

TITLE PAGE

The biopsychosocial barriers and enablers to being physically active following childbirth: A systematic literature review.

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ABSTRACT

Background: Physical activity brings significant health benefits. Childbirth presents many physical, emotional and practical challenges to women and is known to disrupt engagement in regular physical activity. However the specific barriers and enablers to physical activity in the postpartum period have not yet been systematically identified. Adequate understanding of these issues is crucial before effective interventions can be developed.

Objectives: The primary objective was to identify the biopsychosocial barriers and enablers to physical activity following childbirth.

Methods: A systematic literature review of qualitative research was conducted. Relevant literature was sourced using five online databases (CINAHL, Maternity and Infant Care, MEDLINE, PsycINFO and PubMed) and primary snowballing. Studies which met the pre-determined inclusion criteria were critically appraised independently by research team members and then collectively discussed to reach consensus.

Results: 391 potential records were identified. Following the application of eligibility criteria and removal of duplicates, six qualitative studies remained, all of which identified barriers and enablers to postpartum physical activity. Data demonstrated that lack of time and issues surrounding childcare were the most common barriers to physical activity, whilst a common enabler was social support. Reported benefits of physical activity in the postpartum period included improved mental wellbeing and weight loss.

Conclusions: A number of specific barriers, enablers and benefits were identified. Future research should aim to develop and evaluate postpartum physical activity interventions. Outcomes should be collected prospectively at multiple time points and more diverse participant samples should be recruited.

Keywords: Exercise, Parturition, Postpartum Period, Qualitative Research, Review

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MANUSCRIPT

Introduction

Childbirth presents many physical, emotional and practical challenges to women and is known to disrupt engagement in regular physical activity (PA). PA is defined as “any bodily movement produced by skeletal muscles that requires energy expenditure” [1]. The benefits of regular PA for the promotion of health and wellbeing and the treatment of health conditions are widely acknowledged [2,3]. For example, regular PA decreases the risk of premature death [2] and contributes towards the primary and secondary prevention of cardiovascular and pulmonary diseases; muscle, bone and joint diseases; cancer; and metabolic disorders such as type 2 diabetes [2,4]. The risks of physical inactivity have also been identified, with inactive middle-aged women having a 52% increase in all-cause mortality, a 29% increase in cancer-related mortality, and a doubling of cardiovascular-related mortality when compared to physically active women [5].

PA is particularly beneficial for pregnant and postpartum women, helping to reduce fatigue, increasing mental acuity, promoting the return to pre-pregnancy weight and decreasing the risk of developing future chronic health conditions [6]. PA levels are positively correlated with quality of life, and studies have shown the benefits of exercise for reducing postpartum depressive symptoms and improving psychological well-being [7-9]. During the postpartum period, the risk of becoming overweight or obese is high [10]. Women may not only retain gestational weight but also gain additional weight, so PA may be particularly important to mothers' health [11]. The Royal College of Obstetricians and Gynecologists [12] recommended beginning a mild exercise programme immediately postpartum, if pregnancy and delivery were uncomplicated. The 2008 Physical Activity Guidelines for Americans [13]

recommended that healthy pregnant and postpartum women should engage in 150 minutes of moderate intensity aerobic activity a week, although The World Health Organization [1] recommended seeking medical advice before striving for this, as extra precautions may be needed.

Despite the established benefits and guidelines for PA during and after pregnancy, activity levels typically decline throughout pregnancy and most women do not regain pre-pregnancy PA levels postpartum [14]. In the United States of America (USA), 24-26% of non-pregnant women were found to meet current activity guidelines, yet this reduced to only 3-15% during pregnancy [15]. Even in previously active women, postpartum participation levels can decrease. For example, Albright et al. (2008) [16] found that 43.0% of women were classified as 'active' before childbirth (defined as engaging in 30 minutes of moderate intensity activity for five days or more per week) and 'inactive' or 'irregularly active' postpartum. The remainder of the cohort were classified as inactive both before and after childbirth (21.5%), active before and after (22.7%), or inactive before and active after (12.6%).

A previous systematic review by Harrison et al. [17] identified the barriers, enablers and attitudes to PA in pregnant women. The most frequent barriers found were intrapersonal, such as lack of time, pregnancy discomforts and fatigue. The most common enablers were social support, maternal and fetal health benefits, and pregnancy-specific programmes. They concluded that behavior change techniques should be used within strategies to address the barriers, which in turn should translate into increased PA participation.

The review by Harrison et al. [17] focused on pregnancy, however the issues in the postpartum period have yet to be systematically identified. This period is crucial because, as

previously mentioned, many women do not regain their pre-pregnancy PA levels after giving birth [14]. Information about the relevant barriers and enablers to PA after childbirth could be used to design effective interventions to enhance active lifestyle behaviours. The information could also improve the ability of health and social care professionals to advise women about becoming more active. By resolving barriers and maximising the enablers, more postpartum women could experience the benefits of PA.

The primary aim was to systematically identify, from published qualitative research studies, the biopsychosocial barriers and enablers to being physically active following childbirth.

Methodology

The review was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [18].

Search strategy

The search strategy was developed in consultation with a librarian who had expertise in systematic reviewing. To ensure a thorough and comprehensive search, and to limit publication bias, both an online literature search and primary snowballing were used. The electronic databases searched were CINAHL, MEDLINE and PsycINFO (all via the EBSCO search engine), Maternity & Infant Care (via OVID) and PubMed. Primary snowballing was employed from the articles selected from the electronic database search. The reference lists were used to identify any further articles which had been missed. Snowballing is seen as a thorough way of identifying and including all relevant literature [19].

Search terms

Search terms used for the electronic database search were developed through consultation with a librarian, group discussion and consensus. As the primary aim was to identify biopsychosocial barriers and enablers, the search strategy could not be structured in a traditional PICOS format. Key words from the research aim were therefore chosen as the focus for search term development. ‘Barriers’, ‘enablers’, ‘physical activity’ and ‘childbirth’ represented the four search concepts and a range of synonyms were agreed to represent these concepts (Table 1). The Boolean operator ‘OR’ was used to combine terms within each search and ‘AND’ was used to combine all four searches. Each search was conducted concurrently and independently by three research team members and the results compared. Disagreements were resolved through group discussion and consensus, thereby increasing inter-rater reliability and minimising human error.

TABLE 1 HERE

The term ‘physical activity’ (PA) relates to any bodily movement [1], whilst ‘exercise’ is a subcategory of PA which is repetitive, has structure, and aims to improve one or more components of physical fitness [20]. The terms are often confused and used interchangeably so, to ensure that relevant articles were not omitted, both concepts were used synonymously in this review [2].

Study selection

The following limits were employed: a publication date range of 1997-2018 to ensure that articles were contemporary; English language; and peer-reviewed academic journal articles.

AMED via EBSCOhost was used to remove duplicates from MEDLINE, CINAHL and PsycINFO. AMED does not support PubMed or Maternity & Infant Care, so the remaining duplicates from these databases were removed manually.

After completing the search, pre-determined eligibility criteria (Table 2) were used to exclude irrelevant articles. The titles were firstly independently screened by five members of the research team, before group discussion and consensus on exclusions. The abstracts of the remaining articles were then independently assessed by the same five researchers and exclusions were again agreed following discussion and consensus. The full texts of the remaining potentially relevant articles were then read and assessed independently. A final group decision was then made on the studies selected for the review. Snowballing was conducted using the reference lists of these final articles and the same process of individual and group working was used to make decisions on inclusion.

TABLE 2 HERE

The Critical Appraisals Skills Programme (CASP) checklist for qualitative research [21] was chosen as a basis for critical appraisal of the chosen studies. CASP was considered to be comprehensive, yet not overly complex, placing an emphasis on rigour in reporting and the quality of the investigation [22]. Each of the ten questions were answered independently by the five researchers with either 'yes', 'no' or 'can't tell'. When agreement could not be reached after group discussion, a result was marked as 'can't tell' in order to reach consensus.

Relevant data from these studies were independently extracted by each of the five researchers, before discussing and summarising the findings. The data extraction table

included information relating to study setting, study purpose, study method, recruitment strategy, sample size, demographics, time postpartum, physical activity level, barriers and enablers.

Results

The online database search identified 354 results, with another 37 records identified through snowballing. The PRISMA flow diagram (Figure 1) details the reasons for study exclusions.

FIGURE 1 HERE

A total of six qualitative research articles met the criteria for inclusion. The final articles were by Albright et al. [16], Evenson et al. [23], Groth and David [24], Saligeh et al. [25], Symons Downs and Ulbrecht [26] and Symons Downs and Hausenblas [27]. Details of each of the studies, including the specific barriers and enablers identified, are presented in Table 3.

TABLE 3 HERE

All six studies investigated new mothers' opinions related to the biopsychosocial barriers and enablers to PA. The studies used a range of methods to obtain data and some gathered additional information. For instance, four of the papers also recorded women's exercise beliefs [23,24,26,27]. All six studies identified lack of time as a barrier to PA, and social support (or an exercise partner) as an enabler [16,23-27]. Another common barrier related to issues surrounding childcare. Some factors listed under enablers might be more accurately identified as 'benefits' of PA. These reported benefits included losing weight and improving mental wellbeing, such as lifting mood and decreasing stress. All of the included studies

concluded that the information should be used to design interventions, programmes or exercise groups to facilitate PA.

The results of the critical appraisal process are presented in Table 4. Specific strengths and weaknesses of the included studies will be addressed in the following Discussion section.

TABLE 4 HERE

Discussion

The barriers and enablers to post-partum physical activity are multi-faceted and complex, although a number of benefits were reported by women (Table 3). Lack of time, social support and child care were common barriers reported across studies. The identified enablers and benefits could form the focus for development of interventions to enhance engagement in physical activity in this group.

Quality of the studies

It is important to strive for the highest quality possible when conducting and reporting research [28]. Primary research aims to use suitable procedures to gather original data for the specific purposes of the study. Qualitative research designs often involve techniques such as observation, focus groups or in-depth interviews to collect large amounts of data from a small, purposeful sample [29]. The advantage of primary data collection is that the research design and data collection strategy can be tailored to the research question. However, no data collection method is perfect and there can still be many flaws within qualitative research [29,30]. In order to assess the rigor of qualitative research, the terms ‘credibility’, ‘transferability’, ‘dependability’ and ‘confirmability’ can provide a useful framework [31].

Credibility

Credibility refers to how truthful the data is, or the representation and interpretation of the participants' views by the researcher [32]. Qualitative studies can be considered credible if the accounts of human experience are recognised instantly by others who share the same experience [33]. Strategies to increase credibility include member checking, triangulation, prolonged engagement and persistent observation [31]. Member checking involves returning analysed data or an interview to the participant to allow them to validate it, reducing researcher bias [34]. None of the studies explicitly reported using member checking.

Groth and David [24] used a paediatric practice waiting room as their study setting, so participants' responses may have been altered by perceived social desirability. Participants were asked to answer the questions from the perspective of women they knew as well as themselves. Therefore, they may not have given an accurate depiction of their thoughts and instead altered answers based on assumptions, potentially reducing the study's credibility.

Saligheh et al. [25] reported incorporating a continual peer review process upon the completion of interviews and during data analysis. This helped to maintain credibility, as they could use feedback and reflection to refine analysis. Such strategies were not mentioned in the other studies, although other approaches to improve credibility may still have been incorporated into the research process.

Symons Downs and Ulbrecht [26] admitted that they were unable to inspect the effect of moderator variables known to influence exercise behaviors and beliefs, such as ethnicity, age and number of months postpartum due to insufficient data collection.

Transferability

Transferability is defined as how well the findings from the study can be applied to other groups or settings [35]. If the researcher has thoroughly described the study methodology then the reader can determine the transferability of the results [36]. Morse [31] stated that thick description is essential in order for findings to be applied to other contexts.

Groth and David [24] did not explain in depth how participants were selected. Although it is stated that new mothers were recruited via a letter given to them at an outpatient clinic, there is a lack of detail regarding this process, and no description of why the included women were most appropriate. In contrast, much more methodological detail was reported by Evenson et al. [23]. Description was given about the recruitment and interview processes, and a website was provided for greater detail on the protocols and measures. The inclusion criteria for participants were listed, although justification for these was not included.

Albright et al. [16] recruited a large population of ethnic minority women, but the sample was limited to one community organisation. They also reported that the population was generally women of middle to high socio-economic status. Thus, the results may not be more generalisable. Furthermore, as the study was based in Hawaii, the results may not be representative of mothers elsewhere. For instance, there may be differences in available facilities, cultural beliefs or social support, although the researchers justified the setting through explanation of Hawaii's uniquely ethnically-diverse population. Other studies had similarly limited geographical recruitment.

Evenson et al. [23] recruited a large sample size, with 530 participants. A large sample size means more of the target population's views should be obtained and anomalous views can be easily identified, increasing transferability. The concept of saturation is important to note here, which means obtaining a sample size large enough to collect the data needed, but not too large so the responses become repetitive and superfluous [37,38]. Saligheh et al. [25] reported that full data saturation may not have been achieved. Their study had a small sample size due to a low response rate – only 14 of the 150 women who completed a previous survey agreed and were available to be interviewed. The sample may not therefore have been large enough to represent the views of the wider population, reducing the study's transferability.

Symons Downs and Ulbrecht [26] focused on women with Gestational Diabetes Mellitus (GDM). The findings may not therefore be relevant to a wider population of new mothers, although they could inform the development of PA interventions specific to those with GDM.

Dependability

Dependability refers to how consistent the data is over similar conditions [39]. A study's dependability can be determined by the ease with which the researchers' process and descriptions can be used to replicate the study with similar participants in similar conditions, and reach the same findings [40]. The dependability of a study can be increased by using triangulation – the process of drawing conclusions by using multiple sources [41]. In order to provide reliable results from processes of data triangulation, the data analysis must deliver similar results [31]. This can be orchestrated through investigator triangulation, which involves multiple researchers independently analysing the data [31]. This was used by Evenson et al. [23] when interview responses were coded by two researchers, before coming

together to resolve any discrepancies by consensus. Allowing the researchers to debate their points of view helps to reduce bias [42].

In contrast, a lack of information surrounding data analysis was present in the study by Symons Downs and Ulbrecht [26]. They stated that content validity was established by using two Theory of Planned Behavior experts to examine the responses, but there is no detail reported about how this was structured. The researchers did not discuss how the open-ended responses were interpreted or coded into the data presented. This reduces the dependability of the research, as there is not sufficient information provided for other researchers to replicate the study.

Confirmability

Confirmability is concerned with ensuring that the inquirer's interpretation of the findings is clearly derived from the data, and there is an absence of researcher bias [39]. There should be a clear description of the researcher's perspective and researcher subjectivity should be minimised [36].

In the study by Groth and David [24], the participants were interviewed by one of the two authors and therefore the researchers may have influenced responses. Mason [43] suggested that researchers may impose their personal interests and beliefs throughout all stages of the research process, meaning their voice can dominate the participants' voices. Having an independent interviewer or using member checking decreases researcher bias.

Groth and David [24] was the only included study where participants did not complete a survey or questionnaire. Symons Downs and Hausenblaus [27] and Symons Downs and

Ulbrecht [26] chose not to supplement their questionnaire methods with face-to-face or interactive forms of data collection. Although this means there is a lack of visual cues from participants to assist with interpretation, there is no influence from the researchers, and therefore the data extracted is more confirmable. Albright et al. [16] provided refreshments and a \$30 gift certificate to all study participants, whilst the other five studies did not record using incentives. Incentives can affect the study's confirmability and credibility if, as a result, participants feel pressured to provide the responses they believe the researchers are looking for.

Implications of the review findings

There are many implications of the findings from this SLR, both in practical settings such as in the design of PA interventions, and in clinical settings with health professionals such as sport rehabilitators, midwives or physiotherapists.

Walsh and Downe [44] stated that understanding the obstacles women face in the postpartum period is clinically relevant and clinicians are increasingly interested in understanding how qualitative insights can be used in healthcare. In this instance, if healthcare professionals have a better appreciation of women's health needs postpartum, they can offer more appropriate resolutions and guidance to allow greater participation in PA.

Evenson et al. [23] collected data at both three and twelve months postpartum. This allowed a greater insight into the change in barriers and enablers to PA over this period. The information is significant for PA interventions, as interventions targeting postpartum women may need to be structured slightly differently at different times. For instance, 'baby reasons' such as caring for the baby or their feeding schedule was a greater barrier to PA at three

months than at 12 months. However, 'baby reasons' that facilitated PA (such as the baby being older or not being breastfed) increased from 10.4% at three months to 32.3% at 12 months. Furthermore, childcare was recorded as a greater barrier at three months than 12 months, so it could be beneficial to provide an on-site childcare facility for PA interventions earlier in the postpartum period when baby reasons are more of a barrier. Alternatively, PA interventions which include the baby could be valuable and women would be able to feed their child, if needed.

Strengths and limitations of this review

Several strengths and limitations have been noted. Firstly, by systematically comparing and discussing findings within the research team throughout the study selection and review processes, rigour is likely to be high. The selection approach identified six studies relevant to the aims of the review. However, the included studies took quite different approaches to data collection. Dixon-Woods et al. [45] suggested that studies should share a similar methodology if they are to be synthesized effectively, as difficulty developing theory can occur due to changes in their epistemological foundations, even in studies with similar themes. The online database search was limited to the English language and it was decided to exclude grey literature and alternative online sources such as Google Scholar. These decisions may have resulted in relevant studies being missed.

Recommendations for future research

Studies had either a sample of participants from a small geographic area [16,23,24,26], a large majority of women of middle to upper socio-economic status [16,26,27] or stated that the participants were mostly well-educated with partners [25]. Therefore, future research

should aim to recruit postpartum women from a wider range of geographic areas, socio-economic statuses, ethnicities and backgrounds to increase the transferability of the findings.

Future prospective research investigating the barriers and enablers to PA at more than one point during the postpartum period would be useful. Evenson et al. [23] were the only selected study to do this, collecting data at three and 12 months postpartum. By researching the barriers and enablers at different postpartum time points, researchers might be able to identify the points at which women may return to PA. Evenson et al. [23] also suggested collecting data around the six week postnatal appointment period, as this is when postpartum care typically ends in the USA. Health issues can be more pertinent in the early postpartum period, such as urinary stress incontinence, vaginal bleeding and diastasis recti [46].

Saligheh et al. [25] proposed including participants with clinical conditions, such as postnatal depression, in future research. GDM was the only pregnancy-related health issue mentioned in the selected studies [26]. Incorporating other health problems related to pregnancy in future research could allow a greater understanding of the barriers and enablers to PA related to health as well as the biopsychosocial factors already identified, improving the transferability of the research. Participants with health conditions unrelated to pregnancy were part of the exclusion criteria for the SLR, but this could be included in the future to extend the research to further populations. However, it may be hard to differentiate between barriers and enablers to PA related to pregnancy or to other health condition(s).

Future research could be used to develop and evaluate postpartum PA interventions designed to increase participation levels towards international recommendations [14]. Saligheh et al. [25] suggested further research into postpartum lifestyle, which could allow better insight

into designing an appropriate intervention. Albright et al. [16] proposed developing an intervention using theoretically-driven concepts around the long-term benefits of PA, self-efficacy and social support. Such interventions could help to educate new mothers on the multi-faceted benefits of PA through practical interventions, online resources and via health professionals, thereby increasing participation levels in this at-risk population.

Conclusion

Overall, the review has provided an in-depth identification, critical appraisal and summary of the relevant evidence related to the biopsychosocial barriers and enablers to PA in the postpartum period. Lack of time and issues surrounding childcare were the most common barriers found in the selected studies. A common enabler was social support, with weight loss and improved mental wellbeing being reported as important benefits of PA. The selected studies all reached the conclusion that the data collected should be used to inform the development of PA interventions for postpartum women. Further research into postpartum lifestyle and the long-term benefits of such interventions is warranted.

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TABLE AND FIGURE HEADINGS

Table 1. List of search terms.

Table 2. Inclusion and exclusion criteria.

Table 3: Data extraction table.

Table 4: Critical appraisal using the CASP checklist [21]. ✓ = Yes; ✗ = No; ? = Can't

Tell.

Figure 1. Online database search inclusion/exclusion flow diagram. Adapted from PRISMA (Moher *et al.*, 2009).

TABLES AND FIGURES

Table 1. List of search terms.

Search 1	Search 2	Search 3	Search 4
Barriers Limitations Preventions Restrictions Hindrances	Enablers Facilitators Supporters Promoters Helpers Aids	Physical activity Sport Exercise Activity Fitness	Childbirth Postnatal Postpartum New mother Puerperium

Table 2. Inclusion and exclusion criteria.

	Inclusion Criteria	Exclusion Criteria
Study design	Qualitative studies.	Quantitative studies.
Population	Postpartum mothers (<2 years). All types of birth delivery. Mothers using any feeding method. Any age of mother. First-time mothers and those with previous children. Women having had multiple births. All countries.	During pregnancy. >2 years postpartum. Any other health conditions or illnesses unrelated to pregnancy.
Publication type	Published studies.	Unpublished studies. Dissertations.
Outcomes	Data related to biopsychosocial barriers and enablers to physical activity.	Data unrelated to biopsychosocial barriers and enablers to physical activity.

Table 3: Data extraction table. GDM = gestational diabetes mellitus, MET = Metabolic Equivalent Task, PA= Physical Activity, USA = United States of America.

Authors		Albright et al. [16]	Evenson et al. [23]	Groth & David [24]
Study Setting		Hawaii, USA	North Carolina, USA	New York, USA.
Purpose		To investigate PA and related psychosocial factors reported by new mothers.	To document self-reported beliefs, barriers and enablers to PA among a cohort of women at three months and twelve months postpartum.	To describe the attitudes and preferences of ethnically diverse new mothers on weight, exercise and walking as a form of exercise.
Study Method	Design	Socio-demographic survey. Moderator-guided group discussion using open-ended questions.	The Leisure-Time Exercise Questionnaire (frequency of exercise). Exercise Beliefs Questionnaire (Open-ended questions).	Home interview (five closed questions on beliefs about exercise and PA and two open-ended questions about barriers and enablers). Questionnaire (a): interview administered, assessing PA levels at both three months and twelve months postpartum. Questionnaire (b): take-home questionnaire given at 24-29 weeks' gestation, assessing PA levels three months before pregnancy and during first and second trimester <i>Note: Questionnaire (a) was collected at three and twelve months postpartum, but only the results from three months were used for analyses.</i>

	Data Collection	Comments anonymously listed on a flip-chart. Comments transcribed and coded into one of five themes based on socio-ecological categorization identified in previous studies.	Surveys returned within one week.	Response options of questionnaire (a) were collapsed into two categories ('agree' or 'disagree') for analysis. Interview transcripts were coded by two investigators and discrepancies resolved by consensus. Items were then grouped into meaningful categories using the socio-ecological framework.
	Recruitment Strategy	Through a non-profit community-based parenting organization	In continuity with the third phase of the Pregnancy, Infection and Nutrition (PIN3) Study which recruited Pregnant women at <20 weeks' gestation seeking prenatal care at clinics associated with the University of North Carolina Hospital. A subset group of postpartum women from the original study were recruited for data collection.	Racially and ethnically diverse women recruited in an outpatient setting in Rochester, New York.
	Sample Size (n)	79	530 <i>Note: The original sample at three months was n=670. Due to some participants becoming ineligible or dropping out between the two time points, only data reported from the participants who took part in the home interview at both time points was extracted for the review.</i>	49

Demographic Characteristics	Mean age/ Age range	Mean: 31.8 years Range: 18-45 years	Mean: 32 years Range: 25-39 years	<20 years: 2.9% 20-35 years: 71.5% ≥ 35 years: 25.6%
	Marital status	94% married	100% married	Partner: 90.7% Single: 9.3%
	Employment status	Not reported	Working: 75% (Full time: 54%, Part time: 21%) Professional job: 71% Educational job: 19% Service job: 10% On maternity leave: 68%	Employed: 52.2%
	Education	College graduate: 59%	Collegiate education: 73%	College graduate: 65.2% Less than or equal to high school graduate: 17.5% Technical school/college: 17.2%
	Number of children	45% of women had at least one other child.	First Time Mother: 97%	First child: 50%
	Ethnicity/ Nationality	Asian: 37.9% White: 36.7% Hawaii & Pacific Islanders: 13.9% Other: 11.3%	Caucasian: 92% Asian: 8%	Non-Hispanic white: 75% Non-Hispanic black: 14.9% Other: 10.1%
	Mean BMI	23.3kg/m ²	32kg/m ²	Low (<18kg/m ²): 0.5% Normal (18.5 - <25kg/m ²): 46.9% Overweight (25-<30 kg/m ²): 27.2% Obese (≥30kg/m ²): 25.5%
Time postpartum	Range: 2 months - 18 months	3 months and 12 months	Range: 4 days - 11.5 months	

Physical activity level	Active before pregnancy but inactive after childbirth (43%); Active before and after childbirth (22.7%); Inactive before and after childbirth (21.5%); Inactive before but active after childbirth (12.6%)	At 3 months: median 1.5 hours moderate to vigorous activity in the past week. At 12 months: median 1.6 hours moderate activity in the past week.	Not reported
Barriers	Personal issues (48%). Parenting duties (18%). Lack of support from spouse (13%). Sun exposure/hot weather (11%). Financial issue for those with an infant and older child (toddler) to buy a stroller to accommodate both (percentage not recorded).	Lack of time (47.0% at 3 months → 50.9% at 12 months). Lack of childcare (26.0% → 21.9%). Tiredness (11.5% → 12.6%). Baby related (8.3% → 3.8%). Health reason (4.3% → 3.0%). Weather (4.0% → 3.4%). Do not want/enjoy exercising (3.0% → 4.9%). Other children (3.8% → 3.2%). Already active (2.3% → 2.5%). Nursing Issues (2.3% → 0.0%). Overweight/obese (0.8% → 1.1%). Other (0.4% → 0.0%). Work or school (0.2% → 1.3%). Rather spend time with baby (0.2% → 0.9%). Lack of facilities (0.0% → 1.1%). Don't have anyone to be active with (0.0% → 0.8%). No reason (0.0% → 0.6%).	Children (28%). Inadequate time/too busy (16%). Illness/physical limitations (14%). Lack of childcare (8%). <i>Note: The study also looked at barriers specific to walking:</i> Health Problems (36%). Children (8%). Inadequate time/too busy (4%).

		Too expensive (0.0% → 0.4%).	
Enablers (including reported benefits)	<p>Social support for exercise and availability of childcare (especially from spouse) (36%).</p> <p>Identifying personal benefit (more energy, sleep better) (28%).</p> <p>Wanting to be a good role model for their baby or to take the baby 'out' (16%).</p> <p>Nice weather (12%).</p> <p>Receiving programme advice or counselling about how to start exercise programme via email or brief and scheduled telephone contact (percentage not recorded).</p> <p>PA including their infant passively or actively (percentage not recorded).</p> <p>Exercise with a 'buddy' or a group of other mothers (percentage not recorded).</p> <p>Attend a mothers' group which discusses ways to</p>	<p>Partner support for exercise (16% at 3 months → 9.6% at 12 months).</p> <p>Physical and mental well-being (14.3% → 9.4%).</p> <p>Family/social support (10.9% → 10.6%).</p> <p>Baby reasons (10.4% → 32.3%).</p> <p>Improve health (10.0% → 9.8%).</p> <p>Weight Loss (8.7% → 3.2%).</p> <p>Get stronger/toned (6.8% → 3.6%).</p> <p>Childcare (6.0% → 8.1%).</p> <p>Children want to go out (5.9% → 4.3%).</p> <p>New responsibilities (5.7% → 1.9%).</p> <p>Stress relief (4.2% → 2.6%).</p> <p>More time (3.6% → 6.6%).</p> <p>Weather (3.4% → 5.1%).</p> <p>Enjoyment (2.8% → 3.2%).</p> <p>Working/school (2.6% → 1.3%).</p> <p>Incentive, motivation (1.7% → 0.9%).</p> <p>Home exercise equipment (1.5% → 2.8%).</p> <p>Other (1.5% → 0.4%).</p> <p>Get baby outside (1.1% → 0.6%).</p> <p>No reason (1.1% → 0.6%).</p> <p>Walk dogs (0.9% → 0.4%).</p>	<p>Relieves stress (56%).</p> <p>Improves feelings about self (34%).</p> <p>Feel good (27%).</p> <p>Increases energy (18%).</p> <p><i>Note: The study also looked at enablers specific to walking:</i></p> <p>Schedule (36%).</p> <p>Walking with others (20%).</p>

	<p>become more active (percentage not recorded). Information on local resources/facilities that could accommodate infants (percentage not recorded). Information about economical home exercise equipment (percentage not recorded).</p>	<p>Training for exercise event (0.2% → 0.2%). Because of boredom (0.2% → 0.0%). Recovering from injury/pain (0.0% → 0.6%).</p>	
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Table 3 Continued: Data extraction table. GDM = gestational diabetes mellitus, MET = Metabolic Equivalent Task, PA= Physical Activity, USA = United States of America.

Authors		Saligheh et al. [25]	Symons Downs & Ulbrecht [26]	Symons Downs & Hausenblas [27]
Study setting		Western Australia	USA.	Connecticut, USA.
Purpose		To explore beliefs about and experiences of PA and exercise during the six weeks to twelve months postpartum period.	To examine the exercise beliefs and behaviors of postpartum women who had gestational diabetes mellitus (GDM) during a recent pregnancy.	To examine the frequency of women’s behavioral, normative, and control beliefs for exercising during their pregnancy and postpartum, and to determine their most salient beliefs.
Study method	Design	Survey measuring the facilitation of exercise participation, barriers and enablers. Home Interview: face to face, semi-structured, 45 minutes (guided by questions based on the socio-ecological framework).	Interview (face to face). Guided by a questionnaire reviewed by two experts, made of 18 open-ended questions.	The Leisure-Time Exercise Questionnaire (frequency of exercise). Exercise Beliefs Questionnaire (Open-ended questions).
	Data collection	Digitally recorded, transcribed and thematically analyzed. Discrepancies in coding discussed until consensus. Themes were refined, and sub-themes identified in relation to the socio-ecological framework.	Responses documented on the questionnaire.	Raw data themes were tabulated and categorized by beliefs types. Raw data themes were then organized into higher-order themes. To determine the most salient beliefs, a content analysis was conducted.
Recruitment strategy		Recruited from those who had indicated an interest in	GDM women within six months postpartum via nurse at GDM	Women within one year postpartum from a private

		continuing the study after a previous postpartum lifestyle and PA survey.	programme at a local medical practice.	practice physician specializing in obstetrics and gynecology.
Sample size (n)		14	28	74
Demographic characteristics	Mean age/ Age range	Mean: Not reported Range: 18-43 years	Mean: Not reported Range: 18-42 years (80% <30 years)	Mean: 31.3 years Range: 19-40 years
	Marital status	100% married	Not reported	86.5% married
	Working status	Employed full-time: 48% Employed part-time: 27% Employed casual: 26% On unpaid maternity leave: 53%	Not reported	Full time: 55.1%
	Education	Postgraduate degree: 35% Undergraduate degree: 25% College qualification: 40%	Not reported	College graduate: 44.6%
	Number of children	Second child: 100%	1 child: 44% 2 children: 24% 3+ children: 32%	Not reported
	Ethnicity	Australian: 60% British: 30%	Black: 49% Hispanic: 27% White: 24%	White: 81.1%
	Mean BMI	Not reported	Not reported	Not reported
Time postpartum		Range: 6 weeks - 12 months	< 6 months	Range: 6 days - 5 months

<p>Physical activity level</p>	<p>Three participants (21%) engaged in regular PA daily.</p>	<p>Using Leisure-Time Exercise Questionnaire (mean METs/week \pm SD): Pre-pregnancy = 23.94 \pm 20.00, Pregnancy = 22.04 \pm 15.38, Postpartum: 28.77 \pm 21.28. Days exercising/week (mean \pm SD) = 3.07 \pm 1.76. Minutes exercising (mean \pm SD) = 30.93 \pm 20.98. Proportion of participants currently meeting PA recommendations = 39%</p>	<p>Using Leisure-Time Exercise Questionnaire (mean METs/week): Strenuous Exercise (Pre-pregnancy = 13.81, Pregnancy = 3.38, Postpartum = 5.48); Moderate Exercise (Pre-pregnancy = 13.07, Pregnancy = 8.10, Postpartum: 6.50); Mild Exercise (Pre-pregnancy = 9.57, Pregnancy = 7.20, Postpartum = 6.38).</p>
<p>Barriers</p>	<p>Social isolation. Overwhelmed by motherhood responsibility. Lack of child support. Exhausted/lack of energy. Lack of motivation. Lack of appropriate exercise facilities. Lack of professional advice about exercise. Inconvenient class locations. Difficulty finding exercise partner. Lack of finance for classes or membership. Lack of time. ‘Age restrictions’.</p>	<p>No time (50%). Taking care of children (46%). Fatigue (20%). Other priorities (14%). Breast-feeding (7%). No access to exercise equipment (7%). Work (7%). <i>Note: Because some participants reported multiple beliefs, total is more than 100%.</i></p>	<p>Lack of time (time restraints) (48.6%). Physical limitations and restrictions (e.g. nausea, vomiting) (21.6%). Tiredness and fatigue/ no energy (13.5%). Fear of harming self (10.8%). No motivation/ feel lazy (8.1%).</p>

	<p>Poor body Image. Loss of confidence to join exercise class over time. Lack of information and support for post-natal classes. Lack of good quality exercise programme. Lack of programme targeting postpartum women specific needs.</p>		
Enablers (including reported benefits)	<p>Partner support. Physically active partner. Social network such as postnatal mothers groups. Classes involving the children. Achievable goals. Free classes. Crèche facilities at gym. Education about exercise and the class. Positive feeling after exercise. Scheduling exercise (into family routine). Postnatal exercise class.</p>	<p>Lose weight (61%). Get fit- endurance/muscle tone (29%). Have time for self (21%). Increase energy (11%). Decrease risk of type 2 diabetes (7%). Lower cholesterol (7%). <i>Note: Because some participants reported multiple beliefs, total is more than 100%.</i></p>	<p>Controls weight (37.8%). Assists with staying fit (36.5%). Improves overall mood (31.1%). Increases energy and stamina (29.7%). Decreases physical comfort: relieves cramps, soreness and swelling (4.1%). Provides stress reduction/relaxation (2.7%).</p>

Table 4: Critical appraisal using the CASP checklist [21]. ✓ = Yes, ✗ = No, ? = Can't Tell.

CASP Question	Albright et al. [16]	Evenson et al. [23]	Groth & David [24]	Saligheh et al. [25]	Symons Downs & Ulbrecht [26]	Symons Downs & Hausenblas [27]
1. Was there a clear statement of the aims of the research?	?	✓	✓	✓	✓	✓
2. Is a qualitative methodology appropriate?	✓	✓	✓	✓	✓	✓
3. Was the research design appropriate to address the aims of the research?	✓	✓	?	?	✓	✓
4. Was the recruitment strategy appropriate to the aims of the research?	?	✓	✗	?	✓	✓
5. Was the data collected in a way that addressed the research issue?	✓	✓	✓	✓	✓	✓
6. Has the relationship between researcher and participants been adequately considered?	✗	✗	✗	?	?	✓
7. Have ethical issues been taken into consideration?	✓	✓	✓	✓	✓	✓
8. Was the data analysis sufficiently rigorous?	?	?	?	?	✗	?
9. Is there a clear statement of findings?	?	✓	✓	?	✓	✓
10. How valuable is the research?	✓	✓	✓	✓	✓	✓

Figure 1. Online database and snowballing search inclusion/exclusion flow diagram.

Adapted from PRISMA (Moher *et al.*, 2009).

