally are also relevant to effects on health cognitions and behaviour – including the affect infusion model (e.g., Forgas, 1995), the feelings as information (e.g., Schwarz & Clore, 1983), mood as input

(e.g., Martin, 2001), and safety signal (Frijda, 1998) approaches, and the hedonic contingency framework (e.g., Wegener & Petty, 1994).

Rather than review each theory in detail here, we drew upon previous research to identify potential pathways from positive affect to health cognitions and behaviour. The criteria were that (a) the pathways had a conceptual and empirical basis, and (b) we could use the pathway to characterise the empirical studies of positive affect and health cognitions and behaviours located in literature searches. The pathways captured three processes that intervene between the positive affect induction and performance of health behaviour, namely, cognition (information processing and problem solving), motivation (choice of goals and intensity of goal striving), and resources (capacity for self-regulation). The pathways also differed in terms of their direction of influence on healthful cognitions and behaviours, namely, positive paths (i.e., PA promotes health-protective, and reduces health-risk, cognitions and behaviours), negative paths (i.e., PA reduces health-protective, and promotes health-risk, cognitions and behaviours), and ambiguous or context-dependent paths. Figure 1 summarises the 7 pathways and indicates the relevant processes (cognition, motivation, resources) and path directions (positive, negative, or context-dependent). Cognitions (e.g., attitudes, intentions) and behaviours are both included as outcomes as health behaviour theories assume that changing cognitions engenders behaviour change (see Conner & Norman, 2006, for a review) and empirical evidence supports this assumption (Maki et al., 2013; Sheeran, Harris, & Epton, 2014; Webb & Sheeran, 2006).

**Pathway 1: Improved attention**. According to the BBM, positive affect broadens attention which is the mechanism underlying the array of observed changes in cognition (e.g., increased creativity; Isen, Daubman, & Nowicki, 1987). Research on the feelings-as-information perspective suggests that people interpret their mood as providing information concerning their feelings about a target, and make mood-congruent judgments; people in a positive mood are liable to make more favourable judgements about targets. This idea suggests that positive mood could enhance both outcome expectancies (subjective estimates of the

likelihood of good or bad outcomes that would accrue from performing health behaviours) and self-efficacy appraisals (people's confidence in their ability to perform behaviours or achieve outcomes, e.g., Erez & Isen, 2002; Isen & Reeve, 2005). Thus, the first pathway by which positive affect could enhance health cognitions and behaviour is via improved attention to favourable consequences of healthful behaviours.

**Pathway 2: Thorough and forward-looking thinking**. The second cognitive pathway by which positive affect may promote healthful cognitions and behaviour is via thorough and forward-looking thinking (Pathway 2). According to Isen (2004), positive affect can promote thorough thinking and increases openness to information (e.g., Estrada, Isen, & Young, 1997), and should thus enhance processing of health education messages (Schuettler & Kiviniemi, 2006).[1] Positive affect also promotes high-level construal (Labroo & Patrick, 2008), forward-looking thinking (Isen & Reeve, 2005), and engagement with future problems (Oettingen, Mayer, Thorpe, Janetzke, & Lorenz, 2005). In high-risk situations, positive affect engenders more thoughts about losing compared to control conditions, and leads to more conservative behaviour geared at protecting oneself from losses (e.g., Isen & Geva, 1987; Isen, Nygren, & Ashby, 1988). Thus, positive affect could promote realistic and consequential risk perceptions.

**Pathway 3: Increased motivation**. Positive affect could promote more healthful goal choices and stronger behavioural intentions by generating more favourable outcome expectancies and stronger self-efficacy feelings. Individuals experiencing positive affect may also invest greater effort when the focal task is important or when participants' efforts are

[1] Other researchers propose that positive affect induces more superficial, not deeper, processing of information (for discussions, see, e.g., Bless & Fielder, 2006; Isen, 2004).

likely to have positive outcomes (Erez & Isen, 2002; Isen & Reeve, 2005). Positive affect also enhances intrinsic motivation, though not, apparently, at the expense of completing necessary but less enjoyable tasks (Isen & Reeve, 2005).

**Pathway 4: Responsiveness to goal cues.** An alternative view of the impact of positive affect on motivation is that PA increases responsiveness to goal cues. Fishbach and Labroo (2007) proposed that positive mood is a signal to adopt one's currently accessible goal. Participants in a positive mood were more likely to adopt goals regardless of their content (Study 1) and they were more likely to enact the goal that was activated in the situation (Studies 2, 3, and 5; see also Albarracin & Hart, 2011). Orehek, Bessarabova, Chen, and Kruglanski (2011) also observed that positive affect enhanced the activation level of the current goal but also found that a positive affect induction decreased goal activation when competing goals were present. Thus, positive affect could potentially promote health-protective or health-risk behaviours – depending upon the nature of the currently accessible goal.

**Pathway 5: Mood maintenance or repair.** Positive affect could also influence motivation to engage in healthful behaviours via mood maintenance and repair processes. People who are in a positive mood generally are motivated to maintain that mood (e.g., Isen & Simmonds, 1978; Wegener, Petty & Smith, 1995) and thus may choose to engage in behaviours that they believe could prolong their positive mood such as alcohol consumption (Cyders, Zapolski, Combs, Fried-Settles, Fillmore, & Smith, 2010). Conversely, people who routinely seek to improve their affect by performing behaviours are maladaptive to health (e.g., comfort eating, alcohol consumption, or drug use) may refrain from initiating such activities and experience reduced cravings if positive affect is already established.

**Pathway 6: Arousal effects.** Taubamn-Ben-Ari (2012) suggested that elevated positive arousal states, such as excitement, are associated with increased risk-seeking behaviour compared to lower arousal states such as calmness. Affect arousal has been implicated in eating behaviour geared at managing affective states (e.g., Cools, Schotte, & McNally, 1992)

though correlational research has also shown that elevated arousal is associated with increased physical activity (Schwedtfeger, Eberhardt, Chmitorz, & Schaller, 2010). Thus, greater arousal could engender health-protective or health-risk behaviours.

**Pathway 7: Self-control and resilience.** The final route by which positive affect may influence health cognitions and behaviour is via its impact upon resources relevant for successful self-regulation. Early research on the delay of gratification paradigm showed that positive affect aided children's ability to wait for a larger reward (Moore, Clyburn, & Underwood, 1976). More recent research has examined the phenomenon of ego-depletion, whereby exerting self-control on an initial task reduces performance on a subsequent task that also requires self-control (review by Hagger, Wood, Stiff, & Chatzisarantis, 2010). Tice, Baumeister, Shmueli, and Muraven (2007) interspersed positive affect inductions between the initial and subsequent self-control tasks and observed improvements in subsequent self-control in four experiments. Recent evidence also indicates that positive affect can promote resilience by increasing perceptions of social connections with other people (Kok et al., 2013).

### The Present Review

The present meta-analysis was originally designed to test the 7 pathways outlined in Figure 1. Most studies that met the inclusion criteria appeared to test multiple pathways, however, and few cases were available to test several pathways. These considerations led us to focus instead on quantifying the impact of positive affect inductions on health cognitions and behaviours. The particular cognitions examined here include measures of intention, perceived behavioural control, outcome expectancies, risk perceptions, cravings, and message reception.

## Method

### Selection of Studies

A computerised search of the PsycInfo, Science Citation Index, Social Science Citation Index, Medline, Arts and Humanities Citation Index, and Dissertation Abstracts databases from 1 January 1980 to 31 December 2012 was used to locate studies. There were four groups of

search terms. The first, for study design, used the search terms: experiment* OR manip* OR elicit* OR induc* OR trial OR random* control* OR evaluation OR program* OR intervention OR condition OR IAPS[2] OR Velten[3] OR "film clip". The second search, for the outcome measures, used the terms: exercise OR diet* OR nutrition OR fruit OR vegetable OR "physical activity" OR dental OR oral care OR hygiene OR protect* OR detection OR risk* OR driv* OR safe OR sex OR condom OR screening OR cancer OR smoking OR tobacco OR alcohol OR drinking OR sun OR vaccination. The third, for additional outcome measures, used the terms: health AND (intent* OR behav* OR expect* OR norm OR control OR "self-efficacy" OR lifestyle OR perform* OR striv* OR adherence OR practice* OR message OR persuasion OR attitude OR processing OR derogation OR defens* OR beliefs OR promotion OR benefit* OR barrier*). The fourth search, for studies on positive affect, used the terms: "positive emotion*" OR "positive mood*" OR "positive affect*" OR "positive feel*" OR optimism OR joy OR gratitude OR serenity OR interest OR hope OR pride OR amusement OR inspiration OR awe OR love OR happiness OR well-being. Search terms were combined in Boolean form: Search Terms 1 and (Search Terms 2 or Search Terms 3) and Search Terms 4, to ensure that we obtained all listed health outcomes in positive affect experiments. We also searched the reference sections of the selected articles to locate studies that may have been missed.

There were two inclusion criteria for the review. First, studies had to use an experimental design with random assignment (either random assignment of participants to a

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[2] A series of affective images used to influence affect (International Affective Picture System, Lang, Bradley, & Cuthbert, 1999)

[3] A series of affective statements used to influence affect (Velten, 1968).

positive affect versus control condition in a between-participants design, or random order of presentation of positive and control conditions in a within-participants design). Studies consisting of positive affect, negative affect, and control conditions were collated but only data from the positive affect and control conditions were included in the review. Second, studies had to measure health cognitions or behaviours in the wake of the positive affect induction. Health behaviours were defined in line with Gochman's (1997) Handbook of Health Behavior Research (Vol. 1, p. 3) as " ... overt behavioral patterns, actions or habits that relate to health maintenance, to health restoration and to health improvement."

Figure 2 shows the flow of information through the phases of the present review (Moher, Liberati, Tetzlaff, & the PRISMA Group, 2009). The computerized literature search identified 12,563 potentially relevant references and 118 references were obtained by searching reference lists. Thirty-nine articles that reported 54 independent tests of the impact of positive affect on health cognitions and behaviour met the inclusion criteria (see Table 1).

**Meta-Analytic Strategy**

The present meta-analysis used the unbiased effect size estimator d (Hedges & Olkin, 1985). Values of d were coded such that positive scores index favourable cognitions and greater performance of health-protective behaviours (e.g., physical activity) and less favourable cognitions and reduced performance of health-risk behaviours (e.g., smoking, alcohol consumption). Computations of effect size from were undertaken using Schwarzer's (1988) META 5.3 program. Additional analyses (e.g., computation of $I^2$, forest plots) were conducted using STATA Version 11 and Comprehensive Meta-Analysis Version 2 (Borenstein, Hedges, Higgins, & Rothstein, 2005). Sample-weighted average effect sizes ($d_+$) were based on a random effects model because studies were likely to be "different from one another in ways too complex to capture by a few simple study characteristics" (Cooper 1986, p. 526). Effect sizes were interpreted using Cohen's (1992) guidelines. According to Cohen, $d_+ = .20$ should be considered a 'small' effect size, $d_+ = .50$ is a 'medium' effect size, and $d_+ = .80$ is a 'large'

effect size. The homogeneity Q statistic (Cochran, 1954) was used to evaluate variability in effect sizes from the primary studies. When Q is statistically significant, then effect sizes are heterogeneous. Homogeneity was also assessed via the $I^2$ statistic, which indicates the proportion of inconsistency in effect sizes that cannot be explained by chance.

We assessed the power of the primary studies to detect an effect in two ways. First, we used the criterion of 55% power to detect a medium-sized effect (d = .50), that is, at least 35 participants per cell (Coyne, Thombs & Hagedoorn, 2010). Second, we conducted post hoc power analyses using the observed effect sizes from each primary study. The metabias command in STATA was used to test for small study effects using Egger's regression (Egger, Davey Smith, Schneider, & Minder, 1997).

## Results

### Overview of Studies

The majority of studies sampled US university students (median 82 participants per study) and tested outcomes immediately after the induction of positive affect (see Supplementary Materials for Table 3). Specific positive emotions were induced in only two studies; the remaining studies all involved general positive-mood inductions. The most common manipulations of positive affect lasted 10 to 15 minutes and involved film clips (28%), affective imagery or memory recall (19%), or music (17%). Manipulation checks generally involved ad hoc mood scales constructed for the purposes of the study (30%) or the Positive Affect Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988; 19%); the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1992), visual analogue scales (e.g., Aitken, 1969), and Russell Grids (e.g., Russell, 2003) were also used to measure positive affect. The health behaviours examined included food consumption (28%), general health goals (13%), smoking (11%), alcohol consumption (11%), and physical activity (9%). There were 15 tests of the impact of positive affect on health-related behavioural intentions and 23 tests of effects on health behaviours.

**Manipulation Check**

We first checked whether the positive affect inductions were effective. Post-induction positive affect scores for experimental and control conditions were available for 35 tests. Meta-analysis indicated that the inductions generated medium-to-large differences in positive affect between conditions ($d_+$ = .71, 95% CI = .50 to .91). Thus, manipulations of positive affect generally were successful.

**Effects on Health Cognitions and Behaviour**

Positive affect had no reliable effects on any of the health cognitions (intentions, perceived behavioural control, outcome expectancies, risk perceptions, cravings, and message reception; see Table 2). However, planned tests of outcome expectancies for different health behaviours revealed one reliable effect: Positive affect increased outcome expectancies for physical activity ($d_+$ = .52, 95% CI = .10 to .94). Similarly, tests of intention effect sizes for different health behaviours revealed two reliable effects: positive affect reduced intentions to refrain from alcohol (d = -.27, 95% CI = -.53 to -.03) and reduced intentions to drive safely (d = -.35 CI = -.58 to -.14). It is notable, however, that the study with the largest effect size for driving intentions used a film clip from The Fast and the Furious as a positive affect induction (Taubman-Ben-Ari, 2012). As this film glamourises reckless driving at high speeds, the positive affect induction may have been confounded by priming of risky driving behaviour.

There was no reliable effect on health behaviours overall. Most studies examined food consumption (k = 13), which could be further sub-divided into studies that assessed the number of calories consumed (k = 9) and food choice (k = 7). Positive affect has no reliable effect on overall food consumption or calorie consumption. However, positive affect had a reliable positive effect of a small-to-medium magnitude on food choice (d = .38, 95% CI = 0.21 to 0.56). Participants in positive affect conditions were more likely to choose healthy foodstuff.

A sensitivity analysis that involved only those studies that included a manipulation check revealed equivalent findings to those reported in Table 2. Moderator analyses indicated

that there was no difference between the effect sizes for clinical versus non-clinical samples, between neutral affect versus no induction control conditions, or as function of the country in which the research was conducted.

Fifteen out of the 54 studies (28%) fell below Coyne et al.'s (2010) threshold for adequate statistical power. Thirty-four out of the 54 studies (63%) had less than 55% power to detect an effect using post hoc power calculations based on the effect sizes from the original studies; the mean power across studies was 47% (SD = 30).

We also examined the distribution of effect sizes to determine the likelihood that effect sizes are biased due to unpublished studies with small and non-significant results. The funnel plot (Figure 3) shows signs of slight asymmetry, with a tendency towards negative effects being reported. Across all independent tests (k = 54), the estimated bias coefficient from Egger's regression was -1.52 (SE = .60), with a p value of 0.014. These results suggest that negative effects may be more likely to get published.

## Discussion

The present meta-analysis observed no overall impact of positive affect on health cognitions (risk perceptions, outcome expectancies, cravings, message acceptance, perceived behavioural control, or intentions) or health behaviours. There was a smattering of reliable effects for particular behavioural intentions, outcome expectancies, and for food choice behaviour. However, there was no consistent evidence that positive affect promoted health-protective, or reduced health-risk, behaviours. On the one hand, positive affect engendered more favourable outcome expectancies in relation to physical activity and caused participants to make healthier food choices. On the other hand, positive affect increased risky intentions (stronger intentions to consume alcohol, weaker intentions to drive safely).

Issues with three particular findings warrant discussion. First, four studies from a single paper (Taubman-Ben-Ari, 2012) contributed the average effect for intentions to drive safely and one study included an affect induction that may have primed risky driving. Second,

although positive affect engendered healthier food choices, it is notable that food choice measures did not necessarily involve consuming the chosen foodstuff, and there was no reliable effect on the number of calories consumed by participants. There was a high level of heterogeneity in tests of calorie consumption, and carefully designed studies have shown that positive affect increases rather than reduces how much participants consume (Evers, de Ridder, & Adriaanse, 2009). The identification of moderator variables that might help to explain the variability in findings concerning calorie consumption should be addressed in future research.

Third, positive affect influenced expectancies about physical activity but not expectancies about other health behaviours. This finding may be consistent Erez and Isen's (2002) observation that positive affect increased the favourability of ratings of moderately attractive outcomes but had no effect on ratings of unattractive or extremely attractive outcomes. Possibly, participants' pre-existing expectations of physical activity were moderately attractive but expectations concerning other behaviours were more negative. This idea warrants further exploration as it suggests that positive affect inductions may only benefit outcome expectancies for particular samples or particular health behaviours (where outcome expectancies concerning the behaviour are moderately attractive to begin with).

**Limitations and Directions for Future Research**

The present meta-analysis is hampered by the small number of studies available for analysis, by evidence of publication bias, and by under-powered studies. Furthermore, cognitions and behaviours were measured in relation to a wide variety of different health behaviours and there were too few tests to permit inferences regarding the impact of positive affect on specific cognitions for specific behaviours (e.g., self-efficacy for physical activity). The paucity of tests that could be included gravely limits the inferences that can be drawn from this meta-analysis. The most important conclusion to be drawn from the present review is that more research is needed to assess the impact of positive affect on health cognitions and behaviours.

Findings showed that the average difference in positive affect for the experimental versus control condition was of medium-to-large magnitude (in 35 tests). Thus, the small number of reliable effects on outcomes that we observed does not seem to be attributable to failures of the manipulations to engender positive affect. We acknowledge, however, that the positive affect inductions and manipulation checks varied a good deal across the studies included in the review. This variation in affect inductions, and particularly differences in activation (arousal) states, could help to explain the heterogeneity in findings for health cognitions and behaviours. It is also the case that there was a good deal of variation in the neutral-affect, control conditions. Greater standardization of induction procedures and the scales used in manipulation checks would seem valuable to permit cumulative analyses of the impact of positive affect (cf. Kuppens et al., 2012). Consideration also needs to be given to whether and how the impact of positive affect inductions is influenced by participants' pre-existing feelings about both the relevant health problem (e.g., worry about cervical cancer) and the recommended behaviour (e.g., embarrassment about cervical cancer screening).

The present review suggests several additional directions for future research. We set out to evaluate evidence concerning each of the 7 pathways from positive affect to health cognitions and behavior outlined in Figure 1. However, close inspection of the empirical papers (during the analysis phase) revealed that it was not possible to clearly demarcate studies as tests of one particular pathway and not other pathways. Most studies manipulated positive affect and immediately thereafter assessed health cognitions or actions; process measures or additional manipulations that would have permitted stricter tests of particular pathways generally were not deployed. Thus, one important avenue for future research will be to design studies that expressly test the 7 pathways.

We had also hoped to review studies that increased either positive mood or positive emotions. However, only two articles included in the present review (Wilcox et al., 2010; Winterich & Haws, 2011) concerned any of the ten representative positive emotions identified

by Fredrickson (2013). Consedine, Magai and Bonanno (2002) argued that each discrete emotion represents an evolutionary adaptation to specific challenges and opportunities and so particular positive emotions could have more powerful effects on cognition, motivation, and resources relevant to health behaviours than more diffuse positive mood states. For instance, Winterich and Haws (2011) found that hopefulness – a future-focused positive emotion – caused participants to consume significantly less unhealthy food compared to participants who were merely happy. A systematic programme of research is needed that assesses the impact of discrete positive emotions on health cognitions and behaviours in order to draw firm conclusions about the impact of positive 'affect.'

Future studies should also consider using more intensive research designs to assess the impact of the timing or repetition of inductions of positive affect. Research to date has focused on action initiation (usually in the lab) and does not speak to the possible role of positive affect in behavioural maintenance. According to Rothman's (2000) influential account, how much satisfaction people experience with initial changes in their health behaviour is the key determinant of whether behaviour change is maintained. This analysis might suggest that positive affect inductions could fruitfully be deployed during the early stages of behaviour change as an aid to maintaining the behavioural performance. Similarly, the possibility that positive affect and health behaviours mutually reinforce one another over time – as Fredrickson's (2013) Upward Spiral Model of Lifestyle Change proposes – remains to be explored. Longitudinal studies that involve repeated experience of positive affect (e.g., via loving-kindness meditation) and frequent measurements of behaviour are needed to test these ideas.

Studies that test interactions between positive affect induction and other manipulations or measures would be valuable to understand what processes are influenced by positive affect, and when and for whom positive affect is influential. For instance, if positive affect broadens attention as the BBM proposes, then health messages containing strong versus weak arguments

should interact with positive affect such that argument elaboration and attitude change will be greatest in the positive-affect-plus-strong-arguments condition. Similarly, if positive affect indeed facilitates complex decision making (as Carpenter, Peters, Västfjäll, & Isen, 2012, showed), then a useful test in the health domain might involve manipulating positive affect, presenting patients or health professionals with a difficult medical choice, and assessing key features of decision quality as a function of the manipulation. Moderator analyses – such as Erez and Isen's (2002) demonstration that positive affect increases favourability ratings for moderately attractive (but not other) outcomes, and Orehek et al.'s (2011) demonstration that the presence versus absence of competing goals determines whether positive affect activates or deactivates participants' current goal – have offered useful insights. Further research along these lines would help to demarcate when positive affect promotes healthful decisions and behavior. Tests of moderation could also indicate who benefits from positive affect inductions. For instance, Richard and Diefendorff (2011) showed that positive affect promoted goal revision – but only among participants scoring highly on behavioural inhibition system (BIS) sensitivity.

Finally, researchers may need to be sensitive to Fishbach and Labroo's (2007) analysis of positive affect as a "go signal" for currently accessible goals. This analysis suggests that health-relevant goals must be activated in situ to observe significant effects on cognitions and behaviour. If health goals are not activated, then participants may have other priorities that may be antithetical to health goals. As Isen (2008) pointed out, "[if] the task to be done is …boring or negative, and if there is no purpose or benefit to paying attention to it, then positive affect may result in people's not dealing with the material or not dealing with it carefully" (p. 552, italics in the original).

## Conclusion

The present review set out to answer the question: 'Does positive affect promote healthful cognitions and behaviour?' Our findings revealed no reliable effects on health

cognitions or behaviour overall. The reliable effects that were observed offered a mixed picture. Positive affect engendered more favourable outcome expectancies for physical activity and healthier food choices, but promoted riskier behavioural intentions in relation to alcohol consumption and driving behaviour. Caution is warranted in interpreting these findings, however, as our meta-analytic estimates are qualified by underpowered studies, publication bias, and the paucity of tests that could be included in the review. Further tests are needed to draw firm conclusions and to evaluate the 7 pathways outlined in Figure 1. Investigating the impact of discrete positive emotions (e.g., hope, love, gratitude) and testing of interactions between positive affect and other manipulations and measures may show that, under certain circumstances, positive affect inductions indeed benefit health cognitions and behaviours.

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Table 1

Characteristics and Effect sizes for Studies Included in the Meta-Analysis

| Paper | Pathway | Behaviour Targeted | PA induction | | $N_e$ | $N_c$ | Study Power (%)† | Effect size included | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Manipulation | Reported Effect Size | | | | Risk | Expectancy | Craving | Message Reception | Intention | PBC | Behaviour |
| Abele & Hermer (1993) | 1, 5 | General Health Goals | Writing | .34 | 32 | 32 | 20 | -.20 | | | | | | |
| Andrade (2005) | 4, 5 | Food Consumption | Film Clips | 1.85 | 49 | 49 | 99 | | | | | -.91 | | |
| Caine (2004) Study a | 1 | Caffeine Consumption | Film Clips | -.05 | 39 | 39 | 6 | -.03 | | | | | | |
| Caine (2004) Study b | 1 | Caffeine Consumption | Film Clips | 1.31 | 31 | 31 | 22 | -.22 | | | | | | |
| Cerully & Klein (2010) | 3 | Treatment Seeking | Film Clips | 2.15 | 62 | 62 | 30 | | | | | | | .02 |
| Cools et al. (1992) | 4, 5, 6 | Food Consumption | Film Clips | .40 | 30 | 30 | 56 | | | | | | | -.47 |
| Cox, Cox, & Mantel (2010) | 2 | Treatment Seeking | News Clips | .39 | 175 | 166 | 58 | | | | | .20 | | |
| Cunningham (1988) Study a | 3, 6 | Physical Activity | Velten | .59 | 37 | 35 | 90 | | .70 | | | | | |
| Cunningham (1988) Study b | 3, 6 | Physical Activity | Velten | .77 | 20 | 20 | 38 | | .43 | | | | .08 | |
| Cyders et al. (2010) | 5 | Alcohol Consumption | Story, Imagery | .16 | 16 | 16 | 25 | | | | | | | -.35 |
| Evers et al. (2009) | 5 | Food Consumption | Film Clips, Story, False Feedback | -- | 38 | 48 | 95 | | | | | | | -.72 |

| Paper | Pathway | Behaviour Targeted | PA induction | | $N_e$ | $N_c$ | Study Power (%)† | Effect size included | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Manipulation | Reported Effect Size | | | | Risk | Expectancy | Craving | Message Reception | Intention | PBC | Behaviour |
| Fedorikhin & Patrick (2010) Study a | 4, 5 | Food Consumption | Film Clips | .66 | 132 | 132 | 88 | | | | | | | .35 |
| Fedorikhin & Patrick (2010) Study b | 4, 5 | Food Consumption | Film Clips | .88 | 209 | 209 | 99 | | | | | | | .54 |
| Fedorikhin & Patrick (2010) Study c | 4, 5 | Food Consumption | Film Clips | .86 | 122 | 122 | 97 | | | | | | | .45 |
| Fishbach & Labroo (2007) Study a | 3, 4 | Physical Activity | Word Association | .33 | 65 | 65 | 57 | | | | | | | .32 |
| Fishbach & Labroo (2007) Study b | 3, 4 | Caffeine Consumption | | -- | 46 | 46 | 49 | | | | .34 | | | |
| Garg et al. (2007) Study a | 5 | Food Consumption | Memory Recall | -- | 36 | 36 | 85 | | | | | | | .64 |
| Garg et al. (2007) Study b | 5 | Food Consumption | Memory Recall | -- | 46 | 46 | 72 | | | | | | | .47 |
| Haase & Silbereisen (2011) Study a | 1 | General Health Goals | IAPS, MMIP | .89 | 20 | 20 | 78 | -.78 | | | | | | |
| Haase & Silbereisen (2011) Study b | 1 | General Health Goals | IAPS, MMIP | -- | 9 | 9 | 24 | -.46 | | | | | | |
| Hill (2002) Study a | 1, 3 | Vaccination | MMIP | -- | 30 | 31 | 27 | | | | | .27 | | |
| Hill (2002) Study b | 1, 3 | Vaccination | MMIP | -- | 39 | 40 | 24 | | | | | .21 | | |
| Labroo & Mukhopadhyay (2009) | 3, 5 | Food Consumption | Not Specified | -- | 36 | 36 | 21 | | | | | | | .02 |
| Labroo & Patrick (2008) | 2 | Food Consumption | Word Association | .67 | 30 | 30 | 88 | | | | | .66 | | |
| Lench & Levine (2005) | 1, 2 | General Health Goals | Writing | .53 | 24 | 24 | 20 | .24 | | | | | -.20 | |

| Paper | Pathway | Behaviour Targeted | PA induction | | $N_e$ | $N_c$ | Study Power (%)[†] | Effect size included | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Manipulation | Reported Effect Size | | | | Risk | Expectancy | Craving | Message Reception | Intention | PBC | Behaviour |
| Mancuso et al. (2012) | 1, 2, 3 | Physical Activity | Self-Induction, Gifts | -- | 128 | 130 | 6 | | | | | | | .01 |
| Mason et al. (2008) | 4, 5 | Alcohol Consumption | IAPS | .13 | 42 | 42 | 22 | | -.04 | -.19 | | -.08 | .14 | |
| McKee et al. (2003) | 4, 5 | Smoking | MMIP | .42 | 36 | 30 | 14 | | -.14 | | | | | |
| McQueen (2002) | 1, 3 | Alcohol Consumption | MMIP, Imagery | .38 | 43 | 43 | 63 | .23 | .32 | | -.42 | -.43 | -.24 | |
| Ogedegbe et al. (2012) | 1, 2, 3 | Treatment Seeking | Self-Induction, Gifts | -- | 131 | 125 | 14 | | | | | | | .07 |
| Peterson et al. (2012) | 1, 2, 3 | Physical Activity | Self-Induction, Gifts | -- | 131 | 122 | 41 | | | | | | | .18 |
| Pomery (2008) | 1, 5 | Condom Use | MMIP | .83 | 33 | 38 | 46 | | -.37 | | | .12 | | |
| Raghunathan & Trope (2002) | 2, 5 | Caffeine Consumption | Memory Recall | -- | 38 | 38 | 39 | | .33 | | | .25 | | |
| Salovey & Birnbaum (1989) Study a | 1, 7 | General Health Goals | Memory Recall | 1.22 | 21 | 22 | 18 | | .23 | | | .14 | | |
| Salovey & Birnbaum (1989) Study b | 1, 7 | General Health Goals | Memory Recall | .92 | 11 | 15 | 13 | .22 | | | | | | |
| Salovey & Birnbaum (1989) Study c | 1, 7 | General Health Goals | Memory Recall | 3.50 | 11 | 11 | 37 | -.58 | | | | | | |
| Schuettler & Kiviniemi (2006) | 1, 3 | Treatment Seeking | Velten | .43 | 25 | 25 | 66 | | .59 | | | -.24 | .11 | |

| Paper | Pathway | Behaviour Targeted | PA induction | | $N_e$ | $N_c$ | Study Power (%)† | Effect size included | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Manipulation | Reported Effect Size | | | | Risk | Expectancy | Craving | Message Reception | Intention | PBC | Behaviour |
| Shmueli & Prochaska (2012) Study a | 7 | Smoking | Film Clips | .47 | 35 | 36 | 99 | | | | | | | 1.46 |
| Shmueli & Prochaska (2012) Study b | 7 | Smoking | Writing | .47 | 57 | 64 | 37 | | | | | | | -.24 |
| Stein et al. (2000) | 1 | Alcohol Consumption | MMIP | -- | 24 | 24 | 28 | | | | | | | -.31 |
| Taubman-Ben-Ari (2012) Study a | 1 | Driving | Story | .47 | 43 | 61 | 35 | | | | | -.25 | | |
| Taubman-Ben-Ari (2012) Study b | 1 | Driving | Writing | -- | 42 | 49 | 32 | | | | | -.25 | | |
| Taubman-Ben-Ari (2012) Study c | 1, 6 | Driving | Film Clips | -- | 53 | 50 | 97 | | | | | -.70 | | |
| Taubman-Ben-Ari (2012) Study d | 1, 6 | Driving | Film Clips | -- | 52 | 52 | 33 | | | | | -.24 | | |
| Taylor, Harris, Singleton, MoolChan, & Heishman (2000) | 5 | Smoking | Imagery | .77 | 18 | 18 | 17 | | | .22 | | | .24 | |
| Tiffany & Drobes (1990) | 4, 5 | Smoking | Imagery | -- | 60 | 60 | 99 | | | -.85 | | | | |
| Tracy (2008) | 4, 5 | Smoking | Imagery | .51 | 36 | 36 | 98 | | | .09 | | | | |
| Turner et al. (2010) | 5, 7 | Food Consumption | Film Clips | 1.14 | 53 | 53 | 42 | | | | | | | .28 |
| Wardell et al. (2012) | 5, 6 | Alcohol Consumption | IAPS, MMIP | .53 | 43 | 54 | 7 | | | | | | | -.04 |
| Wilcox et al. (2010) | 4 | Food Consumption | Memory Recall | .83 | 48 | 48 | 5 | | | | | | | .01 |

| Paper | Pathway | Behaviour Targeted | PA induction | | $N_e$ | $N_c$ | Study Power (%)† | Effect size included | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Manipulation | Reported Effect Size | | | | Risk | Expectancy | Craving | Message Reception | Intention | PBC | Behaviour |
| Willner et al. (1998) | 5 | Alcohol Consumption | MMIP | -- | 48 | 48 | 43 | | .08 | | | -.30 | -.09 | |
| Winterich & Haws (2011) Study a | 1, 2 | Food Consumption | Story | .54 | 48 | 48 | 40 | | | | | | | .29 |
| Winterich & Haws (2011) Study b | 1, 2 | Food Consumption | Story | .33 | 47 | 190 | 65 | | | | | | | .33 |
| Yeomans & Coughlan (2009) | 5 | Food Consumption | Film Clips | .51 | 32 | 32 | 16 | | | | | | | -.16 |

Note: † Where multiple effects sizes in a single study are reported, the highest power is shown. Study power is calculated post-hoc, based on effect size and sample size, single tail $\alpha$ at 0.05. $N_e$ = number of participants in the experimental (positive affect induction) condition. $N_c$ = number of participants in the control (neutral affect) condition. PBC = Perceived Behavioural Control. Entries marked -- indicated that affect induction manipulation check not conducted. Affect manipulation entries marked IAPS refer to the International Affect Picture system (Lang et al. 1999). Affect manipulation entries marked MMIP refer to the Music Mood Induction Procedure.

Table 2

Impact of Positive Affect on Health Cognitions and Behaviours

| Outcome | k | N | $d_+$ | 95% CI | Q | $I^2$ |
|---|---|---|---|---|---|---|
| Risk Perceptions | 9 | 444 | -.11 | -.32 to .11 | 10.37 | 24.5 |
| Outcome Expectancies | 10 | 641 | .19 | -.03 to .41 | 15.80 | 44.4 |
| Alcohol Consumption | 3 | 266 | .12 | -.12 to .36 | 1.34 | 0.0 |
| Physical Activity | 2 | 112 | .52† | .10 to .94 | 1.20 | 16.7 |
| Craving | 4 | 312 | -.22 | -.68 to .24 | 13.40* | 81.3 |
| Message Reception | 2 | 178 | -.10 | -.73 to .53 | 4.47* | 83.6 |
| Intentions | 15 | 1509 | -.12 | -.32 to .08 | 50.39* | 56.6 |
| Safe Driving | 4 | 402 | -.35† | -.58 to -.14 | 3.74 | 19.8 |
| Alcohol Consumption | 3 | 266 | -.27† | -.53 to -.03 | 1.29 | 0.0 |
| Food Consumption | 2 | 158 | -.13 | -1.66 to 1.39 | 20.85* | 95.2 |
| Vaccination | 2 | 140 | .23 | -.10 to .57 | .03 | 0.0 |
| Perceived Behavioural Control | 8 | 483 | -.06 | -.24 to .11 | 3.00 | 0.0 |
| Behaviour | 23 | 3219 | .15 | -.03 to .33 | 87.10* | 75.1 |
| Food Consumption | 13 | 1,911 | .18 | -.4 to .40 | 46.63* | 74.3 |
| Calorie Consumption | 9 | 1,406 | .18 | -.13 to .49 | 41.52* | 80.7 |
| Healthy Food Choice | 7 | 1,427 | .38† | .21 to .56 | 11.81 | 49.1 |
| Alcohol Consumption | 3 | 177 | -.17 | -.46 to .13 | .85 | 0.0 |
| Physical Activity | 3 | 641 | .14 | -.03 to .31 | 2.18 | 8.2 |
| Smoking | 2 | 192 | .59 | -1.06 to 2.24 | 26.76* | 96.3 |

Note. k = number of independent tests, N = sample size, $d_+$ = sample-weighted average effect size, † = reliable effect, 95% CI = 95% confidence interval, Q = homogeneity statistic, † effect size is reliable, * $p < .05$.

**Figure Captions**

Figure 1

Potential Pathways from Positive Affect to Health Cognitions and Behaviours.

Figure 2

Meta-Analysis Flow Diagram.

Figure 3

Funnel Plot of Effect Sizes in Experimental Tests of the Impact of Positive Affect on Health Cognitions and Behaviour