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Applying Leventhal's self-regulatory model to pregnancy: Evidence that pregnancy-related beliefs and emotional responses are associated with maternal health outcomes.

Donna C Jessop and Lisa Craig
University of Sussex, UK

Susan Ayers
City University London, UK

Corresponding author:

Donna C Jessop, School of Psychology, University
of Sussex, Falmer, Brighton, BN1 9QH, UK.
Email: d.jessop@sussex.ac.uk

Abstract

The study explored whether women's beliefs about, and emotional responses to, pregnancy could account for variations in maternal mental and physical health outcomes, using the self-regulatory model (Leventhal et al., 1992) as a theoretical framework. Women in the last trimester of pregnancy ($N = 408$) completed an online survey including measures of representations of pregnancy, coping, and physical and mental health. Results revealed that representations of pregnancy accounted for up to 30% and 39% of the variance in indicators of physical and mental health respectively. Findings suggest that beliefs about pregnancy may have important implications for maternal health.

Keywords

Pregnancy, self-regulatory model, representations of pregnancy, illness representations, maternal wellbeing

Introduction

The aim of this study was to determine whether the self-regulatory model (SRM; Leventhal et al., 1992) could be usefully applied to pregnancy and thus to explore whether women's beliefs about, and emotional responses to, their pregnancy would influence health-related outcomes as predicted by the SRM.

According to the SRM, when individuals are faced with a health threat or illness they form both cognitive and emotional representations of their condition. Cognitive representations refer to their beliefs about the condition and emotional representations comprise their emotional responses to it. These sets of representations act in parallel to influence individuals' coping strategies and the effectiveness of these coping strategies in attaining the desired outcome is then evaluated. Thus, the SRM is a mediational model, insofar as it contends that cognitive and emotional representations of a health threat shape coping responses, which in turn have important implications for physical, psychological and behavioural outcomes. Furthermore, the resultant information processing system is seen to be self regulating, as the results of this evaluation have the potential to feed back and modify the representations and coping procedures until the system is coherent.

Researchers have identified five components of cognitive representations of illness: identity, consequences, cause, timeline and controllability/curability (Leventhal et al., 1992; Scharloo and Kaptein, 1997). *Illness identity* encompasses the symptoms and the label that an individual attaches to a particular illness; *consequences* reflects the individual's beliefs about illness severity and the likely impact upon physical, social and psychological functioning (Weinman et al., 1996); *cause* comprises the individual's beliefs about what precipitated the illness; *timeline* refers to the individual's thoughts about the likely duration of the illness and *controllability/curability* captures the individual's beliefs about the extent to which the illness and/or associated symptoms are amenable to cure or control. Less attention has been paid to emotional representations of illness in the literature; where these have been assessed they have typically been operationalized in terms of the emotional distress caused by the illness (Moss-Morris et al., 2002).

Research findings support the predictive utility of the SRM, in that illness representations have been shown to be significantly associated with such varied health outcomes as quality of life, psychological health, physical health, treatment adherence and health-related behaviours across a broad range of chronic illnesses including asthma, chronic fatigue syndrome, end stage renal disease, irritable bowel syndrome, multiple sclerosis, myocardial infarction and rheumatoid arthritis (Carlisle et al., 2005; Jessop and Rutter, 2003; Moss-Morris et al., 1996; O'Connor et al., 2008; Petrie et al., 1996; Rutter and Rutter, 2002; Schiaffino et al., 1998; Timmers et al., 2008; Vaughan et al., 2003). Furthermore, a meta-analysis of SRM research revealed moderate to strong associations between illness representations and (i) coping strategies and (ii) health outcomes (Hagger and Orbell, 2003). Support for the mediating role of coping has been less forthcoming however (Timmers et al., 2008).

To date, the SRM has not been applied to pregnancy. Research has explored the influence of women's beliefs and emotions about specific pregnancy-related issues - including body dissatisfaction, psychological needs satisfaction and fear of childbirth - on outcomes and

investigated the implications for intervention (e.g., Fuller-Tyszkiewicz et al., 2012; Gauthier et al., 2010; Salmela-Aro et al., 2012). However, as far as we are aware, research has not been conducted within a theoretical framework to systematically explore the influence of beliefs and emotional responses to pregnancy *per se* on health-related outcomes.

We thus propose that the SRM might present a useful framework within which to explore the interrelationships between cognitive and emotional responses to pregnancy and health-related outcomes. While pregnancy cannot strictly be considered an illness or health threat, it shares similarities with many of the health conditions to which the SRM has been successfully applied, in that it poses physiological and psychological challenges that the expectant mother has to cope with. As such, it seems highly plausible that women might form cognitive and emotional representations of their pregnancies, which in turn influence physical and psychological outcomes as predicted by the SRM.

In light of the above, the aim of the current study was to explore whether the SRM could be usefully applied to pregnancy. This research represents the first application of the SRM to a health-related condition that falls outside of the domains of illness and ill health. As such, research findings will inform the SRM literature, by exploring whether the SRM might be usefully applied to health-related life-events not categorized as illnesses. Furthermore, findings have the potential to make an important contribution to the pregnancy-related literature, as there is a paucity of research that has systematically explored the associations between pregnancy-related beliefs and maternal health outcomes.

In line with the SRM, we hypothesized that representations of pregnancy would be associated with maternal mental and physical health outcomes. We also took the opportunity to explore whether any influence of representations of pregnancy on health-related outcomes would be mediated by coping. We chose to focus on the last trimester of pregnancy as this is a time at which women experience many physical symptoms and pregnancy presents great physiological challenges.

Method

Participants

Four hundred and eight women who met the inclusion criterion that they were in the third trimester of their pregnancy completed the study. Ages ranged from 16 to 42 ($M = 29.18$, $SD = 5.01$). The majority of participants were White European (93.38%), currently resident in the UK (93.46%) and owned their accommodation (69.36%). Most participants were either married to (63.48%) or cohabiting with (32.11%) a partner. Approximately half the sample (52.70%) were educated to undergraduate degree level or above.

Design and procedure

Participants were invited to take part in a study exploring their thoughts and feelings about the last trimester of their pregnancy. Recruitment was via on-line bulletin boards of several pregnancy-related websites; permission to post these advertisements was granted from the community managers of the websites. In order to aid recruitment, participants were entered into a prize draw.

Participants were informed at the start of the study that their responses would be confidential and that all identifying information would be removed from the questionnaires on

completion of the prize draw. Participants were additionally informed of their right to withdraw from the research at any time. On completion of the questionnaire, respondents were automatically redirected to an on-line written debrief. Ethical approval for the study was granted by the University School of Psychology Ethics Committee.

Materials

All participants completed a questionnaire including the following measures:

Demographic information. Participants were asked to indicate their age, ethnicity, marital status, accommodation status, UK residency and level of educational qualification.

Pregnancy related information. Participants were asked to indicate their expected delivery date, time to conception, whether or not they had used fertility treatment, number of other children, number of miscarriages, number of terminations, number of stillbirths and whether they had experienced any complications as part of the current pregnancy.

Cognitive and emotional representations of pregnancy. Representations of pregnancy were assessed using the revised Illness Perception Questionnaire (IPQ-R; Moss-Morris et al., 2002). For the current study, the following four subscales were used: *coherence*, *personal control*, *consequences* and *emotional representations*. Items were modified where appropriate so that they were applicable to pregnancy (and omitted where this was not possible). Responses to all items were given on a 7-point scale ranging from *disagree strongly* (1) to *agree strongly* (7). Participants were instructed to respond to items in relation to the third trimester of their pregnancy.

We elected not to assess either beliefs about what had caused one to become pregnant (i.e., the *cause* component of illness representations) or beliefs about how long one's pregnancy would last (i.e., the *timeline* component), as we considered these to be relatively fixed in pregnancy and, thus, unlikely to display variability between participants.

Symptom identity. Participants were asked to indicate whether or not they had experienced each of a list of 36 symptoms in the last trimester of their pregnancy (*yes/no*). The symptom list included both pregnancy-specific symptoms (e.g., pelvic pain) and indicators of more general malaise (e.g., headaches). A score was calculated for each participant by summing the number of symptoms they indicated that they had experienced.

Coherence. Three items assessed participants' pregnancy coherence (e.g., "I have a clear understanding of my pregnancy"), $\alpha = .75$. A mean score was calculated for each participant, with higher scores indicating greater levels of coherence.

Personal control. Six items assessed participants' perceptions of personal control (e.g., "the course of my pregnancy depends on me"), $\alpha = .83$. A mean score was calculated for each participant, with higher scores indicating greater levels of personal control.

Consequences. Six items assessed participants' perceived consequences of their pregnancy (e.g., "my pregnancy has major consequences on my life"), $\alpha = .65$. A mean score was calculated for each participant, with higher scores indicating greater perceived consequences.

Emotional representations. Five items assessed participants' emotional representations of their pregnancy (e.g., "I get depressed when I think about my pregnancy"), $\alpha = .78$. A mean score was calculated for each participant, with higher scores indicating more negative emotional responses

to pregnancy.

Coping. Participants completed the Brief COPE (Carver, 1997), which comprises 28 items designed to assess 14 dimensions of situational coping (e.g., “I take action to try to make the situation better” is an example item believed to tap active coping). Participants were instructed to respond to the items in relation to how they had dealt with any difficult or stressful events relating to their pregnancies in the last trimester. Responses to all items were given on seven-point scales ranging from *never* (1) to *all the time* (7).

In line with much previous research that has utilized the Brief COPE (see Kapsou et al., 2010, for a review), we used principal components analysis to identify broad dimensions of coping. This analysis identified eight components with Eigenvalues ≥ 1 . However, for reasons of parsimony, we elected to include only those factors with Eigen values ≥ 2 in the following analyses. This criterion resulted in the extraction of four factors, an outcome which was also more in line with examination of the Scree plot (Tabachnik and Fidell, 1989).

Emotional and instrumental support items loaded onto Factor 1 (termed support seeking, $\lambda = .90$); self blame, denial and behavioural disengagement items loaded onto Factor 2 (termed “avoidance coping”, $\lambda = .79$); active coping and planning items loaded onto Factor 3 (termed “problem focused coping”, $\lambda = .84$); and positive reframing, acceptance and humour items loaded onto Factor 4 (termed “emotion focused coping”, $\lambda = .82$). All item loadings were greater than .5. *Mental and physical health.* Participants completed the Short Form 36 Health Survey (SF-36; Jenkinson et al., 1996) which assesses the following dimensions of health: physical function, role limitation due to physical problems, role limitation due to emotional problems, social functioning, mental health, energy/vitality, pain, general health perception and change in health. Each subscale (that was multi-item) was found to have an acceptable level of internal reliability (all α s $> .82$; $rs > .67$), consequently composite scores were calculated for each dimension in accordance with the manual (Jenkinson et al., 1996). The possible range of scores for each dimension is 0-100, with higher scores consistently indicating better health.

Participants additionally completed the Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983), which comprises 7 items that assess anxiety (e.g., “I feel tense or ‘wound up’”) and 7 items that assess depression (e.g., “I feel as if I am slowed down”). Participants were instructed to answer the questions in relation to “how you have been feeling during the last trimester (29-40 weeks) of your pregnancy”. Both the anxiety and the depression subscale were found to have acceptable levels of reliability (α s $> .78$) and composite scores were calculated for each dimension. The possible range of scores is 0-21, with higher scores indicating higher levels of anxiety and depression respectively.

Results

Descriptive statistics for the sample are summarized in Table 1.

Insert Table 1 here

Predicting health-related outcomes

A series of hierarchical multiple regressions was conducted to determine whether representations of pregnancy and coping were associated with each of the following health-related outcomes: physical function, social function, energy/vitality, anxiety and depression.¹ Age, accommodation

status, level of educational qualification, experience of pregnancy-related complications and parity were entered at step one to control for any influence of these variables on outcomes, as preliminary analyses revealed that these variables were associated with one or more of the health-related outcomes under investigation. Representations of pregnancy were entered at step two. Coping strategies were entered at step three to determine both whether they contributed significantly to the prediction of health-related outcomes over and above representations of pregnancy and whether their inclusion reduced the predictive power of representations of pregnancy. The latter finding would suggest that coping strategies may mediate any effects of pregnancy representations on health-related outcomes. Pearson correlation coefficients between representations of pregnancy, coping and health-related outcomes are given in Table 2. The resultant hierarchical multiple regressions are summarized in Tables 3 and 4.

Insert Table 2 here

Physical function. Representations of pregnancy accounted for 13.78% of the variance in physical function, $?F(5, 340) = 11.95, p < .001$. Symptoms, personal control and consequences emerged as significant linear predictors; believing one had more control over the outcomes of one's pregnancy was associated with better physical function, while experiencing more symptoms and believing that one's pregnancy had greater consequences were associated with worse physical function. Including coping strategies in the model failed to significantly increase the variance in physical function accounted for, $?F(4, 336) = 1.61, p = .17; ?R^2 = .01$; however problem focused coping emerged as a significant linear predictor, such that higher levels of problem focused coping were associated with better physical function.

Social function. Representations of pregnancy accounted for 28.05% of the variance in social function, $?F(5, 344) = 29.90, p < .001$. Symptoms, personal control and consequences emerged as significant linear predictors; believing one had more control over the outcomes of one's pregnancy was associated with better social function while experiencing more symptoms and believing that one's pregnancy had greater consequences were associated with worse social function. Including coping strategies in the model significantly increased the variance in social function accounted for, $?F(4, 340) = 3.15, p = .01; ?R^2 = .02$; avoidance coping emerged as a significant linear predictor, with higher levels of avoidance coping being associated with worse social function.

Energy/vitality. Representations of pregnancy accounted for 30.38% of the variance in energy / vitality, $?F(5, 343) = 34.69, p < .001$. Symptoms, consequences and emotional representations emerged as significant linear predictors; believing that one's pregnancy had greater consequences, experiencing more symptoms and reporting more negative emotional responses to one's pregnancy were each associated with lower levels of energy/vitality. Including coping strategies in the model significantly increased the variance in energy/vitality accounted for, $?F(4, 339) = 5.80, p < .001; ?R^2 = .04$. Avoidance coping emerged as a significant linear predictor, such that higher levels of avoidance coping were associated with lower levels of energy/vitality. Although the emotional representations variable was no longer a significant predictor in the final model, supplementary mediation analyses (following Baron and Kenny, 1986) indicated that avoidant coping did not mediate the impact of emotional representations on energy/vitality.

Insert Table 3 here

Anxiety. Representations of pregnancy accounted for 38.84% of the variance in anxiety, $?F(5, 334) = 45.88, p < .001$. Symptoms and emotional representations emerged as significant linear predictors; experiencing more symptoms and reporting more negative emotional responses to one's pregnancy were associated with higher levels of anxiety. Including coping strategies in the model significantly increased the variance in anxiety accounted for, $?F(4, 330) = 10.04, p < .001$; $?R^2 = .06$. Avoidance coping and emotion focused coping emerged as significant linear predictors, such that higher levels of avoidance coping were associated with higher levels of anxiety while higher levels of emotion focused coping were associated with lower levels of anxiety.

Depression. Representations of pregnancy accounted for 39.28% of the variance in depression, $?F(5, 330) = 48.57, p < .001$. Symptoms, personal control, consequences and emotional representations emerged as significant linear predictors; believing one had more control over the outcomes of one's pregnancy was associated with lower levels of depression, while believing that one's pregnancy had greater consequences, experiencing more symptoms and reporting more negative emotional responses to one's pregnancy were associated with higher levels of depression. Including coping strategies in the model significantly increased the variance in depression accounted for, $?F(4, 326) = 14.73, p < .001$; $?R^2 = .08$. Support seeking, avoidance coping and emotion focused coping emerged as significant linear predictors, such that higher levels of support seeking and emotion focused coping were associated with lower levels of depression, while higher levels of avoidance coping were associated with higher levels of depression.

Insert Table 4 here

Discussion

The findings of the current study supported our hypothesis that representations of pregnancy would be related to health-related outcomes. Representations of pregnancy were shown to have substantial associations with maternal health, accounting for as much as 30% and 39% of the variance in indicators of physical and mental health respectively. Overall, the pattern of results indicated that experiencing more symptoms during the last trimester of pregnancy, believing that one's pregnancy had more serious consequences and reporting more negative emotional responses to one's pregnancy were associated with worse mental and physical health. By contrast, holding a stronger belief that one could control the outcomes of one's pregnancy was associated with better mental and physical health.

The relationships reported between each of the various health-related outcomes and the cognitive representations of symptom identity, consequences and personal control in the current study are broadly in line with those found in applications of the SRM to chronic illnesses. Thus, the results of Hagger and Orbell's (2003) meta-analysis indicated significant negative associations between the symptom identity and consequences components of illness representations and physical functioning, social functioning, vitality and psychological distress respectively. By contrast, the control component was found to be significantly positively associated with each of these health-related outcomes.²

Perhaps of particular interest are our findings regarding emotional representations of pregnancy. As alluded to in the introduction, emotional representations have frequently been

overlooked in the SRM literature. The findings of the current study attest to the importance of assessing emotional representations alongside cognitive representations in SRM research. This conclusion is supported by recent applications of the SRM, which have assessed emotional representations and have similarly found them to be important predictors of health-related outcomes (e.g., Byrne et al., 2005; O'Connor et al., 2008).

Relatedly, it is notable that - while a number of different dimensions to cognitive representations have been identified and are assessed discretely in the IPQ-R - emotional representations are treated homogeneously. Thus the emotional representations scale of the IPQ-R includes items that relate to depression, anxiety, fear and anger. It might be profitable for future research to explore the relative associations between these different dimensions of emotional representations and outcomes, as it is conceivable that anxiety-related emotional responses might impact on health-related outcomes in a different manner to, say, anger-related responses.

Contrary to the predictions of the SRM (albeit in line with the findings of much other SRM-based empirical research), we found no evidence that coping mediated the relationships between representations of pregnancy and health-related outcomes. Coping was found to have an independent impact on some health-related outcomes, however. Avoidant coping was associated with worse mental and physical health across a variety of dimensions. By contrast, emotion focused coping appeared to be beneficial in terms of its association with lower levels of anxiety and depression, problem focused coping was associated with better physical functioning and support seeking was associated with lower levels of depression.

Critically, the findings of the current study suggest that the SRM can be usefully applied to pregnancy to help further our understanding of the associations between beliefs about, and emotional responses to, pregnancy and maternal health-related outcomes. Accordingly, the SRM may provide an appropriate framework within which to further explore the importance of beliefs and emotional responses in pregnancy.

Furthermore, as far as we are aware, the present study represents the first application of the SRM to a health-related life-event that falls outside of the domains of illness and ill health. The finding that the SRM might provide an appropriate framework within which to study associations between beliefs about pregnancy and health-related outcomes has important implications for future applications of the SRM. In particular, it suggests that the SRM could potentially be applied to a range of other significant health-related life events, such as the experience of adolescence, the menopause and/or aging.

One limitation to the current study is its cross-sectional design, which means that no definitive assumptions can be made about cause and effect. This limitation is not necessarily problematic from a theoretical perspective. Indeed, the SRM is an iterative model; thus, while cognitive and emotional representations are held to influence health-related outcomes, evaluations of these outcomes are believed to feedback and modify the underlying representations in turn. As such, the SRM allows both that representations should influence health-related outcomes and that health-related outcomes should influence representations. From an applied perspective, however, it may be more important to explicitly determine causality. In particular, if representations of pregnancy influence health-related outcomes, there may be scope to intervene by modifying the underlying

representations with the goal of improving maternal health. Future research would thus benefit from attempting to replicate the current pattern of findings utilizing a prospective design.

The above notwithstanding, the current study has convincingly demonstrated that a theoretical model typically applied to chronic illness can be profitably applied to the health domain of pregnancy. Furthermore, our findings allude to the importance of women's beliefs about, and emotional responses to, their pregnancies in shaping health-related outcomes. Given that these relationships can be replicated in longitudinal studies, applications of the SRM to pregnancy could have potentially important applied significance, in terms of their implications for the design of interventions to augment maternal mental and physical health. Future research would also benefit from exploring whether representations of pregnancy influence the birth experience and / or foetal and neonatal outcomes such as premature birth and low birth weight.

Notes

¹ We have not reported the multiple regressions for all of the SF-36 subscales for reasons of brevity, however full details of all such analyses are available from the first author on request.

² The control component was assessed as an overall perception that one's illness could be cured and/or controlled in the studies included in this meta-analysis, as the studies used the original version of the IPQ (Weinman et al., 1996).

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Table 1. Descriptive statistics

Variable	Min.	Max.	M	SD	N
Age	16	42	29.18	5.01	408
Time to conception (months)	0	124	6.47	13.84	340
Number of children (excluding current pregnancy)	0	6	0.62	1.00	406
Number of miscarriages	0	5	0.40	0.78	406
Number of terminations	0	3	0.15	0.43	403
Number of stillbirths	0	1	0.01	0.11	401
Symptom identity	3	30	14.39	4.82	364
Coherence	1.33	7.00	5.78	1.08	408
Personal Control	2.17	7.00	5.18	0.95	408
Consequences	1.83	6.67	4.25	1.02	408
Emotional representations	1.00	6.20	2.49	1.05	408
Support seeking	1.67	7.00	5.29	1.17	407
Avoidance coping	1.00	5.50	2.32	0.83	407
Problem focused coping	2.25	7.00	5.00	1.07	407
Emotion focused coping	2.17	7.00	5.00	0.96	407
Physical function	0	100	60.77	25.19	401
Role limitation due to physical problems	0	100	36.19	39.66	402
Role limitation due to emotional problems	0	100	79.08	35.30	400
Social functioning	0	100	69.38	24.66	405
Mental health (SF-36)	12	100	70.91	16.35	399
Energy / vitality	0	90	40.21	18.69	402
Pain	0	100	56.27	22.86	404
General health perception	10	100	73.27	17.84	401
Change in health	0	100	49.32	20.11	407
Anxiety (HADS)	0	18	6.53	3.39	395
Depression (HADS)	0	18	5.14	3.31	388

Table 2. Pearson correlation coefficients (r) between representations of pregnancy, coping and health-related outcomes.

Variable	1	2	3	4	5
Age					
Education ^b	-.12*				
Parity ^d	.06	.07			
Accommodation ^a	-.02	.00	.01		
Complications ^c	.09	.02	.03		
Symptom representations	.14**	.13**	.16***		
Coherence	-.09	-.07	-.05	-.04	
Personal control	-.04	-.02	-.11*	-.08*	
Consequences	-.03	-.05	.20***	.18***	
Emotional representations	.54***	.42***	.40***	.24***	
Support seeking	-.04	-.11*			
Avoidance coping	.21***	.20***			
Problem focused coping	-.03	-.04			
Emotion focused coping	-.10*	-.12*			
F	3.27**	45.88***			
R^2	.05**	.39***	.06***	.07***	.39***
df	5, 339	5, 334	4, 330	5, 335	5, 330

* $p < .05$; ** $p < .01$; *** $p < .001$.

^a owner occupier = 1, other = 0; ^b undergraduate degree or above = 1, other = 0; ^c experienced at least one complication = 1, experienced no complications = 0; ^d at least one child = 1, no previous children = 0