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**Examining exercise intention and behaviour during pregnancy using the Theory of Planned Behaviour: A meta-analysis.**

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# **Examining exercise intentions and behaviour during pregnancy using the Theory of Planned Behaviour: A meta-analysis.**

**Background:** The efficacy and predictive utility of the Theory of Planned Behaviour (TPB) in explaining a variety of behaviours including physical activity (PA) is well documented. However, the relative contribution of the theory's components in describing intention and behaviour may differ depending on the context, time and population being studied. Such evidence is necessary to inform PA advice and interventions aimed at special populations including pregnant women. **Objective:** The purpose of this study was to review the existing literature surrounding the application of the TPB in explaining exercise intentions and behaviour during pregnancy and to evaluate the magnitude of relationships between TPB constructs within this context. **Method:** Multiple search strategies yielded 99 potentially relevant studies of which 47 were assessed against the inclusion criteria. Finally, 8 studies were subjected to a random-effects meta-analysis. **Result:** Results confirmed the existence of a strong relationship between intention and behaviour whilst perceived behavioural control (PBC) revealed a weaker correlation with behaviour. Women's attitude towards exercise had the strongest association with their intention to be physically active whilst expecting. However, both PBC and subjective norm showed strong relationships with intention. **Conclusion:** The study supports the TPB as a relevant conceptual framework for the investigation of PA intentions and behaviours during pregnancy. Furthermore, this study supported subjective norm as a pertinent construct to investigate exercise intentions and behaviour in a pregnant population. These findings present both researchers and practitioners with an opportunity for intervention and further research.

**Keywords:** physical activity, exercise, pregnancy, theory of planned behaviour

## Introduction

The notion that attitudes influence behaviour has attracted a great deal of research (Armitage & Christian, 2003). Although the term is often used in general discourse to reflect an opinion; attitude is best described as an individual's disposition to react favourably or unfavourably with respect to a specific object, construct or behaviour (Fishbein & Ajzen, 2010). One theoretical model linking attitude with behaviour is the Theory of Reasoned Action (TRA) which posits that behaviour is primarily determined by an individual's intention to perform that behaviour (Ajzen & Fishbein, 1980). Intention (or an individual's stated orientation towards behaviour), in turn, represent the motivational factors of (1) attitude (a construct based on behavioural beliefs around the likely consequences of engaging in a specific behaviour) and (2) subjective norm (a construct based on normative beliefs representing the perceived pressure to conform to the perceptions of significant others regarding a specific behaviour (Ajzen & Fishbein, 1980; Ajzen, 1991; Fishbein & Ajzen, 2010). Whilst the TRA was successful in predicting volitional behaviours, it did not account for behaviours where volitional control was incomplete (Ajzen, 1991). In response, Ajzen (1991) extended the theory by adding to it the concept of perceived behavioural control (PBC; a construct based on control beliefs signifying the perceived ability with which one can carry out a specific behaviour; Fishbein & Ajzen, 2010; see figure 1). Several studies have since then supported the efficacy and predictive utility of the TPB in explaining a variety of behaviours including physical activity (PA; for reviews see Blue, 1995; Hausenblas, Carron & Mack, 1997; Hagger, Chatzisarantis & Biddle, 2002; Symons Downs & Hausenblas, 2005a). For example, a meta-analysis of 31 exercise related studies incorporating at least two of the constructs contained within the TRA/TPB reported a large effect size (ES) between attitude and intention to exercise (ES = 1.22), whilst subjective norm

only had a moderate impact ( $ES = 0.56$ ; Hausenblas, et al., 1997). PBC, however, showed a large effect on both intention to exercise ( $ES = 0.97$ ) and exercise behaviour itself ( $ES = 1.01$ ). The authors concluded that their study “provide strong evidence that the TRA is a good theory; its extension, the TPB, is an even better theory” (p.47). To establish the predictive utility of the theory constructs, Symons Downs and Hausenblas (2005a) later followed up on this study with a meta-analytic review that included a further 80 TRA/TPB and exercise studies. They found intention to be the strongest predictor of exercise behaviour ( $ES = 1.01$ ), whilst attitude was the strongest determinant of intention to exercise ( $ES = 1.07$ ). Together attitude, subjective norm and PBC accounted for 30.4% of the variance in intention to exercise, whereas intention and PBC explained 21.0% of the variance in exercise behaviour.

[Insert Figure 1 here]

Figure 1: Schematic representation of the TPB (adapted from Ajzen, 2006).

The relative contribution of attitude, subjective norm, and PBC in the prediction of intention is, however, expected to vary between behaviours and situations (Ajzen, 1991). When it comes to exercise behaviour this may be particularly relevant for special populations such as pregnant women at risk of sedentary behaviour (Symons Downs & Hausenblas, 2005b). Whilst the benefits of an active lifestyle during pregnancy are well documented (Pivarnik, Chambliss, Clapp, Dugan, Hatch, Lovelady, Mottola & Williams, 2006), literature consistently shows that PA participation decreases in both frequency and intensity as pregnancy advances (Poudevigne & O'Connor, 2006; Gaston & Cramp, 2011). Poudevigne and O'Connor (2006) suggest that the reasons for this occurrence may be ‘numerous and complex’ (p.27) whilst Symons Downs, Chasan-Taber, Evenson, Leiferman and Yeo (2012)

describe them as ‘multilevel factors’ (p.491). Yet, without an understanding of the psychosocial determinants involved in exercise initiation and continuation during this time, it is unlikely that behaviour change interventions aimed at pregnant women will be appropriate (Godin, Valois & Lepage, 1993; Gaston, Cramp & Prapavessis, 2012). In addition, women could miss out on numerous health benefits which may in turn have implications for their long-term health (Gaston & Cramp, 2011).

As a society, our view of exercise during pregnancy has changed dramatically over the past two decades with pregnancy no longer being considered a condition for confinement and the effects of a sedentary lifestyle requiring consideration (Artal & O’Toole, 2003; Ribeiro & Milanez, 2011; Jukic, Evenson, Herring, Wilcox, Hartmann & Daniels, 2012). However, PA interventions aimed at pregnant women have not typically been based on relevant theoretical frameworks thereby limiting their effectiveness and importance (Gaston & Cramp, 2012). A recent systematic review of such interventions found that only four of the eleven interventions selected for inclusion were based on a theoretical model (Pearce, Evenson, Symons Downs & Steckler, 2013). Methodological weaknesses of the included studies, however, limited the validity and interpretation of findings and the authors emphasized the need for further research to effectively design and evaluate interventions to promote PA during pregnancy. Whilst the TPB is not a theory of behaviour change in itself, it is considered a useful framework for designing effective behaviour change interventions as it differentiates between motivating those who are not inclined to carry out a specific behaviour and enabling others who already have positive intentions towards performing that behaviour (Ajzen, 2014).

The purpose of this study is therefore to review the existing literature surrounding the application of the TPB in explaining PA intentions and behaviour during pregnancy and to evaluate the effectiveness of the TPB in doing so. Specifically, the objectives of this review are to investigate (a) the efficacy of the TPB in explaining pregnant women's exercise intention and to determine which theoretical construct has the greatest effect on intention, (b) the efficacy of the TPB in explaining pregnant women's exercise behaviour and to determine which theoretical construct has the greatest effect on exercise behaviour during pregnancy, and (c) to quantify the relationships between all the remaining constructs within the TPB. Based on the literature outlined earlier and our understanding of the TPB, it is hypothesized that attitude would have the greatest effect on intention to exercise during pregnancy and that intention has the greatest influence on pregnant women's exercise behaviour.

## **Method**

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Moher, Liberati, Tetzlaff & Altman, 2009) was used as a guideline for the development and reporting of this meta-analysis.

### **Literature search strategy**

In a recent review of literature pertaining to the patterns and determinants of exercise during pregnancy, Gaston and Cramp (2011) identified only five studies that examined TPB variables. Of these, one included a multi-level analysis that combined two of the other publications. To ensure that all relevant studies were considered for this review, multiple search strategies were employed. Firstly, computer-based literature searches of the databases PsychINFO, PubMed, ScienceDirect, and SPORTDiscus were conducted during August to

November 2013 using various combinations of keywords related to the TPB (i.e. beliefs, attitude, subjective norm, PBC, intention), exercise or PA, and pregnancy (or pregnant woman or expectant mother; see Appendix 1). Secondly, Google Scholar, SCIRUS and ProQuest Dissertations and Theses (UK & Ireland) were searched to locate unpublished material. Thirdly, the reference lists of all the included studies were scrutinised for potentially relevant studies. Finally, key authors were contacted to identify any additional research studies that could be eligible for inclusion.

### **Eligibility criteria**

A study was considered for this review if: (a) it examined at least two of the constructs as defined by the TPB (i.e. attitude, subjective norm, PBC, intention and behaviour) and reported at least one relationship between them, (b) the target behaviour was specified as exercise or PA during pregnancy, (c) material was available in the English language, and (d) it yielded usable statistics (i.e. correlations or sufficient data to compute correlations).

### **Meta-analytic strategy**

The index of effect size used for analysis was the correlation coefficient reported between TPB variables (e.g. attitude and intention, intention and behaviour, etc.). Authors were contacted for further information where insufficient data was provided. A random-effects meta-analysis was performed for each relationship using the Comprehensive Meta-Analysis (version 3.0) computer software package. This resulted in ten independent analyses; the results of which are summarized in Table 2.

Three of the studies included in this review formed part of a longitudinal research project to assess pregnant women's exercise attitudes and behaviours which resulted in



repeated measures being available for a number of participants represented in this meta-analysis (cf. Hausenblas & Symons Downs, 2004; Symons Downs & Hausenblas, 2003, 2007). However, as women's beliefs about exercise vary by trimester and PA decreases from the first, to the second, and to the third trimester (Hausenblas, Giacobbi, Cook, Rhodes & Cruz, 2011), the results of the three studies in question were not combined but treated as independent data sets.

One doctoral study reported attitudes and behaviours over three trimesters separating results by motherhood status (cf. DiNallo, 2011). As the present analysis did not consider the effect of any potential moderators, the results for women with ( $n = 88$ ) and without ( $n = 78$ ) children were combined to produce a single value for each outcome per trimester ( $n = 166$ ). Consistent with our approach, the results for each trimester were treated as independent data sets.

### **Publication bias**

It is typically assumed that published studies represent a biased sample of all studies conducted in the behavioural sciences (Rosenthal, 1979). Rosenthal's (1979) Fail-Safe N is one method that has previously been used as an assessment of the possible effects of publication bias in meta-analyses involving the TPB and exercise (see Hausenblas, Carron & Mack, 1997, Symons Downs & Hausenblas, 2005a). Specifically, this method was used to determine how many missing studies are required before the summary effect would become non-significant (Borenstein, Hedges, Higgins & Rothstein, 2009). Potential publication bias in this review was assessed by Rosenthal's (1979) Fail-Safe N. These results are summarized in Table 2.

## **Results**

### **Study selection**

An initial search of computer-based electronic databases identified 122 potentially relevant studies. A further 62 studies were obtained through additional searches and/or other sources. Once duplicates were removed 99 studies were screened for eligibility by title and abstract; 52 records were excluded at this point. A total of 47 studies were then assessed against the inclusion criteria by the first and third authors. Forty articles were excluded of which 13 did not involve a pregnant sample, 17 did not use the TPB as conceptual framework, 3 studies did not investigate exercise or PA as the target behaviour, 5 studies did not provide adequate statistical data and 1 study was not available in the English language. Finally, a total of 8 studies were selected for inclusion in the meta-analysis (see Figure 2 and Appendix 2).

[Insert Figure 2 here]

Figure 2: Flow diagram representing study selection (adapted from PRISMA, 2009).

### **Sample characteristics**

All but one of the studies included in the analysis were carried out in the United States with participant numbers ranging from 50 to 272. The majority of participants were recruited in their first or second trimester of pregnancy; in only one study were women recruited during the third trimester. The majority of women were between 18 and 43 years of age with mean age being reported in all but one of the studies. Where behaviour was measured this was done mainly by self-report measures including the Leisure Time Exercise Questionnaire

and the International Physical Activity Questionnaire. Only one study used an objective measurement (i.e. pedometer) of exercise behaviour. Psychometric properties of the measures used to investigate TPB constructs were stated in all of the studies although in one report this was described as a range rather than specified per outcome. All studies included demographic statistics on ethnicity, education levels and socio-economic status with 86% reporting marital status and 86% describing the occupation and/or employment status of participants.

### **Heterogeneity**

Using Cochran's Q-test the null hypothesis that all studies within each of the meta-analyses share a common effect size was examined (Borenstein, et al., 2009). The results indicate that the true effects vary ( $p < .10$ ) for all but one of the summary effects resulting in the null hypothesis being rejected for the majority of outcomes assessed within this paper (see Table 1). For these effects the proportion of variance across studies that is due to heterogeneity ( $I^2$ ) ranges from 71.81% to 92.75%. As heterogeneity affects the precision of the mean effect size, the reader is urged to consider the confidence intervals and standard deviation of the effect size ( $T$ ; i.e. dispersion) alongside the overall effect (Borenstein, et al., 2009). It should be noted, however, that a random-effects model allows true effect sizes to vary between studies and addresses the issue of heterogeneity by using the estimation of true variance in effects ( $T^2$ ) to assign weights to each study in the meta-analysis (Borenstein, et al., 2009).

Table 1: Indices of heterogeneity.

[Insert Table 1 here]

### **Sensitivity analyses**

Sensitivity analyses were conducted to investigate the robustness of the reported findings, risk of bias, and the possible reason for heterogeneity (Borenstein, et al., 2009). Firstly, it was found that no single study dominated any of the analyses. Secondly, the standardized residuals were inspected to determine if any of the studies were outliers. A study that did not fall within two standard deviations of the mean (i.e. the 95% confidence interval or  $p = .05$ ) was found in nine of the ten analyses. The data was subsequently examined to see if the summary effect would change had any one of these potential outliers been excluded. The summary effect remained significant ( $p < .001$ ) in each of these cases and all studies were therefore included in the final analysis.

### **Summary results**

The primary purpose of this study was to examine the efficacy of the TPB in explaining exercise intention and behaviour in pregnant women. The findings (see Table 2) confirm the existence of a strong relationship between intention and behaviour ( $r = .50$ ,  $p < .05$ ,  $T = .20$ ,  $R^2 = 25.00$ ; see Figure 3) and medium relationship between PBC and behaviour ( $r = .38$ ,  $p < .05$ ,  $T = .23$ ,  $R^2 = 14.44$ ; see Figure 4; cf. Cohen, 1988).

[Insert Figure 3 here]

Figure 3: Relationship ( $r$ ) between exercise intention and behaviour in pregnant women.

[Insert Figure 4 here]

Figure 4: Relationship ( $r$ ) between PBC and exercise behaviour in pregnant women.

As hypothesized, results showed that women's attitude ( $r = .59$ ,  $p < .05$ ,  $T = .32$ ,  $R^2 = 34.81$ ; see Figure 5) towards exercise had the strongest association with their intention to be physically active during their pregnancy. However, both PBC ( $r = .58$ ,  $p < .05$ ,  $T = .27$ ,  $R^2 = 33.64$ ) and subjective norm ( $r = .50$ ,  $p = .0000$ ,  $T = .23$ ,  $R^2 = 25.00$ ) showed strong relationships with intention (cf. Cohen, 1988).

The relationships among the remaining constructs of the TPB were also examined. All correlations were significant at an alpha level of .05 two-tailed. The strongest relationships were reported between attitude and PBC ( $r = .60$ ,  $p < .05$ ,  $T = .17$ ,  $R^2 = 36.00$ ) and attitude and subjective norm ( $r = .60$ ,  $p < .05$ ,  $T = .21$ ,  $R^2 = 36.00$ ). The weakest relationship in this examination of the TPB was found between attitude and behaviour ( $r = .33$ ,  $p < .05$ ,  $T = .15$ ,  $R^2 = 10.89$ ).

[Insert Figure 5 here]

Figure 5: Relationship ( $r$ ) between attitude and exercise intention in pregnant women.

Table 2: Summary of results.

[Insert Table 2 here]

Since inferences with regards to causation between variables cannot be made, it would have been useful to assess the construct validity and predictive utility of the TPB by means of regression or path analysis. Using G\*Power version 3.1.7 (Faul, Erdfelder, Buchner & Lang, 2009) and based on a large effect size, a power of 80% and an alpha level of .05 two-tailed, it is estimated that approximately 40 effect sizes will be required to permit multiple regression

analysis. However, as only 8 effect sizes were available resulting in insufficient power, it was not possible to carry out further analyses (see Table 3).

Table 3: Summary of the number of effect sizes and cases available for analysis.

[Insert Table 3 here]

## **Discussion**

In relation to the two main objectives of this review it was found that attitude had the strongest association with intention whilst intention had the strongest correlation with exercise behaviour. These results compare favourably with that of previous narrative and statistical reviews of the TPB and exercise-related studies (see Blue, 1995; Hausenblas, Carron & Mack, 1997; Hagger, Chatzisarantis & Biddle, 2002; Symons Downs & Hausenblas, 2005a). A few interesting findings with reference to our understanding of PA intention and behaviour in the pregnant population, however, stand out.

As hypothesized, results of the present study confirm a strong relationship between pregnant women's intentions and exercise behaviour. Ajzen (1991), however, argues that these intentions can only translate into action if the behaviour of interest is under complete volitional control. Whilst this requirement are met by some PA behaviours, regularly engaging in exercise during pregnancy may be affected by both general issues (e.g. time, finance, childcare, knowledge, etc.) and pregnancy specific factors such as morning sickness during the first trimester or physical discomfort during the third trimester. Combined, these factors represent pregnant women's actual control over exercise behaviour. Thus, within the

context of the TPB, pregnant women's perception of the availability of adequate resources and opportunities coupled with fewer anticipated barriers should result in greater perceived control over exercise behaviour. However, results indicate that PBC only had a moderate relationship with women's exercise behaviour during pregnancy thereby suggesting that expectant mothers are unsure about their ability to participate in physical activities during pregnancy.

Thus, although there is a strong relationship between exercise intention and behaviour in the pregnant population, a lack of actual control over non-motivational factors can reduce the predictive validity of intentions (Ajzen, 2011). This weakened relationship together with the theoretical assumption that both PBC and intention can predict behaviour; could potentially explain why behavioural attainment in terms of PA is low in the pregnant population. Enhancing pregnant women's sense of control seems to be one method of improving the uptake and maintenance of exercise during pregnancy (i.e. overcome the intention-behaviour gap).

Whilst it was not possible to do an analysis by trimester (i.e. subgroup analysis), it is important to recognise that the physical and psychological demands of pregnancy vary between trimesters and that several factors can influence the exercise intentions and behaviours of expectant mothers (Symons Downs & Hausenblas, 2007). It may be that different types of interventions are required for each trimester and future research should aim to differentiate between the findings in each trimester and to compare these changes over the course of a pregnancy.

In contrast to the findings of a previous meta-analysis in the exercise domain where subjective norm did not predict intentions (Symons Downs & Hausenblas, 2005a); this study showed support for its inclusion in the TPB to investigate exercise intentions and behaviour in a pregnant population. Specifically, subjective norm showed a comparable moderate association with behaviour than attitude and PBC. Similar to attitude and PBC, subjective norm also revealed a strong relationship with intention. The perceived social pressure to conform to other people's opinion whether or not to participate in PA during pregnancy may well be an important consideration for expectant mothers. This is not entirely surprising as pregnancy is associated with significant changes that may leave pregnant women feeling vulnerable and seeking the support and approval of those who are most important to them. This finding may thus present with an opportunity for intervention and further research. Firstly, it is generally accepted that health professionals play an important role in the dissemination of pregnancy related information, however, research shows that pregnant women are offered little or no PA advice or have to request it (Olander, Atkinson, Edmunds & French, 2011; Ferrari, Siega-Riz, Evenson, Moos & Carrier, 2013). In developing pregnancy advice and interventions, barriers to providing effective guidance should be investigated from the health professionals' point of view (Phelan, 2010). For example, in a recent review, Heslehurst, Newham, Maniatopoulos, Fleetwood, Robalino and Rankin (2014) found that whilst healthcare providers were confident in providing general PA advice they were also of opinion that there was a lack in accessible opportunities and services to support such guidance. Secondly, it may also be important to include a pregnant women's partner or even a relative or close friend in any intervention aimed at increasing and maintaining PA during pregnancy as the information provided about exercise 'has to compete with that delivered on other subjects, as well as with advice women may seek or receive from other sources, as well as with social and psychological factors' (Gross & Bee, 2004, p.168).



Given its unique contribution in this study, the notion that subjective norm should be excluded from the TPB cannot be supported. However, the fact that research has suggested social support to be superior to subjective norm in explaining exercise intentions has to be acknowledged (Rhodes, Jones & Courneya, 2002). Therefore, instead of removing and/or replacing the construct, social norm and social support should be combined which may, in turn, strengthen the normative component of the TPB. Future research should (a) consider the impact of assistance provided by others to promote PA initiation and maintenance during pregnancy and (b) examine whether construct validity and reliability can be achieved when combining these two determinants and whether this conceptualisation is more effective in explaining the exercise intentions and behaviours of expectant mothers.

The final objective of this review was to quantify the relationships between all the remaining constructs within the TPB. Intention to exercise during pregnancy was influenced primarily by women's beliefs about the positive and negative consequences of doing so. However, attitude also shared strong correlations with both PBC and subjective norm. This suggests that these variables share some aspects which are interrelated. It could thus be argued that a pregnant woman may evaluate exercise as a positive experience if she perceives it to be a manageable task. Also, she may view exercise as more favourable when her perception of PA during pregnancy matches that of important others.

Although the results of this study have been supportive of the TPB, it is important to acknowledge that the theory has not been without criticism. Firstly, there is a lack of consistency in defining and measuring the constructs within the TPB. This is particularly true for PBC (Biddle & Mutrie, 2008). Whilst PBC is said to reflect Bandura's (1977) concept of self-efficacy, some studies have shown self-efficacy to make independent

contributions to the intention-behaviour relationship (Armitage & Conner, 1999; Hagger et al., 2002; Terry & O’Leary, 1995). However, Fishbein and Ajzen (2010) argue that separating items directly measuring PBC into factors ‘identifying them as self-efficacy expectations and perceived control is misleading and unjustified’ (p.165) as ‘theoretically, both items refer to the same latent construct, namely, the perceived ability to perform a given behaviour or to carry out a certain course of action’ (p.166). They propose that instead these should be classed into the categories of perceived capacity (i.e. perceived ease or difficulty) and perceived autonomy (i.e. perceived control) that combine to form a single PBC construct with discriminant validity and high internal consistency. It should be noted, however, that the validity established for items measuring a specific behaviour may not necessarily apply to other behaviours (Fishbein & Ajzen, 2010). For example, Courneya, Bobick and Schinke (1999) found items referring to perceived ease or difficulty of participating in regular exercise to be a good indicator of overall PBC; whilst Kraft, Rise, Sutton and Roysamb (2005) found that the perceived ease or difficulty of recycling behaviour was reflected in both self-efficacy and the affective dimension of attitude. None of the studies included in this review made a distinction between self-efficacy and PBC with internal consistency values ranging from 0.81 to 0.91. This suggests that the direct measurement of PBC is a valid method for examining exercise intentions and behaviour in pregnant women.

Secondly, although the TPB is considered a flexible framework into which other variables can be incorporated, the inclusion of past behaviour as an additional predictor variable has been consistently reported to account for a further variance on intentions of approximately 10% (Fishbein & Ajzen, 2010). In a meta-analysis of 72 studies within a PA context, Hagger and colleagues (2002) found frequency of past behaviour to be related to all TPB variables. This suggests that studies not considering past behaviour may be obtaining

inflated correlations due to the residual effect of past behaviour on the TPB constructs (Biddle & Mutrie, 2008; Fishbein & Ajzen, 2010). Although some researchers have chosen to control for its influence, it is possible that past behaviour may have a direct, causal effect on intentions and/or actual behaviour thereby suggesting past behaviour as an additional variable in its own right (Fishbein & Ajzen, 2010).

Few studies have considered the effects of past behaviour during pregnancy using the TPB. In her doctoral dissertation, Zamora-Flyr (2010) used a modified version of the TPB that included moral obligation to predict walking behaviour in a sample of pregnant Hispanic women (n = 102). The author did not find moral obligation to make an independent contribution to intentions, however, walking behaviour during the second trimester successfully predicted walking behaviour during the third trimester. This study thus offers further support for the inclusion of past behaviour as an additional variable to the TPB. In contrast to Zamora-Flyr's (2010) findings, Hausenblas, Symons Downs, Giacobbi, Tuccitto and Cook (2008) did not find pre-pregnancy exercise participation to moderate the effect of the TPB variables on exercise intention nor did it predict pregnancy exercise behaviour. However, it should be noted that these two examinations of past behaviour vary in the sense that Zamora-Flyr (2010) predicted exercise behaviour during pregnancy (i.e. second to third trimester) using objective measurements (i.e. a pedometer) whilst Hausenblas and colleagues (2008) predicted exercise behaviour during pregnancy based on subjective measurements (i.e. Leisure-Time Exercise Questionnaire) of behaviour prior to pregnancy which varied from the measurement of behaviour during pregnancy (i.e. a behaviour statement). More research using measurements suitable to both pre-pregnancy and pregnancy exercise behaviour is warranted before conclusions can be drawn about the effect of pre-pregnancy PA participation and exercise intentions and behaviour during pregnancy.

Finally, whilst it was possible to quantify the magnitude of the linear relationships between theoretical constructs within the TPB, the effects of any additional or moderator variables were not considered. For example, it would have been useful to compare studies based on (a) the time interval between assessing intention and behaviour, (b) whether scale correspondence was achieved between the measurement of intention and behaviour, (c) background factors (e.g. ethnicity, socio-economic status, education, gravida, parental status, high risk pregnancies, etc.), and (d) the outcomes of published versus unpublished research.

## **Conclusion**

‘The behaviours people perform in their daily lives can have profound effects on their own health and well-being, on the health and well-being of other individuals, groups, and organizations to which they belong, and on society at large’ (Fishbein & Ajzen, 2010, p.1). Understanding and explaining the reasons for human behaviour, however, is a complex undertaking (Ajzen, 1991). Whilst Sniehotta, Penseau and Araújo-Soares (2014) have suggested that the TPB has lost its utility, this study supports it as a relevant conceptual framework for the examination of PA intentions and behaviours in a pregnant population. Specifically, this meta-analysis has summarized the state of our current knowledge of pregnancy and PA related studies utilizing the TPB and in doing so identified areas for future research and key themes in the development of interventions aimed at increasing or maintaining exercise behaviour during pregnancy.

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