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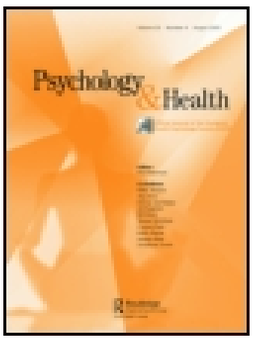

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Title: Can illness beliefs, from the common-sense model, prospectively predict adherence to self-management behaviours? A systematic review and meta-analysis

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Abstract

Objective: To determine whether people's beliefs about their illness, conceptualised by the common sense model, can prospectively predict adherence to self-management behaviours (including, attendance, medication, diet and exercise) in adults with acute and chronic physical illnesses.

Design and Main Outcome Measures: Electronic databases were searched in September 2014, for papers specifying the use of the 'common sense model' in relation to 'self-management,' 'rehabilitation' and 'adherence' in the context of physical illness. Six-hundred abstracts emerged. Data from fifty-two relevant studies were extracted. Twenty-one studies were meta-analysed, using correlation coefficients in random effects models. The remainder were descriptively synthesised.

Results: The effect sizes for individual illness belief domains and adherence to self-management behaviours ranged from 0.04 and 0.13, indicating very weak, predictive relationships. Further analysis revealed that predictive relationships did not differ by the: type of self-management behaviour; acute or chronic illness; or duration of follow-up.

Conclusion: Individual illness belief domains, outlined by the common sense model, did not predict adherence to self-management behaviours in adults with physical illnesses. Prospective relationships, controlling for past behaviour, also did not emerge. Other factors, including patients' treatment beliefs and inter-relationships between individual illness beliefs domains, may have influenced potential associations with adherence to self-management behaviours.

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Key words: illness beliefs, common sense model, self-regulation theory, self-management, adherence, systematic review.

Introduction

Adherence to self-management is an integral feature of long-term illness (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Lorig, Sobel, Ritter, Laurent, & Hobbs, 2001). It also plays a vital role in the management of acute illnesses; this includes rapid onset conditions that are self-limiting (such as, common cold) and acute presentations of existing major illnesses or new chronic diseases (for example, myocardial infarction or stroke) (Jones, White, Armstrong, Ashworth, & Peters, 2010). These conditions may be followed by a long period of recovery, involving complex, multi-faceted treatments (such as, secondary preventive therapy and rehabilitation), where self-management is central to the prevention of further events, complications, or death (Bushnell, Arnan, & Han, 2014; Choudhry et al., 2014).

Self-management includes a range of behaviours, such as: attendance, healthcare use, medication adherence, and lifestyle advice (for example, diet and exercise) (World Health Organization, 2003). Adherence refers to the extent to which a patient's self-management behaviour is concordant with the advice and recommendations of their medical practitioners (World Health Organization, 2003). The importance of adherence to self-management behaviours lies in the fact that it is considered to play a central role in treatment effectiveness. This has been highlighted for numerous illnesses. For example, better control of hypertension is achieved in patients who adhere well to their anti-hypertensive therapy, and can lower peoples' risk of developing serious cardiovascular complications, including stroke (Alhalaiqa, Deane, Nawafleh, Clark, & Gray, 2012). Similar has been found for other long-term conditions, including type 2 diabetes mellitus (Asche, LaFleur, & Conner, 2011), and

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diseases with an acute presentation, such as myocardial infarction, where optimal adherence to secondary preventive therapy protects patients from experiencing further events (Choudhry et al., 2014). It has been reported that patients who self-manage effectively are three-times more likely to experience good health outcomes, than those who are non-adherent with self-management behaviours (DiMatteo, Giordani, Lepper, & Croghan, 2002).

However, adherence with self-management behaviours is generally very low, with estimates suggesting that around 50% of patients struggle to self-manage their long-term conditions (World Health Organization, 2003). These low levels of adherence inevitably undermine the effectiveness of treatments, leading to: increased, and often preventable, hospitalisations; higher rates of morbidity and mortality; worsening of illness and greater disease burden; poorer quality of life; higher healthcare costs; and reduced work productivity (De Vera, Bhole, Burns, & Lacaille, 2014; Iuga & McGuire, 2014; Loon, Jin, & Jin Goh, 2015; Lorig, Ritter, et al., 2001; Nabolsi, Wardam, & Al-Halabi, 2015; Roebuck, Liberman, Gemmill-Toyama, & Brennan, 2011; Simpson et al., 2006; Wagner, Lau, Frech-Tamas, & Gupta, 2012). Adherence to self-management behaviours can also differ among different disease types, such as acute or chronic conditions; across different types of behaviours; and deteriorate over time, particularly within the first six-months of therapy (Diefenbach & Leventhal, 1996; DiMatteo, 2004; Leventhal, Diefenbach, & Leventhal, 1992; Meyer, Leventhal, & Gutmann, 1985; Osterberg & Blaschke, 2005). Given the increasing prevalence of chronic diseases, such as type 2 diabetes mellitus and hypertension, and our ageing population, the impact of poor adherence to self-management behaviours on the health of the population is likely to worsen (World Health Organization, 2003).

Adherence to self-management behaviours has been shown to be affected by a range of factors, such as: age, gender, socioeconomic status, self-efficacy and mood (Adam & Folds, 2014; Cohen et al., 2012; Manteuffel et al., 2014; Wamala, Merlo, Bostrom, Hogstedt, &

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Agren, 2007). However, many of these socio-demographic factors (for example, age and gender) are not modifiable (Gellad, Grenard, & Marcum, 2011). Therefore, psychological, modifiable factors (such as, illness beliefs) have attracted a lot of interest as predictors of adherence to self-management behaviours (Mann, Ponieman, Leventhal, & Halm, 2009).

People's beliefs about their illness provide an opportunity to further understand what underlies their willingness to adopt behaviours that improve or maintain their health (Hagger & Orbell, 2003). The study of adherence to self-management behaviours has been supported by social cognitive models, which provide a theoretical framework for understanding, predicting and improving patients' behaviours (Roter et al., 1998). One of the models that has dominated the health psychology literature is the Common Sense Model (CSM) (Leventhal, Meyer, & Nerenz, 1980). The CSM suggests that, when confronted with a threat to their health, people construct mental representations (or illness beliefs) about their illness and treatment, in order to help them to make sense of, and manage, their condition (Leventhal et al., 1980). Illness beliefs have been shown to influence people's physical, social and psychological functioning, coping, and behavioural outcomes, including adherence to self-management behaviours (Fortune, Richards, Main, & Griffiths, 2000; Hagger & Orbell, 2003; Heijmans, 1998; Horne & Weinman, 2002; Leventhal et al., 1992; Meyer et al., 1985).

The formation of illness beliefs is guided by information from peoples' social environment, including doctors or family; cultural knowledge of the disease; and their current perceptions (such as, of symptomatic information) and previous experiences of the illness (Leventhal et al., 1980; Leventhal, Nerenz, & Steele, 1984). In addition, the model posits that people's beliefs about their illness are cognitive and emotional (Leventhal et al., 1980). These are formed simultaneously, through a parallel process (Leventhal et al., 1980). Cognitive representations have five core domains (Leventhal et al., 1980). 'Identity' describes peoples' beliefs about the label of illness and symptoms, and sets out the targets for change (such as,

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to eliminate symptoms) (Leventhal et al., 1980). 'Timeline' refers to people's perception of the duration of their illness, including, symptoms and recovery; 'timeline' beliefs may be acute or chronic. 'Consequences' refer to beliefs about the seriousness of the disease and impact upon one's daily life. 'Cure-control' refers to perceptions about the amenability of the illness to being cured, prevented or treated. 'Causes' refers to people's own perceptions of the possible causes of their condition; these may be internal (such as, genes) or external (for example, a germ or virus). 'Emotional representations' are the feelings that arise as a result of the illness, such as anxiety or depression following diagnosis of a condition (Diefenbach & Leventhal, 1996; Leventhal et al., 1992). There is a wealth of evidence in support of these illness beliefs (Diefenbach & Leventhal, 1996; Lau, Bernard, & Hartman, 1989; Lau & Hartman, 1983; Leventhal et al., 1992; Leventhal et al., 1980). The CSM is shown in Figure 1.

To date, there have been a number of attempts to synthesise the growing literature using the CSM. Hagger and Orbell (2003) conducted a comprehensive review and meta-analysis, to examine the inter-correlations between the different dimensions of illness beliefs, and to explore the relationship of illness beliefs with coping strategies and illness outcomes. Self-management behaviours were considered as a problem-focused coping-specific strategy, and included: doctor visits, and medication and dietary adherence (Hagger & Orbell, 2003). This review found a significant relationship between cure-control beliefs and problem-focused coping-specific behaviours (Hagger & Orbell, 2003). However, this review was undertaken over a decade ago; therefore, an update was warranted.

More recently, Brandes and Mullan (2014) conducted a systematic review and meta-analysis that specifically examined the role of illness beliefs in predicting adherence. This included a range of adherence behaviours, for example: medication adherence; exercise; diet; and disease-specific behaviours, such as glucose-testing. The paper found very weak

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relationships between individual dimensions of illness beliefs and adherence behaviours (Brandes & Mullan, 2014). Though the authors reported a comprehensive review, several considerations suggested that a further review may be warranted. First, their paper focused on existing chronic diseases, excluding conditions that may have had an acute presentation (such as, myocardial infarction and stroke) where good adherence to self-management behaviours is necessary for secondary prevention, as well as for supporting post-event rehabilitation and recovery. Second, the authors excluded attendance behaviours, which are an important component of self-management; as recognised in the meta-analysis conducted by Hagger and Orbell (2003). Last, the authors did not examine any potential moderating effects of the study design, in the relationship between dimensions of illness beliefs and adherence behaviours. It has been argued that by measuring behaviour cross-sectionally, studies may be providing information on past or current behaviours rather than future behaviours, which is unlikely to be the most appropriate way of examining the utility of a model for predicting behaviour (Weinstein, 2007). This was also a limitation of the Hagger and Orbell (2003) paper, and a criticism of other research on the CSM, including a further systematic review that was published examining illness beliefs and self-management in children and young people (Law, Tolgyesi, & Howard, 2014). Therefore, given that the CSM implies that the relationships of illness beliefs and behaviours may be causal (Leventhal et al., 1980) (denoted in Figure 1), it would be important to consider this formally by focusing on studies reporting prospective measures of behaviour, only.

The aim of the present meta-analysis was to determine whether individual illness belief domains prospectively predicted adherence to self-management behaviours in adults with physical illnesses. Further aims were to: a) review the evidence on chronic and acute illnesses; and b) explore whether the relationship between illness belief domains and

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adherence to self-management behaviours varies according to the type of self-management behaviour; or the duration of follow-up.

Methods

The systematic review was conducted according to best practice guidelines, such as the Cochrane Collaboration (Higgins & Green, 2011). Further, relevant frameworks, including: the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (Moher, Liberati, Tetzlaff, & Altman, 2009), and the American Psychological Association Meta-Analysis Reporting Standards (H. Cooper, 2010), have been used for the reporting of this research.

Search strategy

A systematic literature search was undertaken using the following electronic databases: MEDLINE, PSYCINFO, EMBASE and CINAHL. Searches were also conducted of the grey literature, including unpublished research, dissertations and conference abstracts, using the following electronic databases: Open Grey, PAIS International, Open Thesis and ProQuest Dissertations and Theses. Searches comprised literature from 1980, when Leventhal's original manuscript on the CSM was published, to September 2014. The search strategy (Appendix 1) used Medical Subject Headings and keywords defining important aspects of the review. Keywords used for the CSM were: common sense model OR self-regulation OR self-regulation model. All appendices are included as supplementary material. Additional keywords for the CSM were also used, consistent with the search strategies employed by key papers (Brandes & Mullan, 2014; Hagger & Orbell, 2003): illness belief OR illness perception OR illness cognition OR illness representation. Keywords for adherence to self-management behaviours were: recovery OR rehabilitation OR self-management OR self-care

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OR medication adherence OR help-seeking OR care-seeking OR treatment OR adherence OR compliance OR health behaviour OR behaviour change OR behaviour modification. The following terms were used for physical illness: disease OR acute disease OR chronic disease OR medical condition OR physical illness. Searches were combined, and limited to English language papers only, for practical reasons. Reference lists of included papers and other published reviews were hand-searched, to identify additional references that may not have emerged from electronic searches. Duplicate references were removed.

Search selection and inclusion

Titles and abstracts were initially screened to identify papers that met the inclusion criteria. These were categorised using the PICOS approach (Higgins & Green, 2011). Participants were adults (≥18 years), with any acute (defined in accordance with the King's Fund (Jones et al., 2010)) or chronic physical illness. Papers were considered only if they used the CSM. This was verified by examining reference lists for citations of CSM research by Leventhal and colleagues. Papers investigating behaviours other than self-management (for example: clinical, psychological or functional outcomes; coping - such as, denial or avoidance; and return to work) were excluded. Longitudinal studies, with any length of follow-up, were included to examine prospective relationships between illness beliefs and adherence to self-management behaviours. Twenty-percent of the titles and abstracts were randomly selected and assessed for eligibility by a second reviewer. There was a high level of agreement between both reviewers for the initial screening (Cohen's Kappa=0.86). Any instances of disagreement were resolved by discussion between the reviewers, with a third reviewer available where necessary.

Data extraction

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Data were extracted from all included articles using a structured evaluation form. The following information was recorded: characteristics of the study population; geographical location; sample size; study design; statistical analysis; method of assessment for illness belief domains; self-management behaviour(s) and method of measurement; and key findings, including effect sizes, where available.

Analytic procedure

A meta-analysis was conducted to statistically combine the data. Correlations were the most frequently reported measurement by included papers for the relationship between individual illness belief domains and adherence to self-management behaviours. Therefore, Pearson's product-moment correlation coefficient (r) was used for the estimate of effect size. Follow-up correlations were extracted from the papers. Partial correlations, controlling for baseline adherence to self-management behaviours, were also extracted where possible. Further, many of the articles provided multiple datasets; for example, reporting effect sizes for several illness belief domains across many self-management behaviours. These were included in the meta-analysis as unique datasets (denoted by k). Negative correlations were reversed, where appropriate.

Authors of thirty-five papers that had missing information, such as for correlation coefficients, or where it was unclear from the information provided in the paper whether correlations referred to baseline or follow-up time-points, were contacted. This allowed authors the opportunity to contribute relevant data for the meta-analysis, as well as to verify all possible data to be used for the meta-analysis. Reminders were sent to non-responders two-weeks after the initial mailshot. Twenty-six authors responded with the requested information. A further eligible paper was identified through this correspondence with the authors, and was subsequently included in the review. The remainder of papers where authors

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did not respond were included in the review, but excluded from the meta-analysis. Data from unpublished correlational analyses were provided by authors of eight included papers.

Timeline-cyclical and illness coherence were added as illness belief domains in this review, and the cure-control belief domain from the Illness Perception Questionnaire (IPQ) was analysed separately as personal and treatment control beliefs, to be consistent with the operationalisation in the revised Illness Perception Questionnaire (IPQ-R) (Moss-Morris et al., 2002; Weinman, Petrie, Moss-Morris, & Horne, 1996). The IPQ and IPQ-R are both common methods for assessing illness beliefs outlined by the CSM (Moss-Morris et al., 2002; Weinman et al., 1996). Concern was also added as an illness belief domain, as per the inclusion of this dimension in the Brief Illness Perception Questionnaire (BIPQ), which is further, more recent method for operationalising illness beliefs (Broadbent, Petrie, Main, & Weinman, 2006). However, this domain was excluded from the meta-analysis, because of insufficient data for calculation of a valid composite correlation.

Self-management behaviours were categorised into the following groups: attendance behaviours, including doctor or therapist visits and other healthcare utilisation; medication adherence; dietary behaviours; physical activity; and other disease-specific behaviours, for example: self-monitoring of blood glucose and foot care.

Twenty different physical illnesses were included across 52 papers. Therefore, it was not possible to group articles in the meta-analysis by specific health conditions; however, papers were categorised according to acute or chronic disease. The duration of follow-up varied widely across included studies. Thus, for the purpose of the meta-analysis, the median duration of follow-up was calculated, allowing for papers to be grouped according to follow-up of 6-months or longer. Further analyses, which are described below, were conducted according to these groupings.

Meta-analysis

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The meta-analysis was conducted in STATA 13 (StataCorp LP, College Station, TX, USA). Random effects models were chosen, to allow for the heterogeneity (variability) that was evident across included papers. A fixed effects model assumes that the true effect is the same across all included studies, and the effect size only varies between studies because of random error (Borenstein, Hedges, Higgins, & Rothstein, 2010). In contrast, a random effects model assumes that there are other factors, such as the age of participants, which may differ between studies, and influence the combined effect size (Borenstein et al., 2010; Hedges & Vevea, 1998).

The pooled effect size that was reported in this meta-analysis was the average r, computed using the method described by Hedges and Vevea (1998). Each Pearson's correlation coefficient was converted for normality, using Fisher's Z transformation. The effect sizes were weighted (r+) using the inverse variance, which incorporates a variance component, including the within-study variance and the between-study variance (Tau^2), and depends upon the sample size of each study. A 95% confidence interval (CI) was calculated for each effect size, and an associated p-value was reported. Forest plots illustrated the findings from the meta-analyses. The heterogeneity between studies was also examined. Cochran's Q statistic, which is the classical method for assessing heterogeneity, was used. Cochran's Q uses a chi-squared distribution with degrees of freedom, allowing for calculation of a p-value. Heterogeneity was also examined using the I^2 statistic, which presents the variability as a percentage. Figures of 75% or greater indicate a considerable problem with heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003). In addition, this meta-analysis reported an estimate of the between-study heterogeneity using the Tau^2 statistic, where a low value (<1) indicates little variance between the studies.

Further analyses: Sub-group analyses were conducted to further examine the heterogeneity between studies. These were performed according to the: type of self-management behaviour;

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acute or chronic disease; and duration of follow-up. Sub-group analyses allowed for the investigation of whether any of the predictive relationships were influenced (or moderated) by these factors. It is important to note that for a few of the illness belief domains, the sub-groups contained fewer than three studies, which made it impossible to compute the relevant meta-analysis statistics. This did not affect all domains; therefore, meta-analyses were computable for many of the illness beliefs, but fixed effects models were used, provided that more than one of the sub-groups contained three or more studies. Meta-regression was also conducted to examine whether the abovementioned grouping variables confounded any of the predictive relationships.

Publication bias: The risk of publication bias was examined using funnel plots, where asymmetry indicated bias; and Egger's test, which provided a significance test for the asymmetry. The meta-analyses were re-estimated for individual illness belief domains with asymmetric funnel plots, using the trim-and-fill method (Duval & Tweedie, 2000). This is an iterative, non-parametric approach that identifies and corrects asymmetry in funnel plots, by removing the studies causing the asymmetry and replacing them with their 'missing' counterpart (Peters, Sutton, Jones, Abrams, & Rushton, 2007).

Sensitivity analyses: Two sensitivity analyses were conducted. First, one paper involved a disproportionately larger sample size than other included articles. Therefore, effect sizes for the individual illness belief domains assessed in this paper were re-calculated excluding this article, to determine the extent to which the meta-analysis results were affected by this study. Sub-group analyses were also repeated without this study. Second, partial correlations were meta-analysed for a sub-set of included studies, to examine prospective relationships between individual illness belief domains and adherence to self-management behaviours.

Descriptive synthesis

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Included papers that did not report on correlations were descriptively synthesised. Consistent with the meta-analysis, many of the papers involved in the descriptive synthesis also reported on adherence to multiple self-management behaviours for several of the illness belief domains (again denoted by k). Articles that examined the illness concern belief domain were included in the descriptive synthesis.

Results

The process of study selection is shown in Figure 2. Fifty-two papers met the pre-defined criteria for inclusion and are summarised in Table A2 (Appendix 2). From these included papers, 21 articles contributed data for the meta-analysis.

Sample characteristics

Studies were conducted between 1989 and 2014. Thirty-four studies were undertaken in Europe, where the majority (24 studies) were hosted in the United Kingdom. A further ten studies were conducted in the United States of America, and five studies were undertaken in Australia and New Zealand. The settings included: general practice; hospitals; outpatient clinics; and the community. The 52 studies involved 15, 828 participants altogether, with sample sizes ranging from 21 to 3618 people. All of the studies included men and women in varying proportions. The average age of participants ranged from around 18 to 73 years. The majority of studies adopted observational designs, with the exception of 12 randomised trials. The length of follow-up ranged from 48-hours to three-years. Four of the included papers were based on the same data (French, Wade, & Farmer, 2013; French et al., 2008; Searle, Norman, Thompson, & Vedhara, 2007a, 2007b). Further, one of the papers included in the review was a questionnaire validation study (Weinman et al., 1996).

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Studies included participants with a range of physical health conditions. Over three-quarters of the studies involved people with chronic diseases. Most of the studies (67%) either involved populations with heart problems (for example, coronary artery disease and myocardial infarction) (33%), or metabolic and related disorders (such as, type 2 diabetes mellitus and kidney or liver disease) (27%). In terms of self-management behaviours, over half of the studies assessed medication adherence (52%). Attendance behaviours were assessed in 37% of included papers. Around two-thirds of the studies measured dietary behaviours (29%) and physical activity (31%). Seventeen-percent of the studies examined other, disease-specific, self-management behaviours. In addition, there were a proportion of studies (35%) that assessed adherence to multiple self-management behaviours. Almost three-quarters of the studies measured adherence to self-management behaviours using self-report (73%). Of these, only eight studies (15%) verified the self-reported data using a different, objective method of assessment (such as, confirmatory checks against medical records).

The majority of studies used the IPQ (17%); the IPQ-R (38%); or the BIPQ (17%), to measure illness belief domains. The remainder used other assessment methods, which included: study-specific questionnaires that were tailored to particular diseases, and were self-reported or administered via interviews (17%); and personal model beliefs (such as, for diabetes), which were again disease-specific and either self-completed by patients, or obtained through interviews (13%). In addition, one study used an interview to elicit people's illness beliefs, using a study-specific interview schedule (Lau et al., 1989).

The role of illness beliefs in predicting adherence to self-management behaviours

Significant predictive relationships between individual illness belief domains and adherence to self-management behaviours were not found for 14 out of 52 included papers. Over half of

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these articles examined attendance behaviours (43%) or medication adherence (29%). The remainder measured dietary or physical activity behaviours.

The findings from this meta-analysis suggested that heterogeneity in the weighted effect sizes was evident, to varying degrees, for many of the individual illness belief domains (Table 1). The identity and timeline acute-chronic beliefs appeared to be most affected, with I^2 values exceeding the threshold for high heterogeneity of 75%. Several of the other illness belief domains showed moderate heterogeneity: personal control (I^2=50.1%); timeline-cyclical (I^2=56.1%); consequences (I^2=58.9%); cure-control (I^2=59.0%); and emotional representations (I^2=64.3%). Low, but statistically significant, heterogeneity was found for two of the illness belief domains: treatment control (I^2=47.6%) and causes (I^2=33.6%). Illness coherence was the only belief domain showing no evidence of heterogeneity; therefore, it is possible to assume that the studies comprising this domain were homogenous. It is also noteworthy that for all of the illness belief domains, estimates of the variance between studies were small, 0.02 or below. Table 1 shows a summary of these findings.

Of the 21 studies that were meta-analysed, several provided multiple datasets. Therefore, the number of unique datasets (k) for each illness belief domain varied, as shown in Table 1. Overall, individual illness belief domains did not appear to predict adherence to self-management behaviours in adults with physical diseases. Effect sizes for the individual illness belief domains varied between 0.04 and 0.13, indicating weak predictive relationships with adherence to self-management behaviours. The illness beliefs that emerged as the strongest predictors of adherence to self-management behaviours were: identity (r_+=0.08, $p<0.001$); timeline acute-chronic (r_+=0.12, $p<0.001$); consequences (r_+=0.04, $p<0.01$); personal control (r_+=0.07, $p<0.01$); treatment control (r_+=0.13, $p<0.001$); cure-control (r_+=0.07, $p<0.01$); and illness coherence (r_+=0.04, $p<0.05$). Timeline-cyclical (r_+= -0.01, $p=0.83$), emotional representations (r_+= -0.01, $p=0.85$), and causal beliefs (r_+= -0.01, $p=0.45$)

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were not statistically significant, and showed weak (almost negligible) predictive relationships with adherence to self-management behaviours. A summary of the results is shown in Table 1. In addition, forest plots for each illness belief domain are presented in Appendix 3, where a positive relationship between illness belief domains and adherence to self-management behaviours is shown by correlations up to 1, and correlations below 0 to minus 1 show a negative relationship.

Sensitivity analyses

One of the included studies by Lau et al. (1989), involved the largest sample size of over 1000 people. Therefore, this study held the greatest weight compared to the other studies, for the following illness belief domains: identity, timeline acute-chronic, consequences, cure-control and causes. This was apparent from several of the forest plots (Figures A, B, D, G, and J, Appendix 3). Thus, these illness belief domains were most likely to be affected by this study, and were included in the sensitivity analysis. However, with exclusion of this study, there was very little change in the effect size estimates. These again indicated weak predictive relationships of individual illness belief domains with adherence to self-management behaviours. Identity ($r+=0.09$, $p<0.05$), timeline acute-chronic ($r+=0.13$, $p<0.001$), consequences ($r+=0.05$, $p<0.01$), and cure-control ($r+=0.09$, $p<0.001$) remained as the strongest predictors of adherence to self-management behaviours. In addition, the causal belief domain still showed a statistically non-significant, and weak predictive relationship with adherence to self-management behaviours ($r+=0.01$, $p=0.56$).

With regard to the further sensitivity analysis, data for partial correlations were possible to obtain for only six studies. This small number of studies provided data for the calculation of pooled correlations for just a handful of illness belief domains: timeline acute-chronic; consequences; personal control; and treatment control. The findings from these additional meta-analyses are shown in Table 2, and highlight weak prospective relationships between

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individual illness belief domains and adherence to self-management behaviours that are consistent with the original effect sizes in the earlier meta-analyses (Table 1). With the exception of the timeline acute-chronic domain, the effect sizes for the remainder of illness belief domains were similar to, or became smaller than, the main meta-analysis, but retained statistical significance. Therefore, consequence ($r+=0.04$, $p<0.05$); personal control ($r+=0.04$, $p<0.01$); and treatment control ($r+=0.12$, $p<0.001$) beliefs remained as strong predictors of adherence to self-management behaviours, accounting for baseline adherence to self-management behaviours. Sub-group analyses were not possible to conduct because of the limited data available on partial correlations. In contrast to the original meta-analysis, the timeline acute-chronic illness beliefs domain showed a very small effect size that did not retain statistical significance, indicating a weak (almost negligible) prospective relationship with adherence to self-management behaviours.

Publication bias

The majority of the funnel plots were asymmetrical, indicating that publication bias may be present (Appendix 3). The number of studies that fell outside of the funnel varied across the illness belief domains. The results of the Egger's test are shown in Table 1. Statistical significance for publication bias was found across several of the illness belief domains: timeline acute-chronic, consequences, personal control, treatment control, and emotional representations. The trim-and-fill technique was applied to these domains, and following re-estimation, the effect sizes were smaller for several of these illness beliefs: timeline acute-chronic ($r+=0.01$, $p=0.80$), consequences ($r+=-0.01$, $p=0.39$), personal control ($r+=0.02$, $p=0.20$), and treatment control ($r+=0.06$, $p<0.001$). The latter was the only illness belief domain that retained its statistical significance following application of the trim-and-fill method. In comparison to the main meta-analysis, these estimates were more conservative, with many of the effects sizes now showing even weaker (almost negligible) predictive

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relationships of individual illness belief domains with adherence to self-management behaviours, and statistical non-significance. Emotional representations were the exception. This domain retained its very small effect size, and therefore, weak predictive relationship with adherence to self-management behaviours. However, emotional representations became statistically significant, suggesting that this domain may now be a strong predictor of adherence to self-management behaviours ($r+=0.06$, $p<0.01$).

Further analyses

Significant effect sizes were found for several of the illness belief domains, following stratification of the meta-analysis according to the type of self-management behaviour, acute or chronic disease, and ≤6-months versus >6-months follow-up. However, the majority of statistically significant effect sizes were fairly similar across the groups ($r+$ typically around 0.10 to 0.20). This suggests weak evidence in favour of any of these factors as moderators of the predictive relationships between individual illness belief domains and adherence to self-management behaviours. All of the effect sizes are shown in Tables A5-A and A5-B (Appendix 5). It is important to note that in these further analyses, some of the sub-groups involved too few studies to allow for a valid comparison to be made. Therefore, effect sizes were not calculated for the affected groups.

Additional analyses showed that for the type of physical illness, acute or chronic, there was no evidence of a confounding effect on the predictive relationships between individual illness belief domains and adherence to self-management behaviours, of this factor. This was also the true for the year of publication of included studies. However, further analysis showed that the type of self-management behaviour may have a significant confounding effect for the consequences belief domain. This was found for the duration of follow-up for the casual belief domain as well. This was not evident for any of the other illness belief domains, for the type of self-management behaviour or the duration of follow-up. The findings from these

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analyses are also shown in Appendix 5 (Table A5-C). It is also noteworthy that for the type of physical illness, problems with collinearity for the personal control and treatment control beliefs domains meant that it was not possible to conduct meta-regression analyses for these factors.

Descriptive synthesis

Included papers that were not eligible for the meta-analysis were descriptively synthesised (N=31). Many of the papers (87%) reported predictive relationships for several of the illness belief domains. Six out of the 31 papers reported on multiple self-management behaviours as well. This meant that there were 60 examinable behaviours altogether for the descriptive synthesis. Therefore, consistent with the meta-analysis, the number of unique datasets (k) varied, as shown in Table 3. This table provides a summary of the findings from the descriptive synthesis, specifically showing the frequency that each illness beliefs domain predicted adherence to self-management behaviours.

The findings from the descriptive synthesis were consistent with the results from the meta-analysis. Significant predictive relationships between individual illness belief domains and adherence to self-management behaviours did not emerge in 11 out of the 31 papers that were descriptively synthesised. The remaining 20 studies were heterogeneous. There was a lot of variability between these studies for the type of physical illness, acute or chronic; the type of self-management behaviour; and the duration of follow-up, examined. Therefore, patterns according to these groupings were not discernible. There was a trend for attendance behaviours and medication adherence, with 10 and 19 out of 60 datasets respectively, showing significant predictive relationships with individual illness belief domains. However, adherence to these specific self-management behaviours was measured by around 80% of all papers included in this review, meaning that these behaviours were better represented overall

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by the studies than other, perhaps more complex self-management behaviours, such as adherence to diet or physical activity recommendations.

In general, for the descriptively synthesised papers that found significant predictive relationships between individual illness belief domains and adherence to self-management behaviours, only a handful of studies (typically <3) contributed data (Table 3). This was not sufficient to allow for any, even tentative, patterns to emerge. In addition, the reporting of effect sizes varied for the 31 papers in the descriptive synthesis. Correlation coefficients were not reported by 28 of the 31 papers. The three papers that reported correlation coefficients examined the illness concern beliefs domain, and because of limited data were excluded from the meta-analysis. However, these papers did not report significant predictive relationships between illness concern beliefs and adherence to self-management behaviours; very small (almost negligible) effect sizes ranging from -0.01 and 0.09, which indicated weak relationships that were statistically non-significant, were presented. Eight of the 28 articles that reported effect sizes presented odds ratios that were generally rather small indicating weak relationships, which is consistent with the findings from the meta-analysis. The remainder of papers either provided no information on effect sizes (N=14 out of 28 articles); or point estimates from regression modelling (β-coefficients) only (N=6 out of 28 articles).

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Discussion

This paper reports on a meta-analysis and descriptive synthesis that was undertaken to determine whether individual illness belief domains, outlined by the Common Sense Model (CSM), prospectively predicted adherence to self-management behaviours in adults with physical illnesses. Illness belief domains to emerge as significant predictors of adherence to self-management behaviours were: identity; timeline acute-chronic; consequences; personal control; treatment control; cure-control; and illness coherence. The results from the meta-

analysis identified effect sizes ranging from 0.04 and 0.13, indicating weak predictive relationships between individual illness belief domains and adherence to self-management behaviours. The meta-analysed partial correlations (controlling for past behaviours) showed consistently small effect sizes ranging from 0.04 to 0.12, for a handful of individual illness belief domains (where this data were available): consequences; personal control; and treatment control. These indicated weak prospective relationships with adherence to self-management behaviours. The meta-analysis also examined whether predictive relationships between individual illness belief domains and adherence to self-management behaviours varied according to acute and chronic illnesses; the type of self-management behaviour; and the duration of follow-up. However, the findings generally indicated that this was not the case. Though, this may be an artefact of the consistently small effect sizes found in this meta-analysis.

The findings from the descriptive synthesis were consistent with the results from the meta-analysis. Significant predictive relationships between individual illness belief domains and adherence to self-management behaviours did not emerge for many of the descriptively synthesised papers. Where significant predictive relationships were found, patterns were not discernible because of an insufficient number of descriptively synthesised studies contributing data and poor reporting of effect sizes in included papers. Studies that reported effect sizes generally showed weak relationships of individual illness belief domains with adherence to self-management behaviours. Studies that were descriptively synthesised were also highly heterogeneous, which meant that patterns according to the: type of physical illness (acute or chronic); type of self-management behaviour; or duration of follow-up, were not discernible.

Therefore, the findings from the present meta-analysis suggest that predictive relationships between individual illness belief domains, outlined by the CSM, and adherence

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to self-management behaviours, are weak for adults with acute or chronic physical illnesses. This is consistent with prior research from Brandes and Mullan (2014) that also focussed on the CSM framework and found similar effects for the role of individual illness beliefs in predicting adherence in patients with chronic diseases. We also showed weak prospective relationships between individual illness belief domains and adherence to self-management behaviours, controlling for past behaviours. Based on the evidence to date, the review suggests that the individual components of the CSM may not be helpful in understanding patients' adherence to self-management behaviours. However, there are several methodological and theoretical issues that should be acknowledged, which may have contributed to the apparent lack of predictive utility of the CSM.

To begin with, the statistical reporting of included papers was mostly inadequate, particularly in relation to effect sizes. There were many articles that did not report correlation coefficients. While attempts were made to obtain data directly from the authors of included papers, many articles where correlational analyses were not possible to acquire, had to be excluded from the meta-analysis. This meant that the number of datasets available for the meta-analysis, especially for the sub-analysis using partial correlations to examine prospective relationships, was considerably less than anticipated. Therefore, the present statistical analyses were constrained in several ways.

First, additional data on partial correlations would have allowed for a more robust examination of prospective relationships between individual illness belief domains and adherence to self-management behaviours, enabling firmer conclusions to be drawn. Second, a more sophisticated analysis of moderators of the relationship between individual illness belief domains and adherence to self-management behaviours, controlling for baseline adherence to self-management behaviours, would have been ideal to perform. This particular type of analysis, such as hierarchical analysis, would have been viable provided that there

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were sufficient data on partial correlations available from included studies. McEachan, Conner, Taylor, and Lawton (2011) provide an exemplar of this analysis, which supported their evaluation of the efficacy of the Theory of Planned Behaviour, for prospectively predicting health-related behaviours. Nonetheless, we did statistically examine potential moderators of the relationship between individual illness belief domains and adherence to self-management behaviours i.e., the type of self-management behaviour; acute versus chronic diseases; and the duration of follow-up. However, none of these emerged as important moderators.

An aspect of the CSM that has not been captured by this review, again because of a lack of availability of data from included papers, concerns treatment beliefs. There is a considerable body of literature on the CSM that has focussed on peoples' beliefs about their treatment, particularly around patients' views about medication and how these might influence an individual's subsequent adherence to their medication (Horne & Weinman, 1999). This theory, which is commonly referred to as the 'Necessity-Concerns Framework,' suggests that people undertake a cost-benefit analysis of their medication, where their own beliefs about the necessity of their medication for improving or maintaining their health are weighed up against their concerns about possible adverse effects (Horne & Weinman, 1999). Several studies, including a recent systematic review and meta-analysis, have shown that treatment beliefs are an important predictor of medication adherence in people with a range of acute and chronic physical illnesses (Allen LaPointe et al., 2011; Gatti, Jacobson, Gazmararian, Schmotzer, & Kripalani, 2009; Horne et al., 2013; Jamous, Sweileh, El-Deen Abu Taha, & Zyoud, 2014; Sjölander, Eriksson, & Glader, 2013; Sweileh et al., 2014).

Therefore, treatment beliefs could have had a role in the prediction of adherence to self-management behaviours in the present review; however, we were not able to examine any potential effects. While this is an important part of the CSM, very few papers in this review

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(N=10 out of 52) actually assessed treatment beliefs alongside patients' illness beliefs. Though, where this was examined by one included paper, greater specific concerns about medications were found to better explain non-adherence to medication than peoples' beliefs about their illness (O'Carroll et al., 2011). This necessitates future studies to incorporate simultaneous assessments of treatment beliefs and illness beliefs when examining possible predictors of adherence to self-management behaviours in people with physical illnesses.

Prior research has also argued that another important feature of the CSM is that individual illness belief domains are held as part of a schema rather than in isolation (Henderson, Orbell, & Hagger, 2009; Leventhal et al., 1980). Furthermore, recent studies have shown that when illness belief domains are examined collectively, as part of a schema, such as through cluster analysis methods, they may have greater predictive power for several physical, psychological, coping, and behavioural outcomes, including adherence to self-management behaviours (Clatworthy, Hankins, Buick, Weinman, & Horne, 2007; Harrison et al., 2014; Hsiao, Chang, & Chen, 2012; Lin & Heidrich, 2012; McCorry et al., 2013; Medley, Powell, Worthington, Chohan, & Jones, 2010; Skinner et al., 2011; Snell, Surgenor, Hay-Smith, Williman, & Siegert, 2014).

The present review examined the predictive utility of individual illness belief domains with adherence to self-management behaviours, showing weak relationships overall. However, in light of recent evidence examining schemas of illness belief domains, it may be that the weak effects that we have reported are an artefact of the fact that the CSM was not investigated appropriately (i.e., the model as a whole). Although this was the approach employed by prior reviews, such as Brandes and Mullan (2014) and Law et al. (2014), it is recommended that future research consider examining the predictive utility of the CSM as a whole, rather than only the component parts of the model (i.e., individual illness belief domains). However, through conducting the present review, we ascertained that this type of

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analysis would not currently be feasible. This is because papers do not report sufficient information about inter-relationships between individual illness belief domains and adherence to self-management behaviours. Therefore, we would strongly encourage future studies to provide these details, even if as a supplementary file, to allow for this evaluation of the predictive utility of the CSM as a whole.

Strengths and limitations

A particular strength of the present review was our inclusiveness. We extended previous reviews (e.g., Brandes and Mullan (2014)) by examining a broad range of self-management behaviours, including attendance, and acute (such as, common cold) as well as chronic conditions (for example, asthma). However, with this inclusiveness, the studies included in our review were heterogeneous, such as for the specific physical health condition examined (e.g., myocardial infarction, type 2 diabetes mellitus etc.), which presented challenges for synthesising the literature. The diversity of our included studies meant that we were not able to perform certain analyses (for example, sub-group analysis by specific illnesses). The heterogeneity between studies affected the pooled correlations for particular illness belief domains more extremely than others. Similar problems with heterogeneity were found in the recent paper by Brandes and Mullan (2014). We used random effects models for our meta-analyses to account for this as much as possible. In addition, we undertook some further analyses in an attempt to explain the heterogeneity; though these findings suggested that there may be factors other than those tested in this meta-analysis (e.g., specific physical health conditions) that may be contributing to the diversity between studies. A further strength of our review was that we report on a sub-analysis of prospective relationships (controlling for past behaviour) offering valuable information on causality in predictive relationships between individual illness belief domains and adherence to self-management behaviours. Previous

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research has been limited by the assessment of only cross-sectional relationships. Finally, we employed robust methods for the review. This included conducting the systematic review in accordance with best practice guidelines (e.g., the Cochrane Collaboration (Higgins & Green, 2011)) and reporting the research using relevant frameworks (H. Cooper, 2010; Moher et al., 2009).

A limitation of this review was that our focus was on people with physical illnesses. Studies exploring illness beliefs in people with mental health disorders were excluded. We acknowledge, however, that illness belief domains may also play an important role in people's management of mental health disorders (Baines & Wittkowski, 2013). In addition, we found some evidence of publication bias in this review, with many of the illness belief domains showing asymmetric funnel plots, suggesting that not all of the studies that could have been included were actually included in the meta-analysis. We made significant efforts to obtain relevant research by conducting systematic searches of both the published and grey literature in this area. However, publication bias remains an issue, as it was in the review by Brandes and Mullan (2014). In hindsight, it may be that prominent authors in this field and distribution lists of relevant associations, may have literature that we did not obtain for this review; we would strongly encourage future reviews to pursue this avenue when conducting searches of this literature.

We attempted to address the problems with publication bias, as far as possible, statistically (for example, the 'trim and fill' method). The findings following re-estimation of the meta-analysis were broadly similar, albeit more conservative. It should also be noted that the interpretation of funnel plots be approached with caution, as there may be factors other than reporting bias (for example, delayed publication and selective reporting of outcomes or analyses) that may contribute to funnel plot asymmetry (Sterne et al., 2011; Terrin, Schmid, Lau, & Olkin, 2003). For instance, high heterogeneity and poor methodological quality of

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studies may result in skewed funnel plots: both of these issues were highly relevant to the present study, and have been discussed.

Conclusion

This systematic review and meta-analysis shows that predictive relationships between individual illness belief domains, outlined by the CSM, and adherence to self-management behaviours (including: attendance, medication adherence, dietary and physical activity advice, and disease-specific behaviours) are weak. Prospective relationships, controlling for past behaviour, are also weak. Further, the type of physical disease, acute or chronic; the type of self-management behaviour; or the duration of follow-up did not moderate these relationships. Therefore, based on the evidence to date, this review suggests that the individual components of the CSM may not be helpful in understanding patients' adherence to self-management behaviours. Future studies should, however, examine the utility of the CSM as a whole (i.e., using illness beliefs as schemas) for prospectively predicting adherence to self-management behaviours, rather than only examining the component parts (i.e., individual illness belief domains). Future research should also carefully consider the role of treatment beliefs, outlined by the CSM, enabling further reviews to examine whether treatment beliefs moderate or independently predict adherence to self-management behaviours. Finally, in order to improve the robustness of future meta-analyses, studies need to pay careful attention to conducting more comprehensive searches of the unpublished literature in this area; and to the reporting of effect sizes, particularly correlation coefficients, including better reporting of partial correlations for further examining prospective relationships.

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Figure D: Forest plot for consequence beliefs

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Figure F: Forest plot for treatment control beliefs

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Figure P: Trim and filled funnel plot for treatment control beliefs

Figure Q: Funnel plot for cure-control beliefs

Figure R: Funnel plot for illness coherence beliefs

Figure S: Trim and filled funnel plot for emotional representations

Figure T: Funnel plot for causal beliefs

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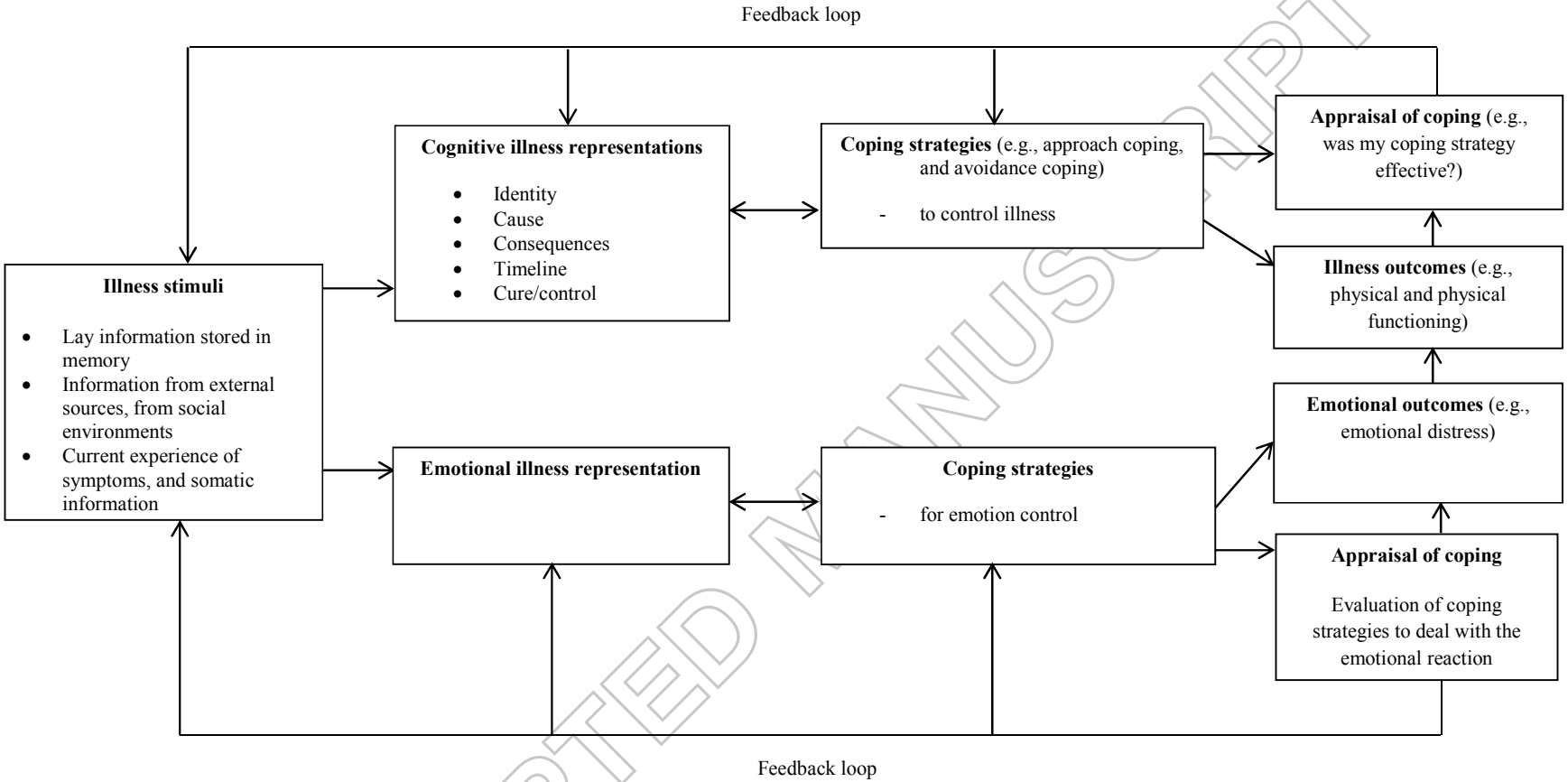

Figure 1. The common sense model (CSM)

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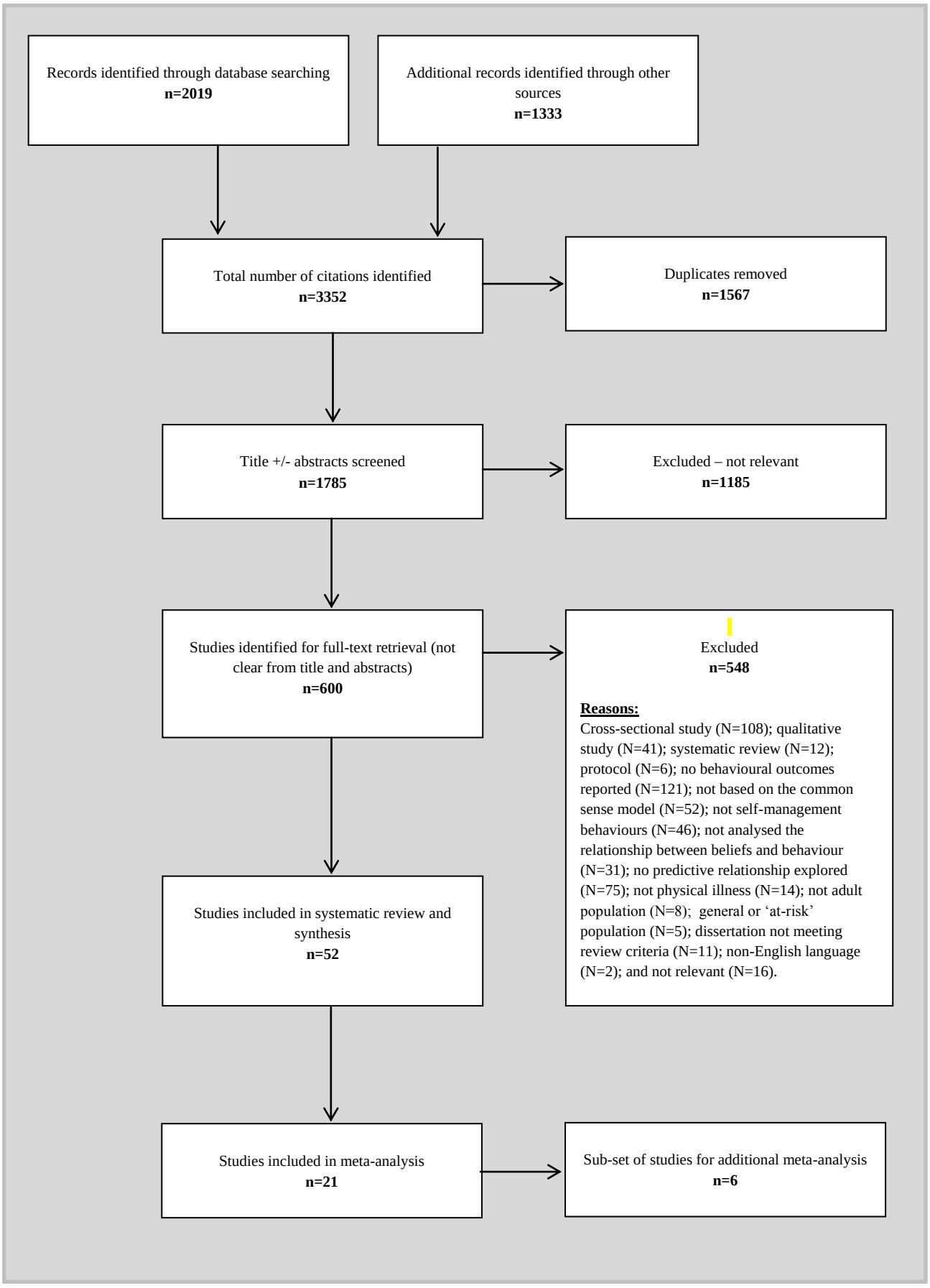

Figure 2. Flow diagram to illustrate the selection of studies

Table 1. Effect sizes for predictive relationship between illness beliefs and self-management behaviour

Illness beliefs	Number of studies	k	Correlations		Heterogeneity			Egger's test (p-value)
			r+ (95% CI)	p-value	Q (DF)	I^2	Tau^2	
Identity	10	32	0.08 (0.04-0.12)	<.001	226.71 (31)	86.3***	0.01	0.90
Timeline (acute/chronic)	14	36	0.12 (0.06-0.17)	<.001	269.19 (35)	87.0***	0.02	<.01
Cyclical timeline	7	25	-0.01 (-0.05-0.04)	0.83	54.71 (24)	56.1***	0.01	0.81
Consequences	16	67	0.04 (0.01-0.07)	<.01	160.51 (66)	58.9***	0.01	<.001
Personal control	11	49	0.07 (0.04-0.10)	<.01	96.26 (48)	50.1***	0.01	<.05
Treatment control	13	65	0.13 (0.09-0.16)	<.001	122.25 (64)	47.6***	0.01	<.01
Cure-control	6	15	0.07 (0.03-0.12)	<.01	34.15 (14)	59.0**	0.00	0.69
Illness coherence	9	28	0.04 (0.01-0.08)	<.05	31.92 (27)	15.4	0.00	0.19
Emotional representations	9	28	-0.01 (-0.06-0.05)	0.85	75.55 (27)	64.3***	0.01	<.05
Causes	4	38	0.01 (-0.02-0.04)	0.45	55.69 (37)	33.6*	0.00	0.99

Symbols and abbreviations: k: Number of unique data-sets; r+: Weighted correlation coefficient; Q: Between-study heterogeneity (chi-squared); DF: Degrees of freedom; I^2: Between-study heterogeneity (percentage); Tau^2: Estimate of between-study variance; Egger's test: Significance test for funnel plot asymmetry; *: p<.05; **: p<.01; ***p<.001

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Table 2: Effect sizes for prospective relationships between illness beliefs and self-management behaviour

Illness beliefs	Number of studies	k	Correlations		Heterogeneity	
			r+ (95% CI)	p-value	Q (DF)	I^2
Identity	-					
Timeline (acute/chronic)	3	8	-0.01 (-0.06-0.05)	0.79	19.92 (7)	64.9**
Cyclical timeline						
Consequences	4	29	0.04 (0.00-0.07)	<.05	37.75 (28)	25.8
Personal control	4	29	0.04 (0.01-0.08)	<.01	39.52 (28)	29.1
Treatment control	5	30	0.12 (0.09-0.15)	<.001	122.44 (29)	76.3***
Cure-control	-					
Illness coherence	-					
Emotional representations	-					
Causes	-					

Symbols and abbreviations: k: Number of unique data-sets; r+: Weighted correlation coefficient; Q: Between-study heterogeneity (chi-squared); DF: Degrees of freedom; I^2: Between-study heterogeneity (percentage); Tau^2: Estimate of between-study variance; Egger's test: Significance test for funnel plot asymmetry; *: p<.05; **: p<.01; ***p<.001

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Table 3. Summary of significant predictive relationships from descriptively synthesised studies

Illness beliefs	Self-management behaviours					
	Appointment attendance	Healthcare use	Diet	Physical activity	Medication adherence	Other
Identity	N=4 k=4					
	N=1 k=1		N=3 k=3			
	N=1 k=1	×	×	×	N=2 k=2	N=1 k=1
Timeline (acute/chronic)	N=6 k=12					
	N=1 k=1		N=5 k=11			
	N=1 k=1	×	×	×	N=3 k=4	N=2 k=7
Cyclical timeline	N=1 k=5					
	×		N=1 k=5			
	×	×	×	×	×	N=1 k=5
Consequences	N=4 k=4					
	N=1 k=1		N=3 k=3			
	N=1 k=1	×	N=1 k=1	×	N=1 k=1	N=1 k=1
Personal control	N=2 k=3					
	N=1 k=1		N=1 k=2			
	N=1 k=1	×	×	×	N=1 k=2	×
Treatment control	N=7 k=10					
	N=2 k=2		N=5 k=8			
	N=2 k=2	×	N=1 k=1	N=1 k=1	N=1 k=2	N=2 k=4
Cure-control	N=3 k=3					
	N=2 k=2		N=1 k=1			
	N=2 k=2	×	×	×	N=1 k=1	×
Illness coherence	N=1 k=1					
	×		N=1 k=1			
	×	×	×	×	N=1 k=1	×
Illness concern	N=1 k=1					
	×		N=1 k=1			
	×	×	×	×	×	N=1 k=1
Emotional representations	N=1 k=1					
	×		N=1 k=1			
	×	×	×	×	×	N=1 k=1
Causes	N=8					

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	k=16					
	N=2 k=2		N=6 k=14			
	N=2 k=2	×	N=3 k=5	×	N=2 k=6	N=1 k=3

Symbols:×: not examined by included papers; N: Number of included papers; k: Number of unique datasets

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Appendix 1

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Search Strategy:

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1 Leventhal#.mp. (141)

2 Disease/ or Acute Disease/ or Disease.mp. (3237198)

3 Chronic disease.mp. or Chronic Disease/ (241009)

4 Medical condition.mp. (4713)

5 Physical illness.mp. (2225)

6 (Common adj sense model).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (161)

7 (Self adj regulation model).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (134)

8 1 or 6 or 7 (372)

9 Illness.mp. (371225)

10 2 or 3 or 4 or 5 or 9 (3473010)

11 "Illness behaviour".mp. or Illness Behavior/ (1130)

12 Recovery.mp. (351055)

13 Rehabilitation.mp. or Rehabilitation/ (127559)

14 (Self adj care).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (31601)

15 (Self adj management).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (9832)

16 Medication Adherence/ or Adherence.mp. (99745)

17 Treatment.mp. (3538360)

18 Patient Compliance/ or Treatment adherence.mp. (50831)

19 Illness belief*.mp. (319)

20 Illness perception*.mp. (956)

21 Illness cognition*.mp. (98)

22 Illness representation*.mp. (318)

23 19 or 20 or 21 or 22 (1496)

24 Health Behavior/ or Behavio?r change.mp. (42391)

25 Behavio?r modification.mp. (2371)

26 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 24 or 25 (4010351)

27 8 or 23 (1694)

28 10 and 26 and 27 (951)

29 (Help adj seeking).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (3192)

30 (Care adj seeking).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (1815)

31 26 or 29 or 30 (4013233)

32 28 and 31 (951)

33 limit 32 to (english language and humans and yr="1980 -Current" and ("adolescent (13 to 18 years)" or "young adult (19 to 24 years)" or "adult (19 to 44 years)" or "young adult and adult (19-24 and 19-44)" or "middle age (45 to 64 years)" or "middle aged (45 plus years)" or "all aged (65 and over)" or "aged (80 and over)")) (670)

34 from 33 keep 1-122 (122)

35 from 34 keep 13 (1)

****

Figure A1: Example search strategy for the systematic review – MEDLINE

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Appendix 2

Table A2: Summary of studies included in the review

Author & year	Country & setting	Study design & length of follow-up	Number of participants	Age, mean (SD), unless otherwise stated	Type of illness	Belief measurement & how completed	Self-management behaviour(s) & how measured	Key findings
Callaghan, Condie, and Johnston (2008)	Scotland, hospital	Longitudinal, 1 and 6-months	166	66.7 (10.3)	Peripheral arterial disease amputation	IPQ-R; assisted self-completion	Prosthetic use; self-reported using the Locomotor Capabilities Index	• Indoor prosthetic use at 1-month: independently, and significantly, predicted by beliefs about a cyclical timeline. Treatment control beliefs and causal attributions (risk factors) were marginally significant • Indoor prosthetic use at 6-months: cyclical-timeline and treatment control beliefs were significant predictors • Outdoor prosthetic use at 6-months: cyclical-timeline and

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								treatment control beliefs, and causal attributions to emotional-psychological factors were all significant predictors • Timeline-cyclical beliefs and causal attributions (risk factors and emotional-psychological factors) significantly predicted the number of hours and days of prosthetic-use at 6-months
Clarkesmith, Pattison, Lip, and Lane (2013)	England, specialist and outpatient clinics	Randomised trial, 1, 2, 6 and 12-months	97	72 (8.2)	Warfarin-naïve patients with atrial fibrillation	Brief IPQ; self-completion Beliefs About Medication Scale; self-reported, to assess peoples' specific beliefs about their medication, including concerns, necessity, harm and overuse	Medication adherence; objectively measured, using the time spent within the therapeutic range (INR 2.0 - 3.0)	Illness perceptions were not significantly associated with time within therapeutic range
Cooper, Lloyd, Weinman, and Jackson (1999)	England, hospital	Prospective, 6-months	152	Attendees – 58.4 (NR); non-attendees – 64.9 (NR)	Hospitalised for acute myocardial infarction or coronary artery bypass graft surgery	IPQ (timeline, control/cure, consequences, causal attribution to lifestyle and stress sub-scales, only); self-completion	Attendance at cardiac rehabilitation programme; self-reported using a postal/telephone questionnaire	Control beliefs and causal attributions to lifestyle significantly predicted attendance (models adjusted for: belief dimensions,

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								age and knowledge of total cholesterol concentration)
Cossette, Frasure-Smith, Dupuis, Juneau, and Guertin (2012)	Canada, hospital	Randomised trial, 6-weeks	242	Intervention - 59.4 (10.5); control - 59.4 (9.4)	Acute coronary syndromes	IPQ-R; self-completion	Attendance at rehabilitation session; assessed using electronic records Physical activity; self-reported, using the 'Do you have a healthy heart?' scale Healthy diet; self-reported, using the 'Are you eating healthy?' scale	• Illness beliefs were not reported to be significantly associated with attendance at cardiac rehabilitation, or healthy diet and physical activity
Coutu, Dupuis, D'Antono, and Rochon-Goyer (2003)	Canada, hospital	Longitudinal, 3, 6 and 12-months	214	Women – 55.4 (12.5); men – 49.6 (10.7)	Hypercholesterolemia	Cognitive representation of hypercholesterolemia questionnaire; self-completion The Expectancy Questionnaire for Hypercholesterolemic Patients; self-completed, to assess peoples' perceived control of their condition	Dietary intake (self-reported using the Food Record Rating); adherence to lipid-lowering agents (self-reported using a visual analogue scale)	• People with low-moderate fat consumption at baseline: reduction in beliefs about stress and symptoms and beliefs about hypercholesterolemia as chronic significantly predicted 1-year reduction in fat and cholesterol intake • People with high fat consumption at baseline: accurate represen

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								tation of hypercholesterolemia at baseline significantly predicted improved dietary intake. Models controlled for perceived self-efficacy, treatment efficacy and BMI
Dalbeth et al. (2011)	New Zealand, primary care and hospital clinics	Longitudinal, 12-months	142	Median=57; Range=19 - 85	Gout	Brief IPQ; self-completion	Medication adherence relating to urate-lowering therapy; self-reported, using an adapted version of the Medication Adherence Report Scale	• Adherence: significantly associated with greater understanding of illness • Non-adherence: significantly associated with greater symptom severity and serious consequence beliefs
Fennessy, Devon, Ryan, Lopez, and Zerwic (2013)	USA, a large Midwestern academic medical centre	Prospective, two-group comparison, 30-days (post-procedure)	180	65.1 (8.3)	Stable coronary artery disease, recruited after coronary angiography and optimal medical therapy (OMT) or after percutaneous coronary intervention (PCI) with initiation of OMT	IPQ-R; self-completion	Adherence to dual anti-platelet therapy (aspirin and thienopyridine) physical activity and need for emergent care, self-reported using the Health History Update questionnaire	• Thienopyridine adherence: significantly predicted by chronicity beliefs • Aspirin adherence: chronicity, cyclical-timeline and

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								treatment control beliefs were significantly related, but only chronicity beliefs predicted adherence
Fischer et al. (2009)	Netherlands, hospital (centre for pulmonary rehabilitation)	Longitudinal, 3-months	217	63.4 (9.4)	Chronic obstructive pulmonary disease	IPQ-R; self-completion	Attendance at pulmonary rehabilitation course; derived by comparing patients' weekly appointment schedules (extracted from medical notes) with therapists' daily work logs	Treatment control significantly predicted poor attendance, alongside fat free mass index (adjusting for living with partner, stopped smoking and male gender)
French et al. (2008)¥¥	England, general practice	Randomised trial, 12-months	339	65.9 (10)	Non-insulin treated type 2 diabetes mellitus	IPQ-R (excluding the causal beliefs scale); self-completion Self-monitoring of blood glucose beliefs; self-reported, using specifically developed scales incorporated into the IPQ-R Beliefs About Medicines Questionnaire; self-completed, to assess peoples' beliefs about their diabetes medication, including beliefs about necessity and	Diabetes self-care activities; self-reported using the Diabetes Self-Care Activities questionnaire, and medication adherence; self-reported using the Medication Adherence Report Scale	Consequence beliefs significantly predicted change in self-reported fruit and vegetable consumption (relationship became non-significant with adjustment for group allocation – usual care versus. less and more intensive self-monitoring of blood glucose)

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						concerns		
French, Lewin, Watson, and Thompson (2005)	England, hospital	Prospective, 6-months	194	63.3 (10.6)	Myocardial infarction	IPQ; self-completion	Attendance at cardiac rehabilitation programme; self-reported and checked against hospital records	Illness beliefs were not significantly associated with attendance at cardiac rehabilitation *
French, Wade, and Farmer (2013)¥	England, general practice	Randomised trial, 12-months	453	65.9 (10)	Non-insulin treated type 2 diabetes mellitus	IPQ-R (excluding the causal beliefs scale); self-completion Beliefs About Medicines Questionnaire; self-completed, to assess peoples' beliefs about their diabetes medication, including beliefs about necessity and concerns Study-specific questionnaire; self-completed, to assess beliefs about physical activity and diet	Diabetes self-care activities; self-reported using the Diabetes Self-Care Activities questionnaire, and medication adherence; self-reported using the Medication Adherence Report Scale	• Illness beliefs did not significantly predict: medication adherence, exercise, general dietary behaviours, or consumption of high fat foods. • Strong consequence beliefs, weak emotional representations and lesser symptom severity significantly predicted fruit and vegetable consumption.
Goodman, Firouzi, Banya, Lau-Walker, and Cowie (2013)	England, hospital (specialist heart failure services)	Longitudinal, 2 and 6-months (post-hospital-discharge)	88	70.5 (12.8)	Heart failure	IPQ-R; self-completion	Self-care behaviour; self-reported using the Self-Care Heart Failure Index	Illness beliefs were not significantly associated with self-care behaviour
Halm, Mora, and Leventhal (2006)	USA, hospital	Prospective,1 and 6-months	198	49.9 (17.4)	Asthma	Asthma as a chronic disease or an acute, episodic illness; and disease chronicity; Interview administered survey	Medication adherence and self-management behaviours, including attendance at routine visits; self-reported via	• 'No symptoms, no asthma' belief: poor adherence to inhaled corticosteroids;

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							interview	and people were less likely to: report using inhaled corticosteroids when asymptomatic and adhere to other self-management behaviours, including routine doctor visits when asymptomatic, use of peak flow measurements, and self-adjustment of medications • 'No symptoms, no asthma' belief: associated with significantly lower odds of using inhaled corticosteroids all or most days when asymptomatic (even after controlling for age, sex, asthma severity, prior intubation and frequency of

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								oral steroid use)
Hampson, Glasgow, and Foster (1995)	USA, community setting	Prospective, 1 and 4-months	81	70 (6.5)	Non-insulin-dependent diabetes	Personal models of diabetes interview (cause, seriousness, and treatment effectiveness), with some open-ended questions; interview administered	Self-care (e.g., blood glucose testing, dietary intake, physical activity, and medication-taking), using the Summary of Diabetes Self-Care Scale	• Beliefs about treatment effectiveness significantly predicted dietary intake at 4-months • Beliefs about treatment effectiveness and responsibility for causing diabetes predicted physical activity at 4-months • Personal model beliefs did not predict levels of glucose testing at 4-months
Hampson, Glasgow, and Strycker (2000)¥¥	USA, outpatient clinics	Randomised trial, 3, 6 and 9-months	111	62 (NR)	Diabetes	Personal models of diabetes (e.g., perceived seriousness, treatment effectiveness, and personal control) brief questionnaire; self-completion	Dietary self-management, using the Kristal Food Habits Questionnaire	Strong beliefs in treatment effectiveness associated with lower high fat eating patterns
Hampson, Glasgow, and Toobert (1990)	USA, outpatient clinics	Prospective, 2-weeks	46	64 (NR) (range=46-79)	Older women with non-insulin-dependent diabetes	Personal models of diabetes interview, involving open and closed ended questions to assess four constructs (cause, symptoms, treatment and seriousness); interview	Diabetes self-care activities, using a revised version of a questionnaire by Glasgow and colleagues, including dietary intake, physical activity and	• Diet level: prediction enhanced by addition of personal model constructs; importance of treatment and

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							medication-taking	• seriousness of diabetes predicted high dietary self-care • Exercise: beliefs about the importance of treatment significantly predicted physical activity, and more frequent glucose testing
Hampson, Glasgow, and Zeiss (1994)	USA, community	Prospective, 2-weeks post-interview and 8-months	61	72 (7.8)	Older adults (>60 years) with osteoarthritis	Personal models of arthritis interview, assessing symptoms, seriousness, cause, control, treatment, with some open-ended question; structured interview	Self-management (e.g., low-impact activity, medication, rest, range-of-motion exercises, relaxation techniques, heat or cold applied to joints, joint protection, massage, and splinting joints), using the Summary of Arthritis Management Methods questionnaire providing a summary of typical and worse-days	Symptoms and seriousness significantly predicted typical and worse-day self-management at 2-weeks and 8-months
Hand and Adams (2002)	England, general practice	Longitudinal, 1 and 3-months	44	Median: 38 years (range 18 - 55)	Asthma	IPQ; self-completion Attitudes to Treatment to Asthma Questionnaire; self-completed, to measure treatment beliefs, including: the prevention and relief of asthma using inhalers, and problems and concerns about	Inhaler use behaviours; self-reported	Illness beliefs were not significantly associated with inhaler use*

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						inhalers		
Harrison et al. (2014)	England, hospital	Prospective observational, 6-months	128	70.8 (8.87)	Acute exacerbation of chronic obstructive pulmonary disease	IPQ-R; self-completion, during home visit Pulmonary Rehabilitation Adapted Index of Self-Efficacy; self-completed, to assess self-efficacy in a pulmonary population	Uptake, attendance, and completion of pulmonary rehabilitation; collected from hospital records	• Three illness belief patient groups identified: 'in control,' 'disengaged,' and 'distressed' • No differences emerged between clusters for attendance and adherence to previous pulmonary rehabilitation, or acceptance and uptake of pulmonary rehabilitation six-months after hospitalisation for acute exacerbation
Heerema-Poelman, Stuive, and Wempe (2013)	Netherlands, rehabilitation centre	Longitudinal, 6-months (early dropouts, only) and 12-months	60	61.3 (10.3)	Chronic obstructive pulmonary disease, receiving home-care rehabilitation	IPQ-R (personal and treatment control sub-scales, only); self-completion Exercise Self-Regulatory Efficacy Scale; self-completed, to assess self-efficacy of exercise behaviour in people with chronic obstructive pulmonary disease	Adherence to a maintenance exercise programme; self-reported (early drop-outs - telephone call, and completers - remaining at the end of programme)	Illness beliefs were not significantly associated with adherence to the maintenance programme
Hemphill, Stephens, Rook, Franks,	USA, NR	Longitudinal, 6 and 12-months	129 patient-spouse dyads	66 (7.78)	Patients with type 2 diabetes mellitus and their partners	IPQ-R; interview administered Disease duration	Dietary behaviour; self-reported using the diet sub-	• Interaction between duration and variabili

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and Salem (2013)¥¥						beliefs, computed using the mean of four-items from the timeline (acute/chronic) sub-scale Symptom variability beliefs, computed using the mean of three-items from the timeline (cyclical) sub-scale	scale of the Diabetes Self-Activities questionnaire	ty beliefs signficiantly predicted change in dietary adherence over time • Improved dietary adherence at 12-months: significantly associated with duration beliefs, for people who believed that their symptoms did not fluctuate
Lau, Bernard, and Hartman (1989)	USA, community setting (university)	Longitudinal, 3-years	1029 students and 947 parents	Students=17 or 18 (NR) (when the study began); parents = 47 (NR).	Common, everyday minor illnesses (e.g., cold)	Open-ended questions structured around identity, timeline, consequences, causes, and cure/control beliefs, and independently coded to develop scales; self-completion questionnaire Lau-Ware Health Locus of Control Scale; self-completed, to assess self-control and provider control over health, chance health outcomes, and general health threat Study-specific questionnaire;	Number of doctor visits over 1-year; health centre visits over 3-years and recent attendance for a preventative check-up, collected using health centre records	• Strong awareness of symptoms significantly associated with: number of visits to the doctor in 1-year and health centre visits in 1-year and over 3-years • Strong curability beliefs significantly related to: health-centre visits in 3-years, and a recent

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						self-completed, to assess illness behavioural intention, around visiting the doctor		preventative check-up
Leung, Ceccato, Stewart, and Grace (2007)¥¥	Canada, primary and secondary care (health centre and hospitals)	Longitudinal, 9 and 18-months (post-hospital-discharge)	417	63.1 (10.2)	Coronary artery disease	IPQ-R (timeline cyclical/episodic, consequences, personal control and cure/controllability sub-scales only); administered (in-hospital) and self-completion (follow-up) Exercise Benefits and Barriers Scale; self-reported, to assess peoples' exercise perceptions	Participation in recreational and physical activities; self-reported using sub-scales of the Health Promoting Lifestyle Profile	• Exercise maintainers: significantly more likely to attribute causes of their coronary artery disease to own behaviour compared to inactive participants (adjusting for gender, exercise history, cardiac rehabilitation enrolment, exercise barriers and current/past smoker) • Irregular exercisers: significantly more likely to attribute causes of their coronary artery disease to own behavio

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								ur compared to exercise maintainers (adjusting for current smoker and diabetes)
Massey et al. (2013)	Netherlands, outpatient clinics	Longitudinal, 6-weeks and 6-months post-transplant	113	Median: 53 years (range 19 - 75)	Kidney transplantation	Brief IPQ; interview administered Study-specific questionnaire; self-reported, to assess goal cognitions, which examined the extent to which people perceive immunosuppressive medication adherence to be an important personal goal Beliefs About Medicines Questionnaire; self-reported, to assess peoples' beliefs about their immunosuppressive medication, such as necessity and concerns	Adherence to immunosuppressive medication; self-reported through an interview using the Basel Assessment of Adherence to Immunosuppressive Medications Scale	• Consequence beliefs weaker in non-adherent patients • Timeline perceptions, of longevity of graft, predicted non-adherence at 6-weeks
Massey et al. (2015)	Netherlands, outpatient clinics	Longitudinal, 18-months post-transplant	84	Median: 53 years (range 19 - 75)	Kidney transplantation	Brief IPQ; interview administered Study-specific questionnaire; self-reported, to assess goal cognitions, which examined the extent to which people perceive immunosuppressive medication adherence to	Adherence to immunosuppressive medication; self-reported through an interview using the Basel Assessment of Adherence to Immunosuppressive Medications Scale	Illness beliefs were not significantly associated with medication adherence*

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						be an important personal goal Beliefs About Medicines Questionnaire; self-reported, to assess peoples' beliefs about their immunosuppressive medication, such as necessity and concerns		
Michie, O'Connor, Bath, Giles, and Earll (2005)	England, hospital	Longitudinal, 2-weeks before attending cardiac rehabilitation, 8-weeks and 8-months after programme	158	59 (NR)	Admitted with myocardial infarction or undergone coronary artery bypass graft surgery	IPQ; self-completion Single-item study-specific measures, self-completed to assess self-efficacy beliefs around particular behaviours, such as: eating, exercise and stress	Healthy eating; self-reported using a study specific single-item measure	Illness beliefs were not significantly associated with healthy eating*
Mosleh, Bond, Lee, Kiger, and Campbell (2014)	Scotland, hospital	Randomised trial, 8-weeks	375	62.5 (11.2)	Admission for myocardial infarction, coronary artery bypass graft surgery, or coronary angioplasty	IPQ (plus two items for symptom distress); self-completion Theory of Planned Behaviour Scale; self-completed, to measure peoples' attitudes and intentions for adhering to treatment guidelines	Attendance at cardiac rehabilitation programme; assessed using cardiac nurse records	Greater symptom severity significantly associated to cardiac rehabilitation attendance.
O'Carroll et al. (2011)	Scotland, hospital	Longitudinal, 4-6 weeks	180	69 (11.4)	Ischaemic stroke (1-year post-stroke)	IPQ-R (timeline and treatment control sub-scales only); assisted self-completion Perception of risk of further stroke in the next 5 years was also assessed with a 0-100 visual analogue scale; score recorded as a percentage; assisted self-completion	Medication adherence; self-reported using the Medication Adherence Report Scale, and an opportunistic urinary sample measured for urinary salicylic acid/creatinine ratio (for aspirin adherence)	Illness beliefs were not significantly associated with medication adherence

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						Beliefs About Medicines Questionnaire; self-completed, to assess peoples' specific beliefs about their prescribed medication Desire for medication now and perception of medication benefits also assessed with a visual analogue scale; assisted self-completion.		
O'Connor, Jardine, and Millar (2008)	Scotland, hospital	Prospective, 3-weeks	73	51.9 (14.7)	End-stage renal disease	IPQ-R; self-completion Kidney Knowledge Questionnaire; self-reported, to assess peoples' own knowledge of kidney disease and its treatment	Self-care behaviours: adherence to phosphate-binding medication measured using pre-dialysis serum phosphate; weight gain calculated using post-dialysis and next pre-dialysis weight; and adherence to dietary restrictions measured using serum potassium levels	• Emotional representations predicted pre-dialysis potassium levels and pre-dialysis phosphate levels (with adjustment for age, gender and ideal weight) • Timeline beliefs predicted pre-dialysis phosphate levels (adjusting for the same confounding factors)
O'Rourke and Hampson (1999)	England, hospital	Longitudinal, 6-months	70	Hospital 1 – 57.7 (9); hospital 2 – 59.4 (10.4)	Myocardial infarction	IPQ; self-completion Recovery Locus of Control Scale; self-completed, to measure peoples' perceptions of control over their recovery, and Generalised Self-Efficacy	General practitioner contact and hospital admissions; self-reported and checked against electronic medical records for hospital admissions and further medical	Illness beliefs were not significantly associated with health service utilisation.

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						Scale; self-completed, to measure the strength of peoples' beliefs in their own ability to handle difficult situations and setbacks	procedures, only	
Olszanecka-Gliniano wicz and Almgren-Rachtan (2014)	Poland, outpatient clinic	Prospective, NR	Asthma - 3618; chronic obstructive pulmonary disease - 2602	Asthma - 46.7 (15.0); chronic obstructive pulmonary disease - 60.0 (13.5)	Asthma and chronic obstructive pulmonary disease	Brief IPQ; interview administered	Medication adherence to the Fantasmino inhaler; measured using the Morisky 8-item Medication Adherence Questionnaire	• Strong illness beliefs observed in adherent asthma patients • Non-adherence: related to serious consequence beliefs and strong emotional response for chronic obstructive pulmonary disease patients and greater symptom severity for asthma patients • Adherence: related to chronicity, strong personal and treatment control beliefs, understanding of disease and interest in knowledge for asthma patients and strong personal

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								and treatment control beliefs for chronic obstructive pulmonary disease patients • Significant negative association found between medication adherence and illness perception scores, including disease controllability, understanding of illness and interest in knowledge in asthma patients and for chronic obstructive pulmonary disease patients, disease controllability and acute timeline beliefs
Orbell, Hagger, Brown, and Tidy (2006)	England, secondary care (colposcopy clinics)	Longitudinal, 15-months	660	33.9 (10.3)	Abnormal cervical screening result	IPQ-R; self-completion Study-specific items; self-completed, to measure Theory of Planned Behaviour variables, such as attitude and behavioural intention	Appointment attendance; assessed using medical records	Illness beliefs were not significantly associated with attendance
Petrie, Weinm	New Zealand,	Longitudinal, 3	143	53.2 (8.4)	Myocardial infarction	IPQ (identity, timeline,	Attendance at cardiac	Control/cure beliefs

an, Sharpe, and Buckley (1996)	hospital	and 6-months				consequences, and cure or control sub-scales only); self-completion	rehabilitation programme; from practitioner records	weaker in non-attendees, and a trend towards less serious consequence beliefs and lower distress in this group.
Phillips, Leventhal, and Leventhal (2013)	USA, primary care clinic of a research hospital	Prospective, 30-days	71	67.9 (12.3)	Hypertension, and on daily pill-form medication	Coherence beliefs, measured using two survey questions; interview IPQ-R treatment control sub-scale, and the Beliefs about Medicines Questionnaire; self-reported, to assess treatment-related health beliefs Self-Report Habit Index; self-reported, to assess habit strength These were all assessed in the interview	Adherence to anti-hypertensive medication in the previous two-weeks; self-reported in an interview, using the Morisky Medication Adherence Scale, and the Medication Adherence Scale. Medication adherence was also assessed objectively, using electronic monitoring pill bottles (Medication Event Monitoring Systems)	Coherence beliefs significantly predicted intentional non-adherence
Poliakoff et al. (2013)	England, community setting	Randomised trial, 10 and 20-weeks	32	Intervention: median=68.6 years (range=48 - 77); Control: median=66.6;((range=49 - 78)	Parkinson's disease	Brief IPQ; NR	Exercise training (for example: cardiovascular activity at the gym); undertook various assessments of motor function	Gym group perceived a low sense of personal control and more serious consequences over the duration of training, but had a reduction in beliefs about illness concern over the intervention period
Powell et al. (2013)¥¥	New Zealand, community antenatal clinic	Randomised trial, monthly and bi-weekly until 37-weeks gestation	175	28.5 (5.4)	Pregnant women with asthma (12 to 20 weeks gestation)	Brief IPQ; administered to patients	Exacerbations (for example: hospitalisation, emergency visit, unscheduled	Future exacerbation risk significantly predicted by beliefs about controllability of asthma

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							doctor visit, or oral corticosteroid use for worsening asthma), prospectively assessed at monthly antenatal clinic visits and fortnightly telephone follow-up	
Rabin and Pinto (2006)	USA, hospital	Longitudinal, 3 - months	61 survivors and 31 relatives	Survivors – 56.2 (10); relatives – 46.3 (13.4)	Breast cancer survivors (and their first-degree relatives)	Perceived cause and perceived ability of health behaviour to prevent cancer occurrence/recurrence; self-completion	Changes in health practices (diet, physical activity, smoking and alcohol consumption); self-reported using study-specific questionnaires, including the Paffenberger Activity Questionnaire	• Strong beliefs that a healthy diet overall and consumption of more fruit and vegetables could prevent cancer predicted behaviour change. Borderline significance was found for more high-fibre foods • Causal beliefs related to dietary behaviour change: survivors who believed an unhealthy diet contributed to their cancer were more likely to change their diet, and marginal significance emerged

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								for these causal beliefs and consumption of calories from fatty foods over time
Richardson et al. (2013)ŧ	England, secondary care (ophthalmology clinic)	Quasi-experimental study, 1 and 3-months	21	Median=69; Range=44-89	Glaucoma	IPQ-R; self-completion Beliefs About Medicines Questionnaire; self-completed, to assess peoples' beliefs about their medication, including necessity and concerns Patient Enablement Instrument; self-completed, to assess peoples' feelings of empowerment and ability to cope with illnesses and their associated treatments	Adherence with eye-drops; self-reported using the Revised Glaucoma Adherence Questionnaire, and objectively measured using a Medication Event Monitoring Systems container	Illness beliefs were not reported to be significantly associated with adherence
Sampaio, Pereira, and Winck (2014)	Portugal, outpatient sleep disordered breathing clinic	Prospective, 1-2-months and 3-6-months	153	52.2 (10.3)	Obstructive sleep apnoea	BIPQ; interview administered	Adherence to automatic positive airway pressure treatment; objectively measured, using a five-channel recording device	• Adherent patients perceived obstructive sleep apnoea as a less threatening disease over time
Scharloo, Kaptein, Weinman, Willems, and Rooijmans (2000)	Netherlands, secondary care (pulmonology outpatient clinic)	Longitudinal, 12-months	64	63.8 (7.7)	Chronic obstructive pulmonary disease (minimum illness duration of 1-year)	Illness perceptions (identity, cause, timeline, consequences, cure, emotional representations); interview IPQ; self-completion (immediately	Outpatient clinic visits and prescribed medication; measured using patients' medical records	Less belief in emotional attributions to others and stress as causes of illness, was associated with more visits

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						post-interview)		
Schuez, Wolff, Warner, Ziegelmann, and Wurm (2014)	Germany, population-based	Longitudinal, 6-months	215	73.3 (5.10)	Elderly adults with multi-morbidity (at least 2 physical illnesses)	Brief IPQ (adapted for multi-morbidity); self-completion	Medication adherence; self-reported, using one-item from the Medication Adherence Report Scale.	• Three factors emerged: consequences (comprising: identity, consequences, coherence, and emotional response); control (including personal and treatment control); and timeline, for two illnesses (first and second most severe to patients). • These factors were all significant predictors of medication adherence
Searle and Murphy (2000)	England, community (homeopathy clinics)	Prospective, 4-6 weeks	30	39 (11.7)	Chronic conditions, including skin complaints, rheumatoid arthritis, respiratory problems, menopause and myalgic encephalomyelitis	IPQ; self-completion Study-specific questionnaire; self-completed, to measure peoples' own understanding of their condition	Adherence to practitioners' advice and prescription of remedies; self-reported using a study-specific questionnaire	• Non-adherence: significantly predicted by causal, particularly weak attributions to one's own behaviour and others and strong beliefs in

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								chance, and greater consequence beliefs • Adherence to prescribed remedies: significantly predicted by weak causal attributions to pollution and strong beliefs in poor past care, and greater symptom severity • Adherence to dietary recommendations: significantly predicted by strong causal attributions to poor past care and chance
Searle, Norman, Thompson, and Vedhara (2007a)	England, general practice	Prospective, 12-months	164	Patients – 67 (NR); partners – 67 (NR)	Patients with type 2 diabetes mellitus and partners	IPQ-R; self-completion. IPQ-R identity sub-scale replaced by sub-scales of the Personal Models of Diabetes Interview; self-completion.	Self-management behaviours : diet (self-reported using the Food Frequency Questionnaire); physical activity (self-reported using the Baecke Habitual Physical Activity Questionnaire); medication adherence (self-reported using the	• Patients' timeline perceptions significantly predicted engagement with physical activity and fruit, vegetable and fibre intake (mediated by partners' timeline

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							Medication Adherence Report Scale)	perceptions) • Patients' and partners' perceived personal control of diabetes significantly predicted engagement with physical activity (mediated by partners' personal control perceptions) • Partners' treatment control perceptions significantly predicted patients' engagement with physical activity
Searle, Norman, Thompson, and Vedhara (2007b) ¥	England, general practice	Prospective, 12-months	134	67 (NR)	Type 2 diabetes mellitus	IPQ-R; self-completion IPQ-R identity sub-scale replaced by sub-scales of the Personal Models of Diabetes Interview; self-completion.	Self-management behaviours: diet (self-reported using the Health Education Authority (HEA3) food intake questionnaire); physical activity (self-reported using the Baecke Habitual Physical Activity Questionnaire); medication adherence	• Medication adherence significantly predicted by treatment control beliefs • Illness representations did not predict physical activity, fat and carbohydrate intake • Perceived consequ

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							(self-reported using the Medication Adherence Report Scale)	ences of diabetes significantly and independently predicted fibre intake • Perceived timeline (with adjustment for gender) significantly predicted fruit and vegetable intake • Perceived timeline significantly predicted sugar consumption
Siemonsma et al. (2013)	Netherlands, outpatient rehabilitation clinic	Randomised trial, 18-weeks	156	Intervention - 45.6 (12,9); control 47.1 (11.1)	Chronic low back pain	IPQ-R; self-completion	Physical activity level; measured using the Quebec Back Pain Disability Scale	Illness beliefs were not significantly associated with physical activity level
Sniehotta, Gorski, and Araujo-Soares (2010)	Scotland, hospital	Prospective, 2-months	110	63 (10.3)	Myocardial infarction and underwent percutaneous coronary interventions, had bypass surgeries or other surgeries	IPQ-PS; self-completion	Physical exercise (self-reported using the Leisure Score Index) and attendance at phase IV cardiac rehabilitation programme (self-reported and checked against medical records)	• Illness beliefs were not significantly predictive of physical activity (though post-hoc analyses showed that adding timeline-cyclical into the model whilst controlling for past behaviour and perceived behavioural control* added significa

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								ntly to the predicti on of the model) • Illness beliefs were not significa ntly associat ed with phase IV cardiac rehabilit ation
Stafford , Jackson, and Berk (2008)	Australia, hospital	Prospecti ve, 3, 6 and 9-months (post hospital discharg e)	193	64.1 (10.4)	Patients hospitalised for percutaneous transluminal coronary angioplasty or coronary artery bypass graft surgery	IPQ-R; self-completion	Adherence to secondary prevention behaviours (such as physical activity, taking medications, weight management , alcohol use and smoking); self-reported using the Specific Adherence Scale	Perceptions of more serious consequence s of coronary artery disease significantly predicted improved adherence (adjusting for depression, social support, age, educational status, disease severity and social desirability)
Steed, Barnard , Hurel, Jenkins, and Newma n (2014)	England, hospitals	Randomi sed trial, 1-week, and 3- and 9-months post-intervent ion	124	Intervention - 59.2 (8.8); control - 60.3 (8.6)	Type 2 diabetes mellitus	Beliefs about Diabetes Scale, a five-point scale measuring personal models of diabetes (e.g., beliefs about seriousness, treatment effectiveness, personal control over diabetes); self-completion Multidimensio nal Diabetes Questionnaire; self-completed, to assess self-efficacy	Self-management behaviours; assessed using the Revised Summary of Self-Care Diabetes Activities Measure - examines the number of days (0-7) in the last week that diet, exercise, and blood-glucose monitoring recommenda tions were followed	• Changes in treatme nt effectiv eness or sense of control between baseline and 1-week post-interven tion did not mediate changes in self-manage ment behavio ur • Changes in sense of control over

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								diabetes mediated changes in exercise behaviour between baseline and 1-week post-intervention, but this was statistically non-significant • Changes control beliefs between baseline and 3 or 9-months follow-up also did not mediate changes in self-management behaviour
Telles-Correia, Barbosa, Mega, and Monteiro (2012)	Portugal, secondary care (outpatient clinic)	Longitudinal, 12-months	62	57.7 (19.3)	Family amyloid polyneuropathy or chronic liver disease	IPQ-R (consequences, personal control, treatment control, timeline, causal attributions and identity sub-scales only); self-completion	Adherence (medication, appointment attendance and treatment compliance, and alcohol consumption); self-reported using the Multidimensional Adherence Questionnaire	Post-transplant medication adherence: significantly predicted by personal control beliefs adherence (controlling for adherence to medication before transplant)
Weinman, Petrie, Moss-Morris, and Horne (1996)¤	New Zealand, hospital	Longitudinal, 3 and 6-months	Discharged patients=104¥	53.8 (8.2)	First-time myocardial infarction	IPQ; self-completion	Recent doctor visits (in the last 3-months); NR	• Strong illness identity and beliefs about serious consequences were significantly related to doctor visits • Doctor

								visits significantly related to: greater symptom severity, chronicity, serious consequence beliefs and strong control perceptions
Yardley et al. (2010)	England, university	Exploratory randomised trial, 48-hours and 4-weeks	714	NR; Range=18-79	Minor respiratory illnesses	IPQ-R (illness coherence and emotional representations sub-scales only); self-completion Study-specific questionnaire; self-completed, to assess peoples' intentions to consult a doctor, confidence to self-care, and consultation necessity beliefs	Health services use; measuring using three-items asking respondents whether they had contacted: their GP, tele-care (for example: NHS Direct) or A&E	Illness beliefs were not significantly associated with health service use
Yohannes, Yalfani, Doherty, and Bundy (2007)	England, secondary care (outpatient clinic)	Prospective, 6-weeks	147	Completers – 61.4 (9.2); non-completers – 58.7 (7.2)	Myocardial infarction and enrolled to a rehabilitation programme.	IPQ-R; self-completion	Drop-out from cardiac rehabilitation; assessed using medical records	Perceptions of more serious consequences, higher perceived personal control and poor perceived treatment control perceptions were significantly predictive of drop-out from rehabilitation (adjustments were made for age, gender, anxiety and depression).

Symbols and abbreviations: BMI: Body mass index; Brief IPQ: Brief Illness Perception Questionnaire; IPQ: Illness perception questionnaire; IPQ-PS: Illness perception questionnaire – psychometrically shortened; IPQ-R: Illness perception questionnaire-revised; OMT: Optimal Medical Therapy; PCI: Percutaneous Coronary Intervention; NR: Not reported; * Due to non-significant correlations between beliefs and behaviour, modelling did not include illness belief components; ¤: Validation paper for the illness perception questionnaire-revised; ¥: Based on same data as a study previously reported by the authors (French et al., 2008; Petrie et al., 1996; Searle et al., 2007a); ¥¥:

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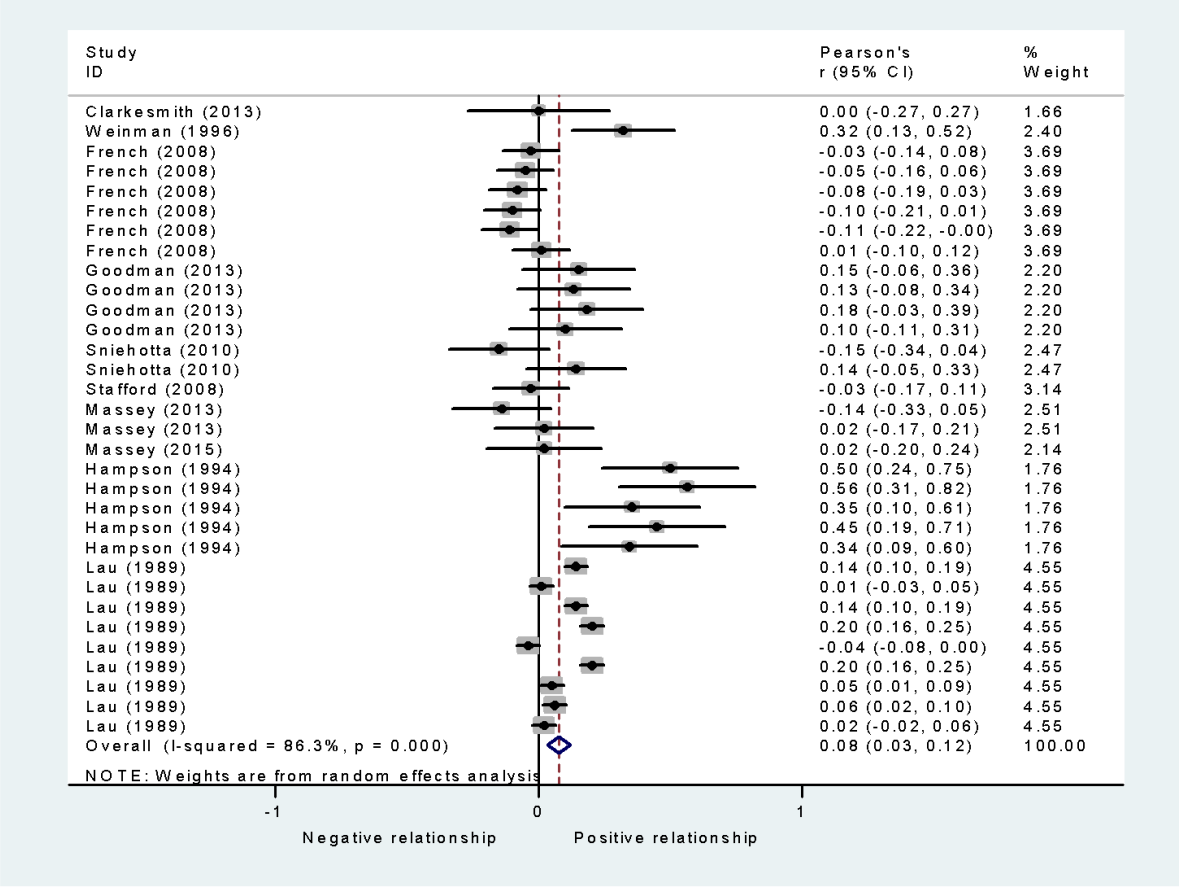
Secondary analysis of a previously reported study (Farmer et al., 2007; Glasgow, Toobert, Hampson, & Noell, 1995; Grace et al., 2007; Iida, Parris Stephens, Rook, Franks, & Salem, 2010; Powell et al., 2011); ǂ: Feasibility study



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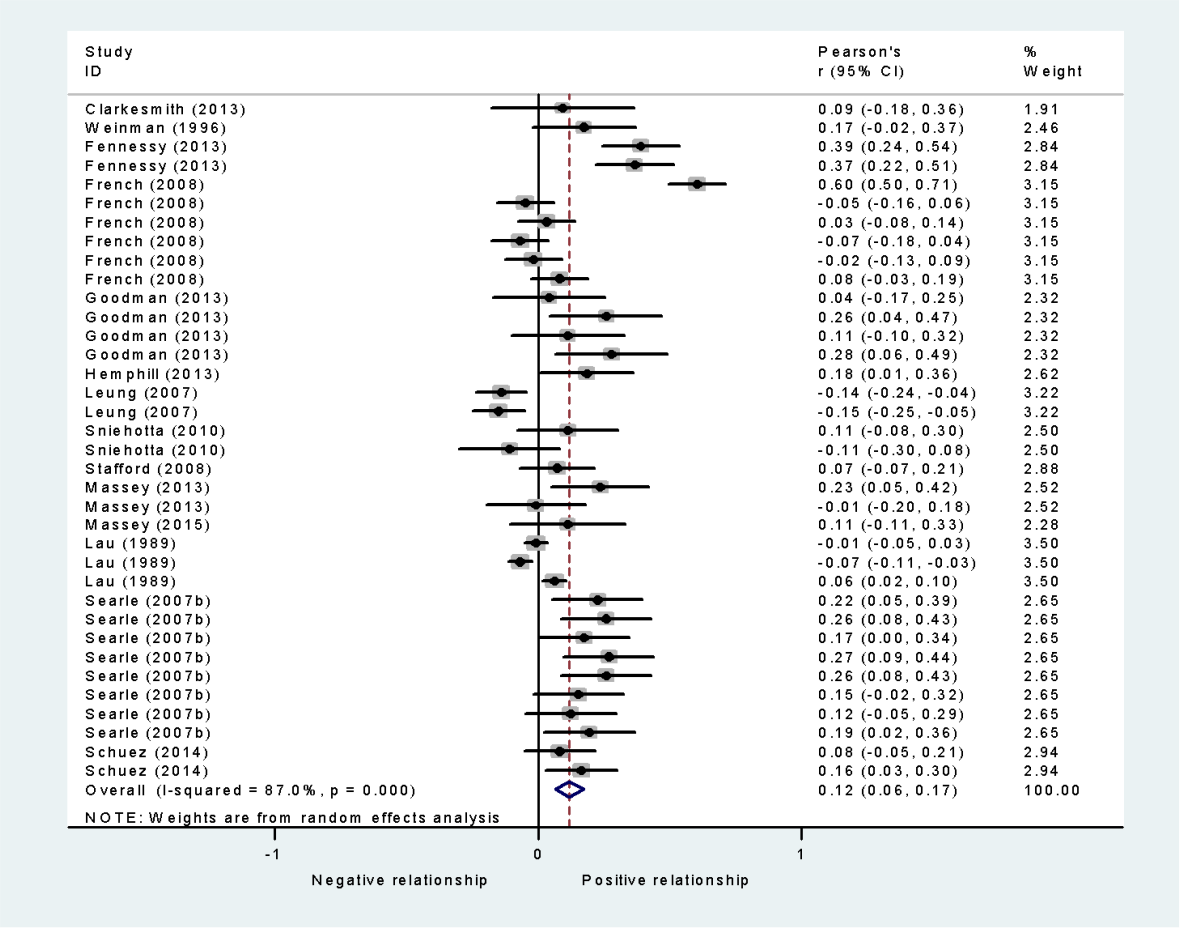

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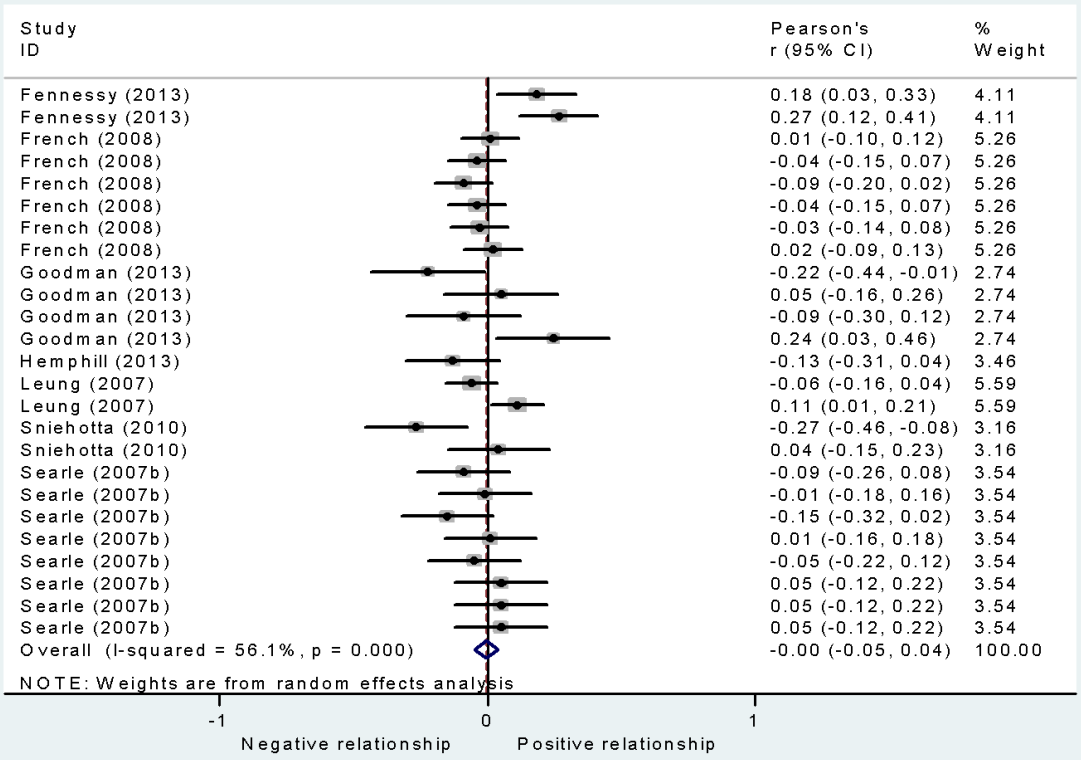

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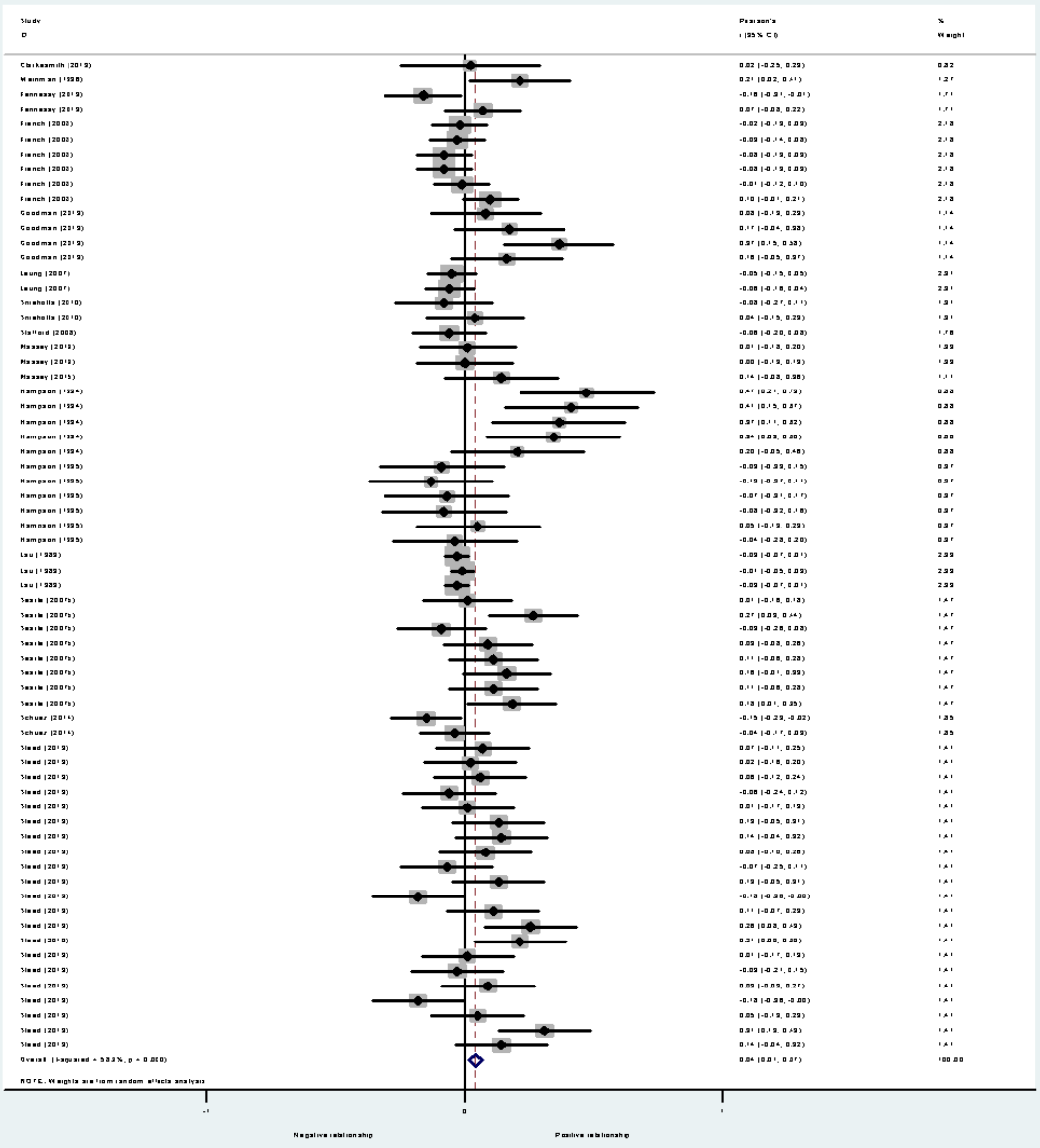

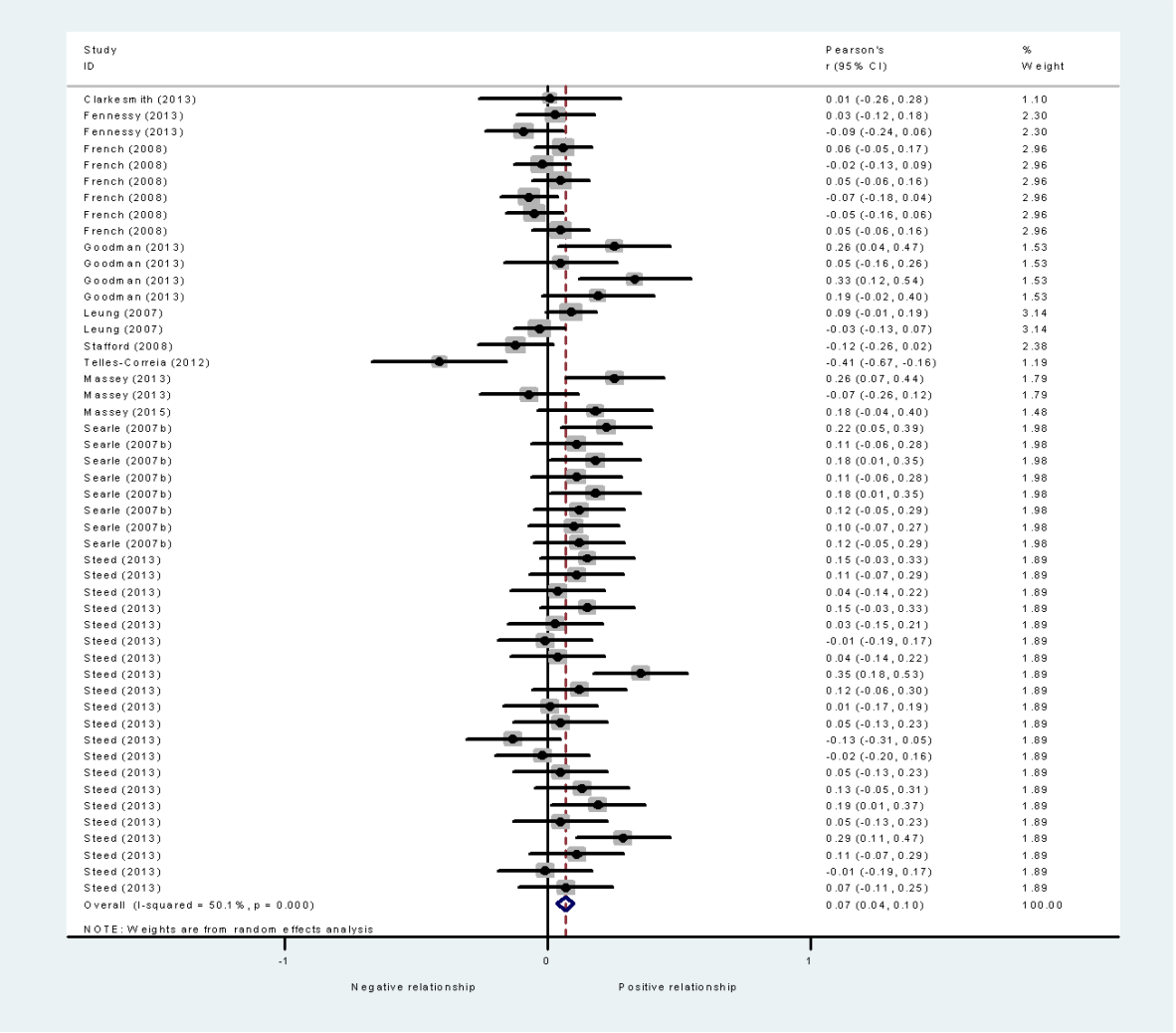

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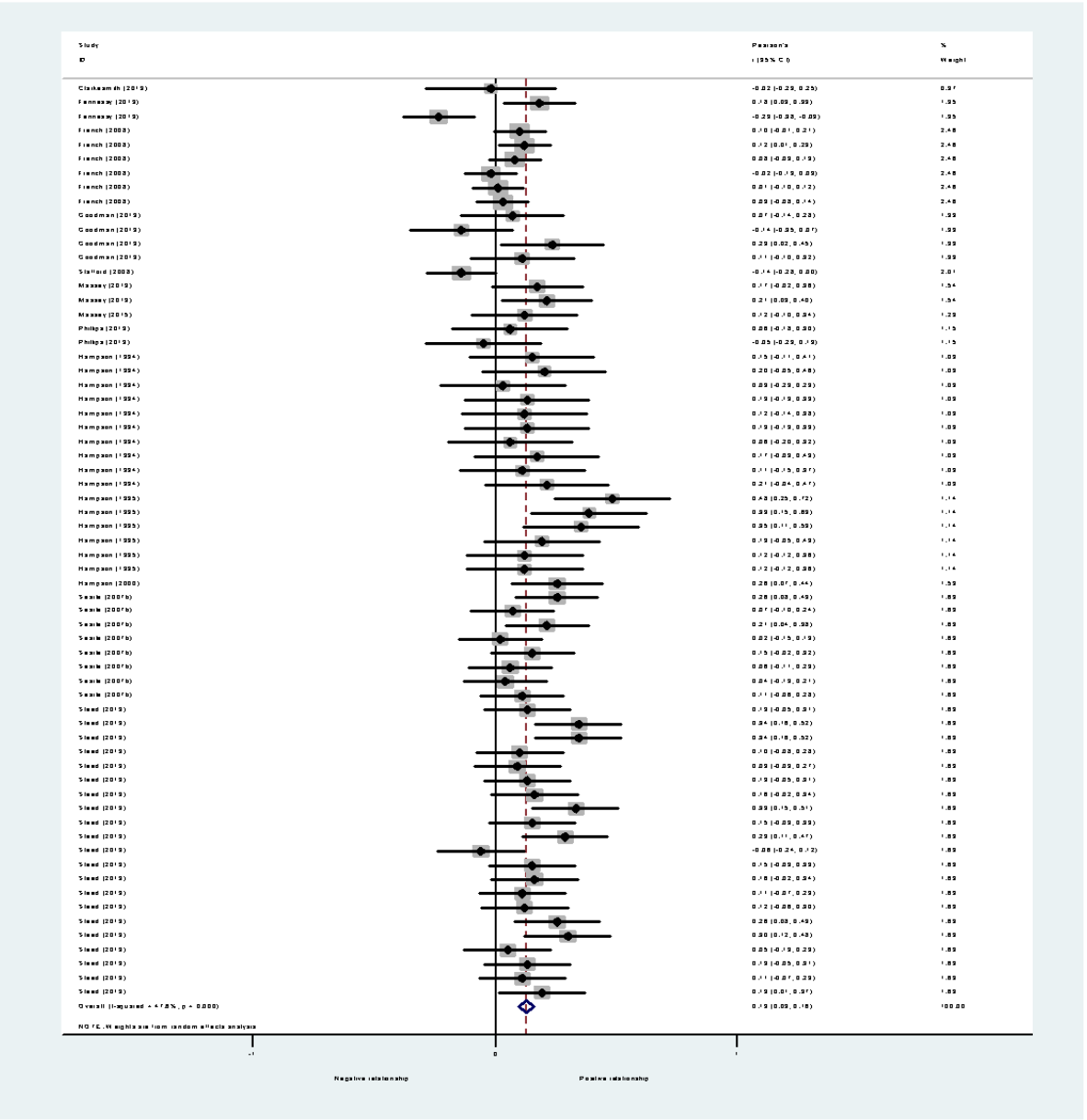

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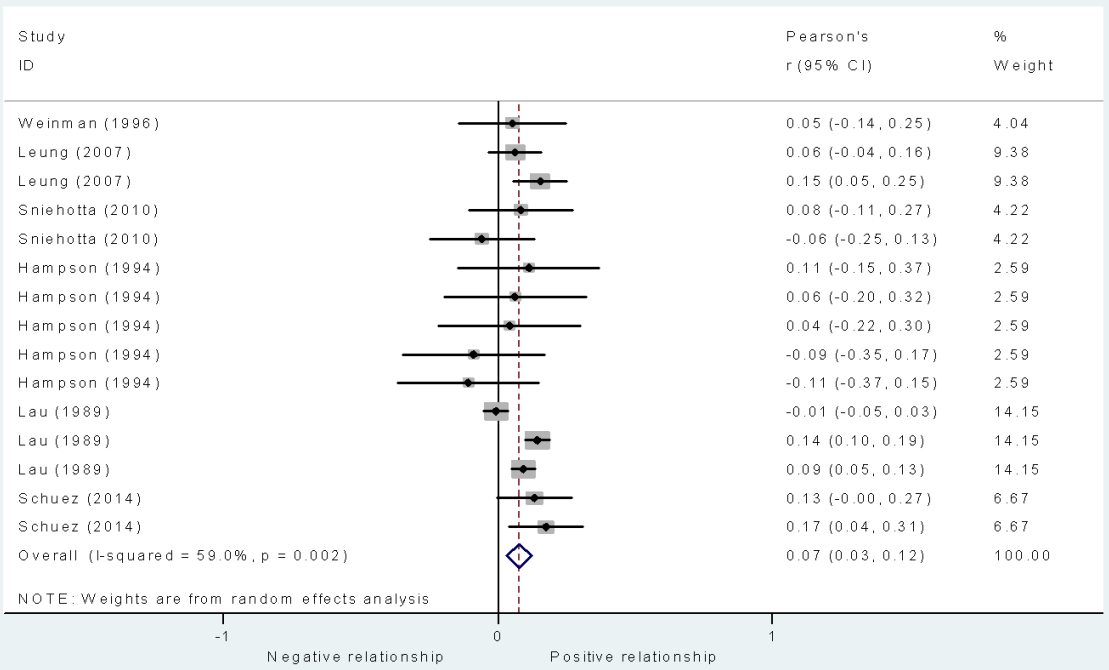

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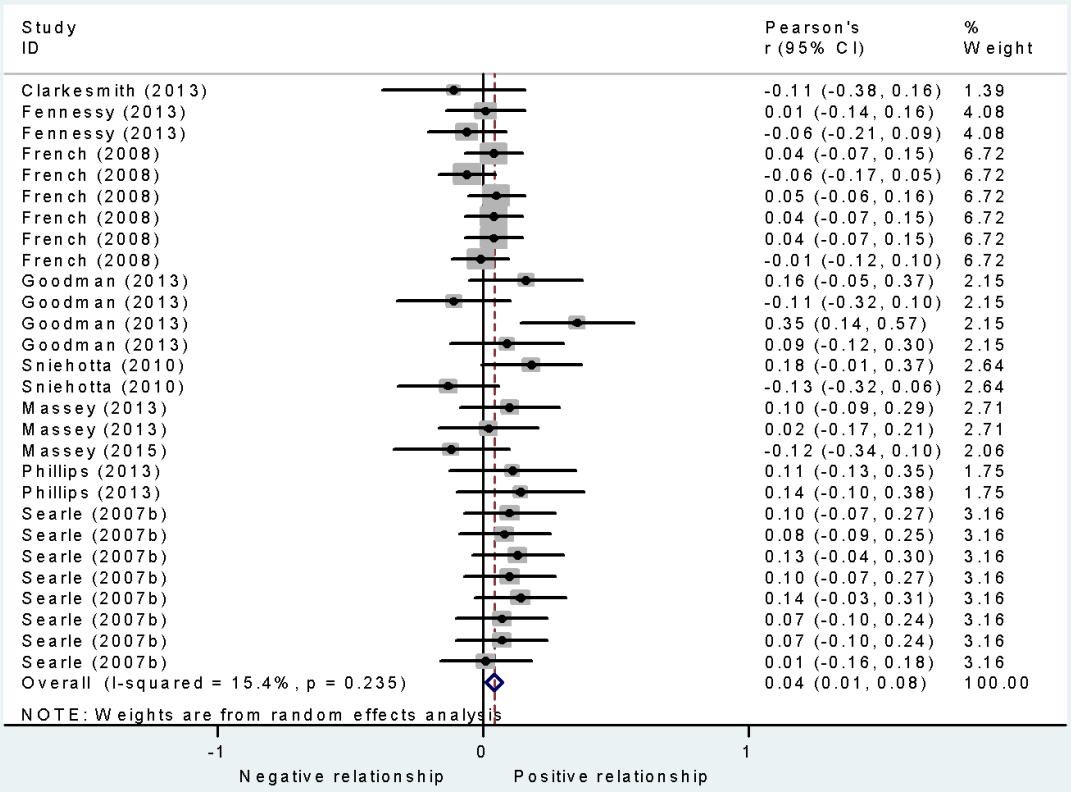

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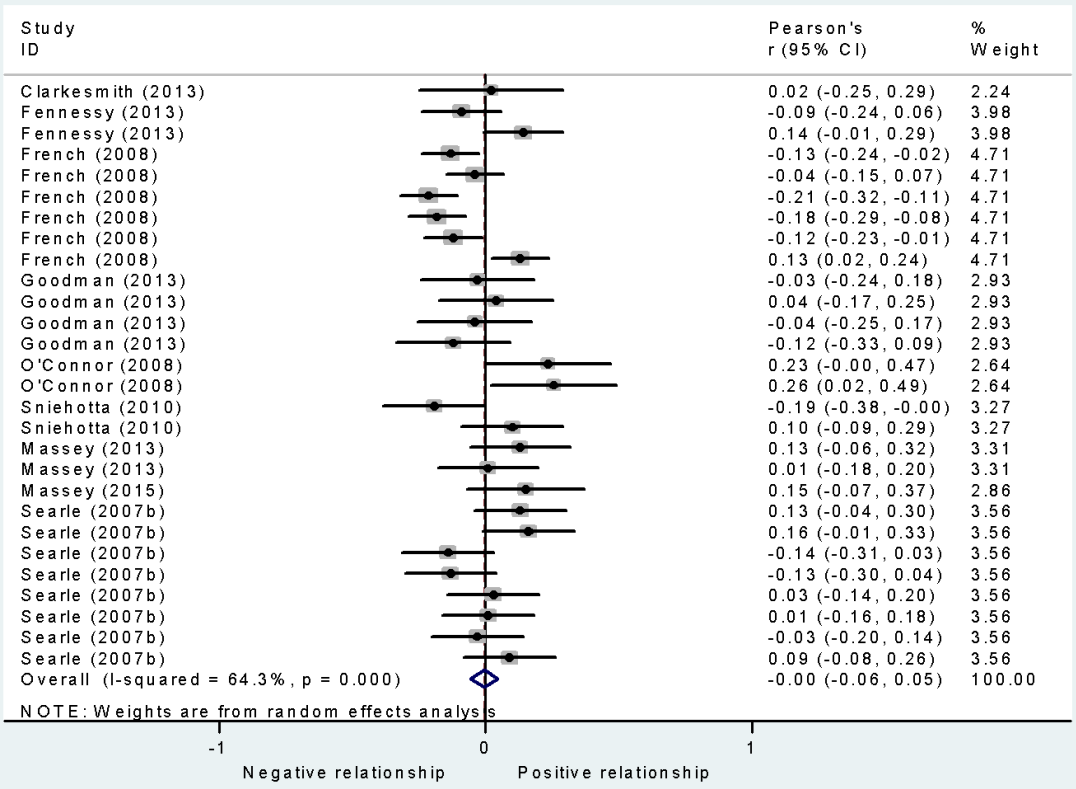

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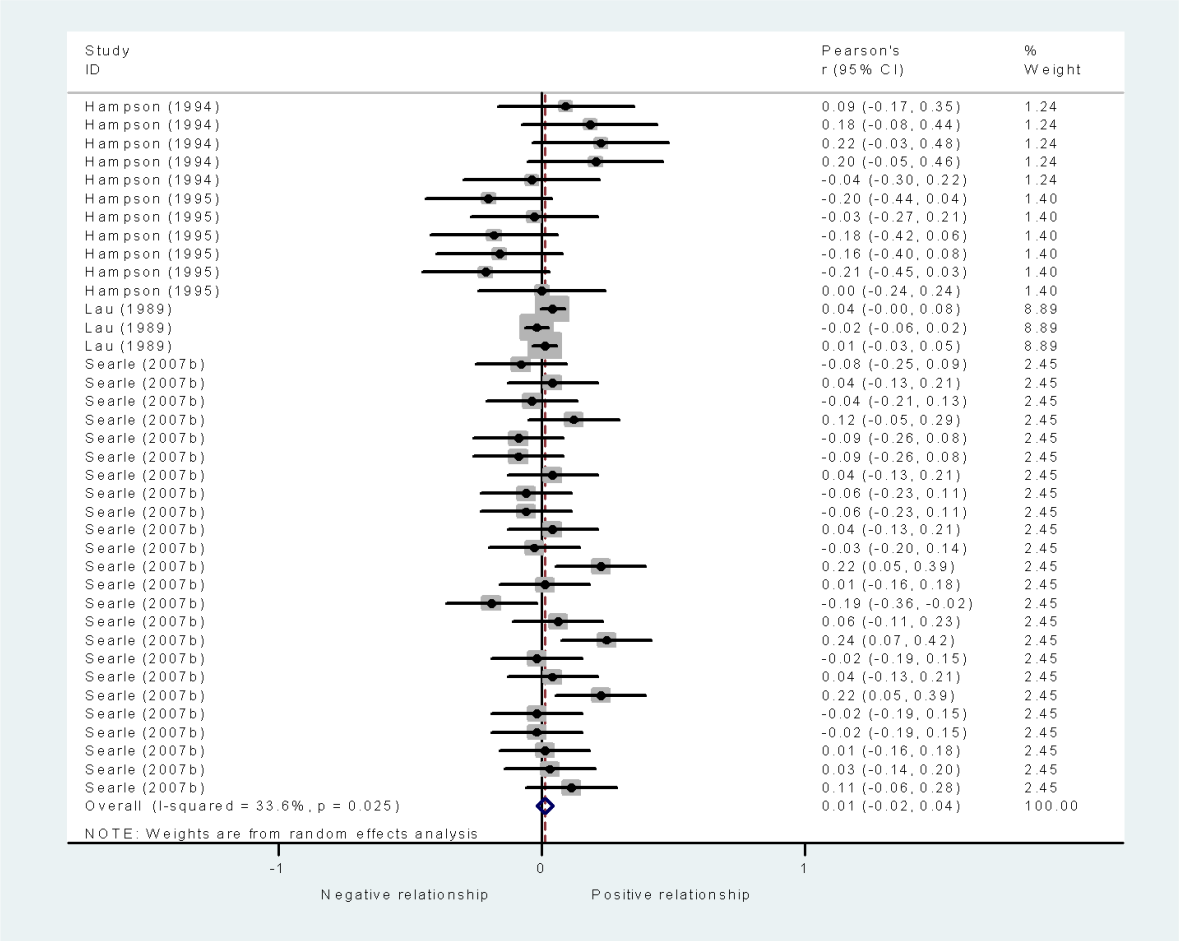

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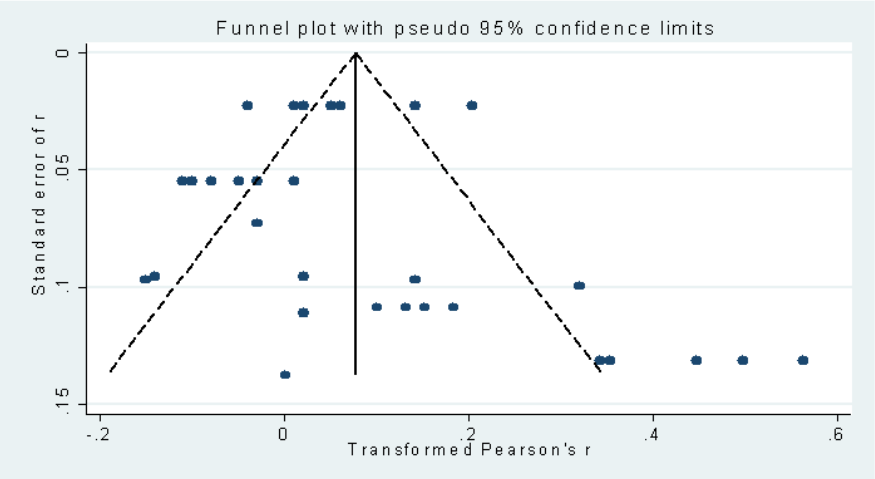

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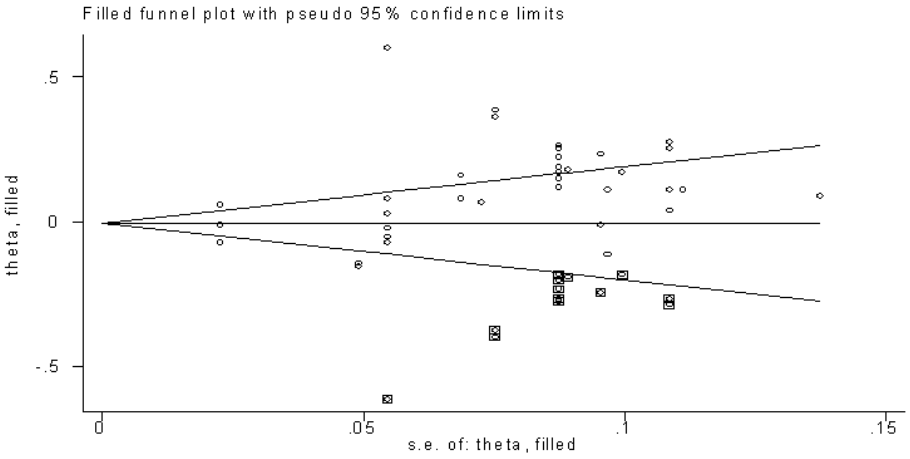

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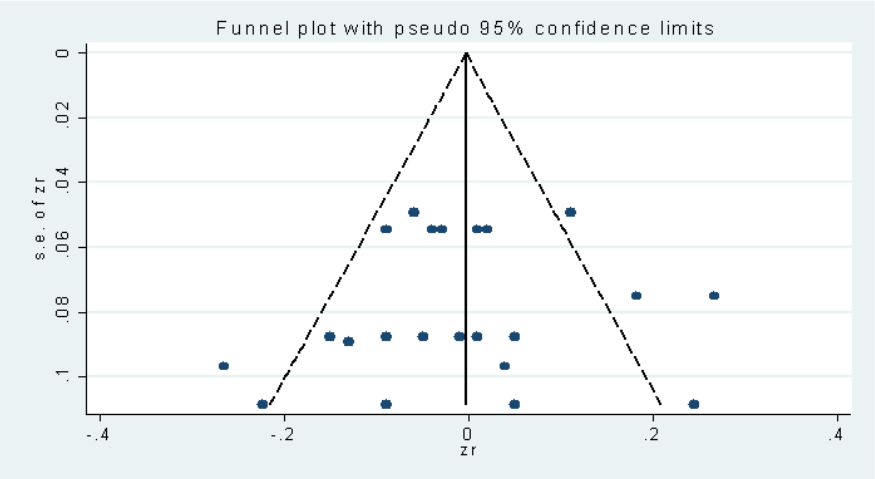

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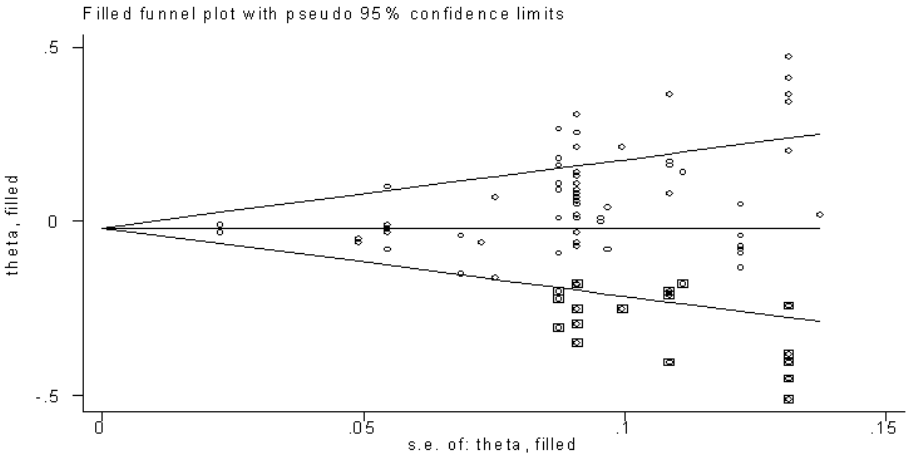

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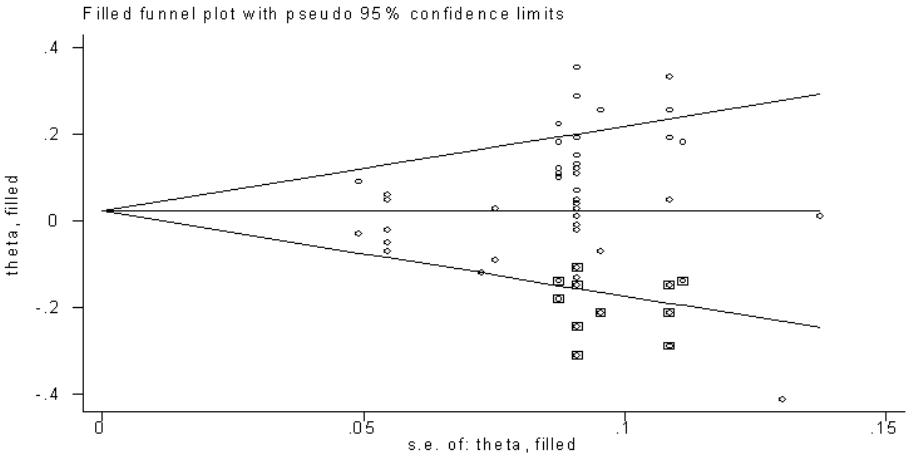

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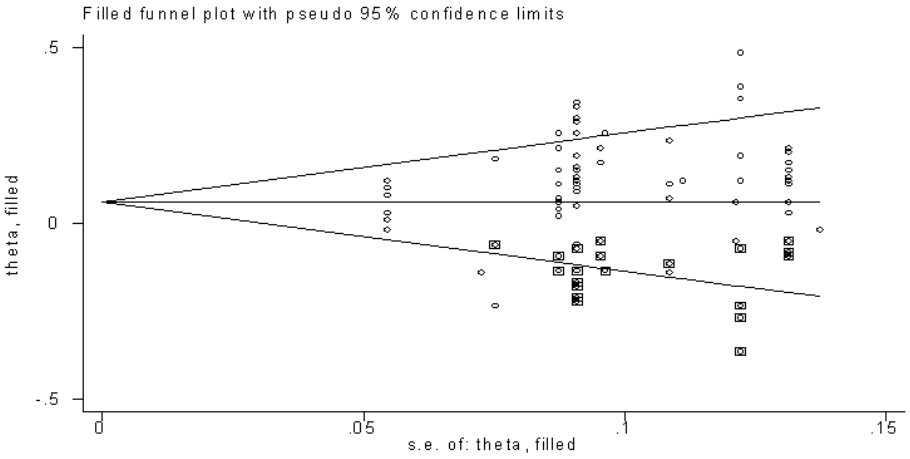

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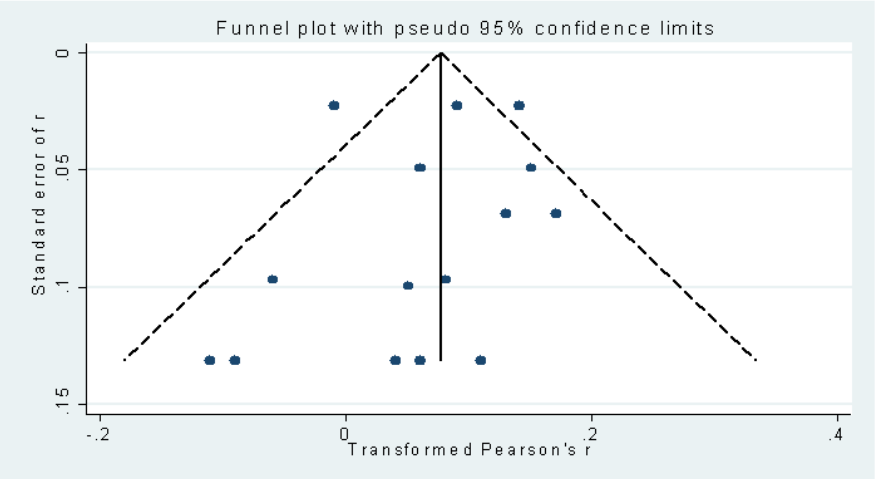

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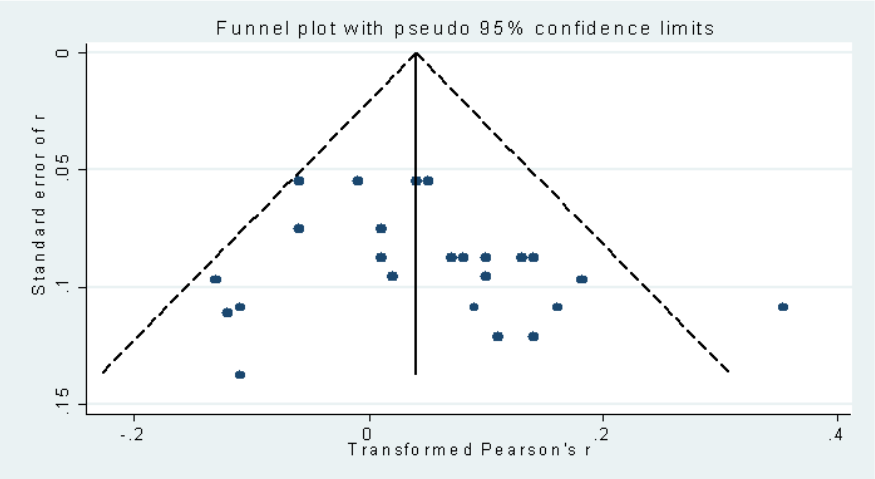

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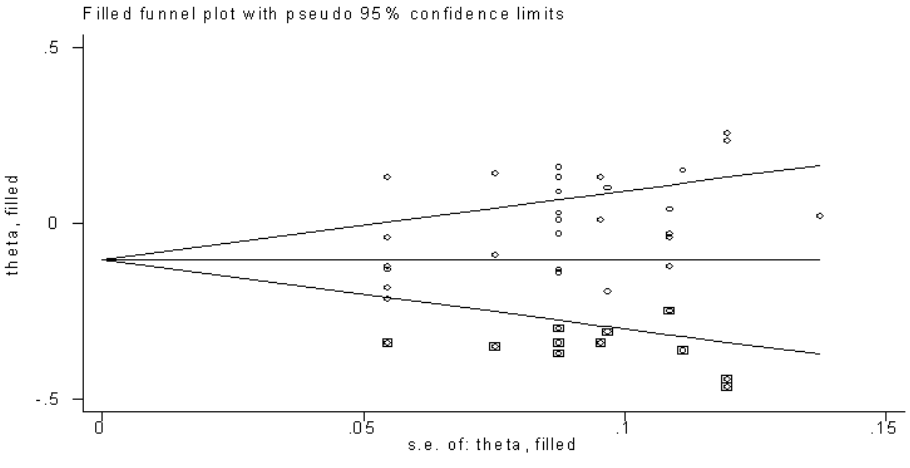

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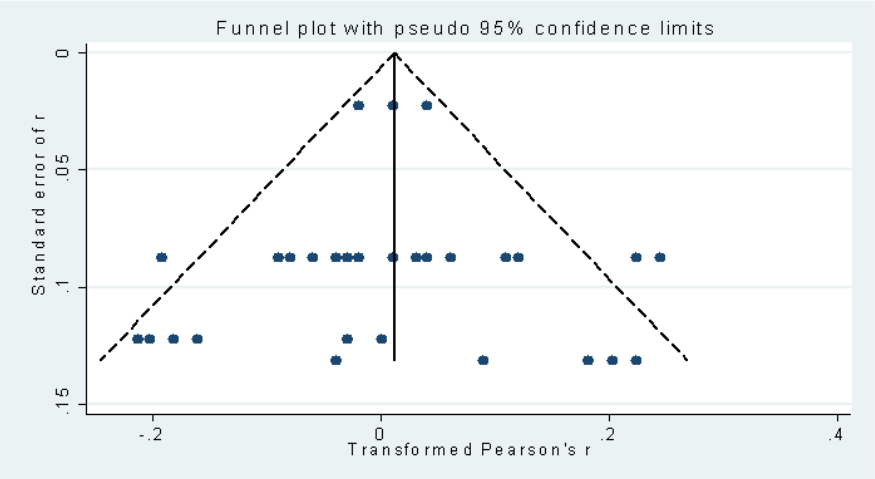

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Appendix 5

Table A5-A: Effect sizes following stratification of the meta-analysis by the type of self-management behaviour

Illness beliefs	Number of studies	k	Correlations		Heterogeneity		
			r+ (95% CI)	p-value	Q (DF)	I^2	Tau^2
Identity	*10*	*32*	*0.08 (0.04-0.12)*	*<.001*	226.71 (31)	*86.3****	*0.01*
Attendance	4	12	0.09 (0.08-0.11)	<.001	130.30 (11)	91.6***	-
Medication	4	5	-0-03 (-0.11-0.04)	0.41	1.88 (4)	0.0	-
Diet	1	4	-	-	-	-	-
Exercise	2	2	-0.07 (-0.17-0.02)	0.12	0.83 (1)	0.0	-
Other	3	9	0.19 (0.13-0.26)	<.001	29.22 (8)	72.6***	-
Timeline (acute/chronic)	*14*	*36*	*0.12 (0.06-0.17)*	*<.001*	*269.19 (35)*	*87.0****	*0.02*
Attendance	3	5	0.00 (-0.07-0.07)	0.99	21.11 (4)	81.1 ***	0.00
Medication	7	10	0.22 (0.09-0.35)	<.01	65.38 (9)	86.2***	0.04
Diet	3	11	0.12 (0.04-0.19)	<.01	28.15 (10)	64.5**	0.01
Exercise	4	5	-0.02 (-0.14-0.10)	0.75	19.72 (4)	79.7**	0.02
Other	2	5	0.14 (0.05-0.23)	<.01	4.56 (4)	12.3	0.00
Cyclical timeline	*7*	*25*	*-0.01 (-0.05-0.04)*	*0.83*	*54.71 (24)*	*56.1****	*0.01*
Attendance	1	1	-	-	-	-	-
Medication	3	4	0.08 (0.01-0.14)	<.05	16.61 (3)	81.9**	-
Diet	3	11	-0.02 (-0.06-0.02)	0.29	6.07 (10)	0.0	-
Exercise	4	5	-0.02 (-0.08-0.03)	0.38	14.95 (4)	73.3**	-
Other	1	4	-	-	-	-	-
Consequences	*16*	*67*	*0.04 (0.01-0.07)*	*<.01*	*160.51 (66)*	*58.9****	*0.01*
Attendance	4	6	-0.01 (-0.05-0.04)	0.80	9.26 (5)	46.0	0.00
Medication	7	10	-0.04 (-0.09-0.02)	0.20	11.13 (9)	19.1	0.00
Diet	4	24	0.03 (-0.02-0.07)	0.29	43.29 (23)	46.9**	0.01
Exercise	4	10	-0.03 (-0.07-0.02)	0.23	4.64 (9)	0.0	0.00
Other	5	17	0.20 (0.12-0.26)	<.001	34.25 (16)	53.3**	0.01
Personal control	*11*	*49*	*0.07 (0.04-0.10)*	*<.01*	*96.26 (48)*	*50.1****	*0.01*
Attendance	0	0	-	-	-	-	-
Medication	7	9	0.04 (-0.02-0.09)	0.20	25.94 (8)	69.2**	-
Diet	3	22	0.08 (0.05-0.11)	<.001	34.63 (21)	39.4*	-
Exercise	4	7	0.03 (-0.02-0.08)	0.23	12.66 (6)	52.6	-
Other	3	11	0.05 (-0.01-0.11)	0.08	19.10 (10)	47.7*	-
Treatment control	*13*	*65*	*0.17 (0.09-0.16)*	*<.001*	*122.25 (64)*	*47.6****	*0.01*
Attendance	1	2	-	-	-	-	-
Medication	7	10	0.08 (-0.02-0.17)	0.11	26.49 (9)	66.0**	0.02
Diet	4	25	0.15 (0.09-0.20)	<.001	64.31 (24)	62.7***	0.01
Exercise	4	7	0.16 (0.10-0.22)	<.001	5.01 (6)	0.0	0.00
Other	4	21	0.10 (0.05-0.14)	<.001	21.21 (20)	5.7	0.00
Cure-control	*6*	*15*	*0.07 (0.03-0.12)*	*<.01*	*34.15 (14)*	*59.0***	*0.00*
Attendance	3	6	0.07 (0.04-0.09)	<.001	27.10 (5)	81.50***	-
Medication	1	2	-	-	-	-	-
Diet	0	0	-	-	-	-	-
Exercise	2	3	0.10 (0.04-0.17)	<.01	1.78 (2)	0.0	-
Other	1	4	-	-	-	-	-
Illness coherence	*9*	*28*	*0.04 (0.01-0.08)*	*<.05*	*31.92 (27)*	*15.4*	*0.00*
Attendance	1	1	-	-	-	-	-
Medication	7	10	0.03 (-0.03-0.08)	0.31	7.58 (9)	0.0	-
Diet	2	10	0.05 (0.01-0.09)	<.05	3.12 (9)	0.0	-
Exercise	3	3	0.02 (-0.06-0.10)	0.60	5.81 (2)	65.6	-
Other	1	4	-	-	-	-	-
Emotional representations	*9*	*28*	*-0.01 (-0.06-0.05)*	*0.85*	*75.55 (27)*	*64.3****	*0.01*
Attendance	1	1	-	-	-	-	-
Medication	7	9	-0.01 (-0.06-0.05)	0.82	20.85 (8)	61.6**	-
Diet	3	11	-0.04 (-0.09-0.00)	<.05	44.51 (10)	77.5***	-
Exercise	3	3	-0.03 (-0.11-0.05)	0.48	6.24 (2)	67.9*	-
Other	1	4	-	-	-	-	-
Causes	*4*	*38*	*0.01 (-0.02-0.04)*	*0.45*	*55.69 (37)*	*33.6**	*0.00*
Attendance	2	4	0.01 (-0.02-0.04)	0.60	3.70 (3)	18.9	-
Medication	1	3	-	-	-	-	-
Diet	2	20	0.03 (-0.01-0.07)	0.16	33.62 (19)	43.5*	-
Exercise	2	5	-0.06 (-0.15-0.02)	0.14	3.10 (4)	0.0	-
Other	2	6	0.07 (-0.03-0.17)	0.17	8.84 (5)	43.5	-

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Symbols and abbreviations: k: Number of unique data-sets; r+: Weighted correlation coefficient; Q: Between-study heterogeneity (chi-squared); DF: Degrees of freedom; I^2: Between-study heterogeneity (percentage); Tau^2: Estimate of between-study variance; *: p<.05; **: p<.01; ***p<.001

Table A5-B: Effect sizes following stratification of the meta-analysis by the type of physical illness and length of follow-up

Illness beliefs	Number of studies	k	Correlations		Heterogeneity		
			r+ (95% CI)	p-value	Q (DF)	I^2	Tau^2
Identity	*10*	*32*	*0.08 (0.04-0.12)*	*<.001*	226.71 (31)	*86.3****	*0.01*
Acute	3	12	0.09 (0.04-0.14)	<.01	132.72 (11)	91.7***	0.01
Chronic	7	20	0.08 (0.01-0.16)	<.05	78.31 (19)	75.7***	0.02
≤ 6-months follow-up	4	9	0.08 (-0.02-0.18)	0.13	19.27 (8)	58.5*	0.02
> 6-months follow-up	6	23	0.08 (0.03-0.12)	<.01	207.44 (22)	89.4***	0.01
Timeline (acute/chronic)	*14*	*36*	*0.12 (0.06-0.17)*	*<.001*	*269.19 (35)*	*87.0****	*0.02*
Acute	3	6	0.01 (-0.06-0.08)	0.79	22.52 (5)	86.2***	0.00
Chronic	11	30	0.14 (0.03-0.21)	<.001	210.81 (29)	77.8***	0.03
≤ 6-months follow-up	4	9	0.12 (0.03-0.20)	<.01	13.43 (8)	40.4	0.01
> 6-months follow-up	10	27	0.12 (0.05-0.18)	<.001	251.71 (26)	89.7***	0.02
Cyclical timeline	*7*	*25*	*-0.01 (-0.05-0.04)*	*0.83*	*54.71 (24)*	*56.1****	*0.01*
Acute	1	2	-	-	-	-	-
Chronic	6	23	-	-	-	-	-
≤ 6-months follow-up	3	8	0.03 (-0.11-0.17)	0.67	33.24 (7)	78.9***	0.03
> 6-months follow-up	4	17	-0.02 (-0.05-0.01)	0.27	17.11 (16)	6.5	0.00
Consequences	*16*	*67*	*0.04 (0.01-0.07)*	*<.01*	*160.51 (66)*	*58.9****	*0.01*
Acute	3	6	-0.02 (-0.05-0.02)	0.32	6.85 (5)	27.1	0.00
Chronic	13	61	0.05 (0.02-0.09)	<.01	144.38 (60)	58.4***	0.01
≤ 6-months follow-up	7	19	0.01 (-0.05-0.07)	0.71	35.46 (18)	49.2***	0.01
> 6-months follow-up	9	48	0.05 (0.02-0.09)	<.01	124.89 (47)	62.4**	0.01
Personal control	*11*	*49*	*0.07 (0.04-0.10)*	*<.01*	*96.26 (48)*	*50.1****	*0.01*
Acute	0	0	-	-	-	-	-
Chronic	11	49	-	-	-	-	-
≤ 6-months follow-up	3	8	0.11 (0.00-0.22)	0.06	20.53 (7)	65.9**	0.02
> 6-months follow-up	8	41	0.06 (0.03-0.10)	<.001	74.80 (40)	46.5**	0.01
Treatment control	*13*	*65*	*0.13 (0.09-0.16)*	*<.001*	*122.25 (64)*	*47.6****	*0.01*
Acute	0	0	-	-	-	-	-
Chronic	13	65	-	-	-	-	-
≤ 6-months follow-up	5	16	0.14 (0.04-0.23)	<.01	51.20 (15)	70.7***	0.03
> 6-months follow-up	8	49	0.12 (0.09-0.15)	<.001	71.05 (48)	32.4*	0.00
Cure-control	*6*	*15*	*0.07 (0.03-0.12)*	*<.01*	*34.15 (14)*	*59.0***	*0.00*
Acute	3	6	0.06 (-0.01-0.13)	0.09	25.21 (5)	80.2***	0.01
Chronic	3	9	0.10 (0.05-0.15)	<.001	8.00 (8)	0.1	0.00
≤ 6-months follow-up	3	5	0.10 (0.02-0.17)	<.05	4.32 (4)	7.3	0.00
> 6-months follow-up	3	10	0.07 (0.01-0.12)	<.05	25.91 (9)	69.5**	0.00
Illness coherence	*9*	*28*	*0.04 (0.01-0.08)*	*<.05*	*31.92 (27)*	*15.4*	*0.00*
Acute	1	2	-	-	-	-	-
Chronic	8	26	-	-	-	-	-
≤ 6-months follow-up	5	12	0.06 (-0.01-0.14)	0.10	20.19 (11)	45.4*	0.01
> 6-months follow-up	4	16	0.03 (0.00-0.07)	0.05	11.36 (15)	0.0	0.00
Emotional representations	*9*	*28*	*-0.01 (-0.06-0.05)*	*0.85*	*75.55 (27)*	*64.3****	*0.01*
Acute	1	2	-	-	-	-	-
Chronic	8	26	-	-	-	-	-
≤ 6-months follow-up	5	12	0.03 (-0.05-0.11)	0.42	20.85 (11)	47.2*	0.01
> 6-months follow-up	4	16	-0.03 (-0.09-0.04)	0.41	49.22 (15)	69.5***	0.01
Causes	*4*	*38*	*0.01 (-0.02-0.04)*	*0.45*	*55.69 (37)*	*33.60**	*0.00*
Acute	1	3	-	-	-	-	-
Chronic	3	35	-	-	-	-	-
≤ 6-months follow-up	1	6	-	-	-	-	-
> 6-months follow-up	3	32	-	-	-	-	-

Symbols and abbreviations: k: Number of unique data-sets; r+: Weighted correlation coefficient; Q: Between-study heterogeneity (chi-squared); DF: Degrees of freedom; I^2: Between-study heterogeneity (percentage); Tau^2: Estimate of between-study variance; p<.05; **: p<.01; ***p<.001

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Table A5-C. Findings from the meta-regression for several possible confounding variables

	Publication year			Type of self-management behaviour (attendance, medication adherence, diet, exercise or other)			Type of physical illness (acute or chronic)			Length of follow-up (≤6-months or >6-months)		
Illness beliefs	**β**	**95% CI**	**p-value**	**β**	**95% CI**	**p-value**	**β**	**95% CI**	**p-value**	**β**	**95% CI**	**p-value**
Identity	-0.03	-0.06-0.00	0.08	0.02	-0.02-0.06	0.35	0.01	-0.13-0.12	0.89	0.01	-0.14-0.15	0.93
Timeline (acute/chronic)	0.02	0.00-0.05	0.09	0.01	-0.05-0.04	0.81	0.12	-0.03-0.27	0.11	0.00	-0.14-0.14	0.98
Cyclical timeline	0.01	-0.03-0.05	0.55	-0.03	-0.08-0.21	0.24	0.12	-0.08-0.32	0.24	-0.06	-0.18-0.05	0.25
Consequences	0.00	-0.01-0.01	0.67	0.04	0.02-0.07	<.01	0.05	-0.06-0.15	0.36	0.05	-0.03-0.12	0.25
Personal control	0.01	-0.02-0.03	0.59	0.00	-0.04-0.03	0.90	-	-	-	-0.04	-0.14-0.06	0.43
Treatment control	-0.01	-0.03-0.01	0.25	0.00	-0.03-0.03	0.88	-	-	-	0.00	-0.08-0.08	0.92
Cure-control	0.00	-.00-0.01	0.41	0.00	-0.03-0.04	0.77	0.03	-0.07-0.13	0.56	-0.02	-0.13-0.09	0.71
Illness coherence	-0.01	-0.04-0.02	0.44	0.03	-0.01-0.06	0.12	0.02	-0.01-0.18	0.84	-0.02	-0.10-0.06	0.59
Emotional representations	0.01	-0.03-0.05	0.68	-0.03	-0.08-0.03	0.34	0.04	-0.17-0.26	0.68	-0.06	-0.17-0.05	0.26
Causes	0.00	-0.03-0.03	0.94	0.01	-0.02-0.03	0.75	0.00	-0.08-0.08	0.97	0.15	0.04-0.27	<.05

Symbols and abbreviations: -; Problems with collinearity, meta-regression results were not computable.

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