



## Original Article

# Mental and physical support (MAPS) for moms: preliminary findings from a prenatal health support program<sup>☆</sup>

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## ABSTRACT

**Background:** The low incidence of exercise during pregnancy and the high rates of prenatal depression indicate more opportunities are needed for mothers to engage in exercise and obtain health-related support and education. MAPS (mental & physical support) was developed to support mothers' psychological and physical health during pregnancy. MAPS consisted of physical activity classes 2×/week followed by either a speaker or group discussion regarding a parenting or health-related topic. The primary purpose of this study was to determine if the format was feasible prior to developing a main scale randomized trial.

**Methods:** Program measurements included a pre/post survey, post-program focus group, attendance logs and scales for exercise, self-efficacy, and social support.

**Results:** Findings indicated the program format is well-received by participants; however, issues in attendance warrant program format alterations. Further, larger scale studies and the addition of a control group are needed.

**Conclusion:** This format offers practitioners an effective strategy for supporting pregnant women's physical and psychological health.

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## 1. Introduction

Supporting the health of a mother during pregnancy can have a critical influence on not only her health but also the health of her child.<sup>1</sup> A mother's psychological health is particularly vulnerable during pregnancy as approximately 14–23% of mothers struggle with depression during pregnancy.<sup>2</sup> There are numerous factors that can contribute to a pregnant mother's risk of depression including low self-efficacy for motherhood and a lack of support from family and friends.<sup>3–5</sup> One method that has been shown to improve maternal self-efficacy during pregnancy is improving education for childbirth and parenting related practices.<sup>3,6</sup> Quality childbirth education classes build confidence, address fears, and help mothers feel empowered when caring for their newborn.<sup>7</sup> In addition, education opportunities that occur in a group setting often provide pregnant mothers the ability to connect with other

pregnant mothers, thus helping to develop social support networks, a key contributor to positive mental health.<sup>8</sup>

Finding ways to support pregnant mothers' mental health is of paramount importance and often difficult as research has shown many mothers who exhibit signs or symptoms of depression will not obtain professional assistance and even fewer are willing to go on medication.<sup>9</sup> This has increased the need for treatment options that do not involve a pharmacological intervention. Physical activity is one such option as it has similar benefits for stress relief as the use of anti-depressant medications.<sup>10</sup> However, only 23% of pregnant mothers are engaging in the physical activity recommendations of being active 150 minutes per week.<sup>11,12</sup> Further, participation in physical activity tends to decrease throughout a woman's pregnancy.<sup>13</sup> This is even more concerning as regular physical activity during pregnancy has also been associated with physical benefits such as healthy weight gain, a decrease in back pain, and positive birth outcomes.<sup>13,14</sup>

Owing to the low incidence of physical activity during pregnancy and the high rates of prenatal depression, it is clear more opportunities are needed to support mothers in their ability to engage in physical activity and obtain health-related support and education. A health support program presents a natural avenue for delivering prenatal education along with physical activity. However, previous prenatal health support programs have only shown

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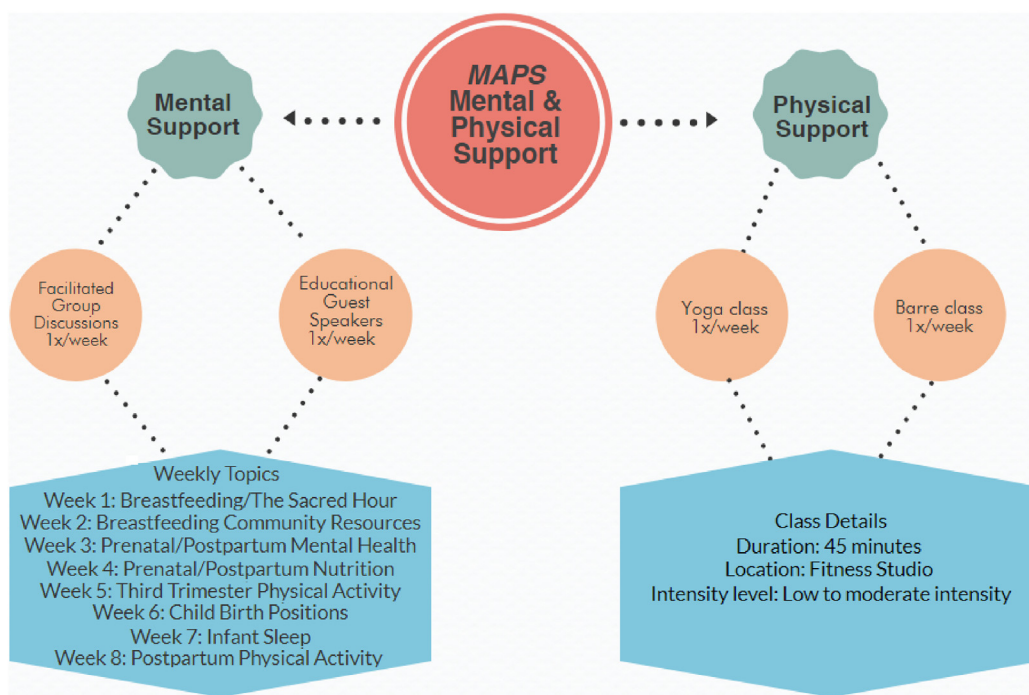


Fig. 1. Model of MAPS (mental and physical support).

modest results.<sup>15,16</sup> The development of a program utilizing theoretical insights can help strengthen a program and its likelihood for success.<sup>17,18</sup>

One theoretical framework that has been utilized in previous interventions is the self-determination theory (SDT). SDT is a theory of human motivation that holds there are three basic psychological needs that must be met to achieve motivation to engage in a behavior. These needs being, autonomy (control of oneself and one's behavior), competence (the ability and skills to engage in that behavior) and relatedness (support from those around them for that behavior).<sup>19</sup> Importantly, although SDT has been utilized in interventions designed to improve mothers' health, no interventions have been conducted under the constructs of SDT specifically for pregnant mothers. Thus, mental and physical support (MAPS) – was developed based on SDT to support mothers' psychological and physical health during pregnancy. The primary purpose of this study was to pilot MAPS and determine if the format was feasible prior to developing a main scale randomized trial. The secondary purpose of the study was to determine if the program resulted in changes of maternal exercise self-efficacy and perceived social support.

## 2. Methods

MAPS was developed to provide opportunities for mental and physical support for expecting mothers. Under the guidance of SDT, the program combined physical activity two times per week followed by an educational speaker or a group discussion. The program format was developed to support the basics needs of SDT, autonomy, competence, and relatedness. Specifically, it was believed that by providing education from experts and the utilization of a fitness instructor to teach mothers how to exercise would enhance their autonomy for engaging in healthy behaviors. In addition, the use of group fitness instructors and expert speakers could provide women with new knowledge and skills to enhance their abilities to engage in healthy behaviors helping them to feel competent in exercise and related health behaviors. Finally, the group setting and discussion opportunities were selected to meet

the need of relatedness. Further description of the program can be seen in Fig. 1.

The acronym was created by the lead author and discussed with colleagues and expectant mothers prior to program development. A process evaluation was used to monitor and document program implementation. Specifically, elements measured included: recruitment and retention; fidelity; dose delivered and received; engagement and acceptability.<sup>20</sup> Program participation was completely voluntary and reviewed by a University affiliated institutional review board. In addition, a safety and emergency protocol was developed for the fitness studio in which the program took place in collaboration with the University. The protocol provided details regarding how to proceed if a life-threatening or non-life threatening injury were to occur for an expectant mother. Finally, prior to participation mothers completed a medical release for physical activity known as the ParMed-X for pregnancy.<sup>21</sup> A physician's signature along with approval on the ParMed-X was required in order to enroll in the program. Once enrolled, women were asked to inform the lead researcher if their health status changed at any time and were also informed they could freely withdraw from the program at any time.

### 2.1. Participants

Researchers utilized purposive sampling to identify possible participants. Program flyers were shared by social media sites associated with pregnancy, breastfeeding, and pediatric clinics. Mothers were eligible to participate if they were within their second trimester of pregnancy at the program start, had completed, physician signed ParMed-X for pregnancy, and were not currently members of the fitness studio in which the program was to take place.<sup>21</sup> A total of 15 mothers were recruited for this pilot program.

### 2.2. Program development

Researchers met with a local fitness studio that specializes in prenatal and postpartum physical activity. The organization offered to serve as the study site and provide certified group exercise

**Table 1**  
Speaker Information

|        | Speaker                    | Credentials | Topic                             |
|--------|----------------------------|-------------|-----------------------------------|
| Week 1 | Pediatrician               | M.D., IBCLC | Breastfeeding/The Sacred Hour     |
| Week 2 | Breastfeeding Educator     | CLC         | Breastfeeding Community Resources |
| Week 3 | Psychologist               | LMHP, IBCLC | Prenatal/Postpartum Mental Health |
| Week 4 | Nutrition Coach            | AFPA NWC    | Prenatal/Postpartum Nutrition     |
| Week 5 | Group Exercise Instructor  | ACE, M.S.   | Third Trimester Physical Activity |
| Week 6 | Doula                      | DONA        | Childbirth Positions              |
| Week 7 | Pediatric Sleep Consultant | M.S.        | Infant Sleep                      |
| Week 8 | Group Exercise Instructor  | ACE, M.S.   | Postpartum Physical Activity      |

ACE, American Council of Exercise; AFPA, American Fitness Professionals Association; CLC, Certified Lactation Counselor; DONA, Doula National Association; IBCLC, International Board Certified Lactation Consultant; LMHP, Licensed Mental Health Professional; MD, Medical degree; MS, Master of Science; NWC, Nutrition and Wellness Consultant.

instructors to conduct the physical activity portion of the program at no cost. The 8-week program was developed to occur two times per week. To help determine the type of physical activity that should be offered, mothers were asked in a pre-program survey to report their current physical activity level. Results indicated no mothers were currently engaging in regular physical activity. The owner of the fitness studio was then consulted to determine what would be the best low-intensity options for non-regular exercisers in their second trimester of pregnancy. It was determined that a 45-minute barre class on Wednesdays followed by a 1-hour prenatal yoga class on Saturdays would be optimal.

The education and support components of the program were also developed based on feedback from the pre-program survey. To help determine the topics of interest, mothers were asked to report their reasons for wanting to participate based on five pre-designated answers determined as motives for participation in previous studies.<sup>22</sup> Mothers were also asked via an open-ended question to report what topics they would like more information on. Survey responses determined mothers wanted information pertaining to childbirth (28%), breastfeeding (22%), parenting practices (22%), nutrition (17%), and mental health (11%). The topics selected can be seen in Table 1.

Mothers also reported their reasons for participation. The most common reason cited was a desire for more physical activity (42%) followed by wanting more education on pregnancy and childbirth (23.5%) and wanting to meet other pregnant mothers (23.5%). See Fig. 2 for additional information.

The education component consisted of a guest speaker that would speak for approximately 20 minutes with 10 minutes left for questions immediately following the Wednesday barre class. The speakers also provided tangible takeaways including handouts and online resources to support the mother's health and well-being. After yoga on Saturdays, the group would engage in a discussion based on that week's speaker topic so that mothers could hear from other mothers and learn from their experiences. Mothers were

compensated for participating by receiving a \$25 Target gift card at the mid-point and end of the program.

2.3. Data collection & outcome measures

primary outcomes

Measurements were guided by the process evaluation how-to guide developed by Saunders and colleagues (2005) to assess recruitment, fidelity, delivery dose and received, engagement, and acceptability.<sup>20</sup> Data sources included a demographic questionnaire, post-program survey, a post-program focus group as well as an attendance log that was kept by a researcher that attended all program sessions. The demographic questionnaire obtained the following information: age, race/ethnicity, household income, number of children, and job status. The post-program survey and focus group were developed by two researchers and focused on elements related to Saunders and colleagues (2005) process evaluation as well as constructs of SDT.<sup>19,20</sup> The 29-question post-program survey was sent to the mothers electronically after the final class. The focus group consists of a total of 24 questions and all questions utilized open-ended responses. The focus group occurred in lieu of the final week's discussion after the second group exercise class in the 8<sup>th</sup> week. The focus group was audio recorded and transcribed verbatim utilizing transcription software. The attendance log was kept electronically by the primary investigator. After each class, the investigator recorded absences and reason for that absence as well as documented whether the class was delivered as intended. If the reason for absence was unknown, the investigator contacted the mother via text.

2.3.1. Secondary outcomes

As previous research has identified low social-support and low exercise self-efficacy as barriers to physical activity engagement during pregnancy, the secondary outcomes of this program were perceptions of social support and exercise self-efficacy.<sup>23,24</sup> Social

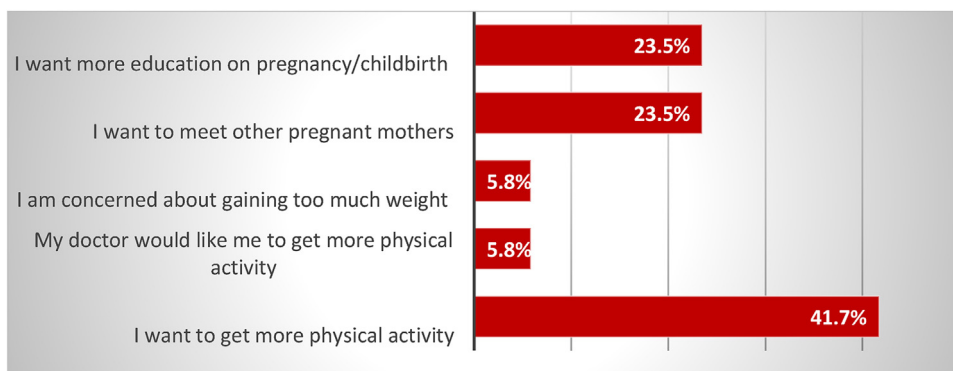


Fig. 2. Topics for future information.

support was measured via the multidimensional scale of perceived social support.<sup>24</sup> The 12-item instrument utilizes a likert scale for responses (1, very strongly disagree, 7, very strongly agree). Questions are divided into subscale groups related to the source of social support (i.e. significant other, family or friends). Scores are determined by developing a sum score for each factor group with higher scores indicating greater levels of perceived social support. This scale has been shown to have internal consistency with a Cronbach Alpha of 0.93.<sup>24</sup>

Exercise self-efficacy was measured via the self-efficacy for exercise scale (SEE).<sup>25</sup> This instrument has been demonstrated to be valid with lamda X estimates  $\geq 0.81$  as well as reliable ( $r = .92$ ). The 9-item instrument utilizes a likert scale of 0–10 (0, not confident, 10, very confident). Instrument scores are obtained by calculating sum responses with a higher score indicating greater self-efficacy for exercise. Both instruments were provided to mothers prior to the start of the program and following the last class.

#### 2.4. Statistical analysis

Quantitative measures were analyzed using SPSS software. Survey data were analyzed via a Wilcoxon Signed-rank test to compare differences between pre- and post-program responses. Feasibility characteristics were given numerical codes and analyzed as categorical variables. Qualitative data from the focus group were analyzed via the process of immersion and crystallization until common themes emerged. Finally, the post-program survey and focus group data were triangulated via simultaneous triangulation, the combination of qualitative and quantitative measures at the same time, to attempt to enrich the descriptions given from both measurements.<sup>26,27</sup> The survey's categorical variables and focus groups themes were analyzed for similarities by the lead researcher. These similarities were then discussed with another researcher to try to remove researcher bias. The categorical variables and themes that overlapped were then combined into a mixed-method theme.<sup>27</sup>

### 3. Results

#### 3.1. Primary outcomes

##### 3.1.1. Recruitment

Within 36 hours of posting program fliers on social media, 15 mothers reported interest in participating. Of those 15, all were eligible to participate and were provided further enrollment information and a copy of the ParMed-X form. At this time because of limited funding, enrollment was halted. Between program enrollment and program start (~5 weeks later) 5 mothers dropped out due to medical reasons ( $n = 2$ ), miscarriage ( $n = 1$ ), reported lack of time ( $n = 1$ ) or unresponsiveness ( $n = 1$ ). Of the 10 mothers remaining, the mean age was 30.1 years old (28–36), 100% were white with a mean household income between \$75,000–\$99,999. All mothers had at least one additional child and were employed at least part-time except for one mother that worked as a homemaker. By the end of week 3 of participation, 2 mothers were unable to be reached via phone or e-mail and another had dropped out due to medical concerns leaving a total of 7 mothers for the duration of the program.

##### 3.1.2. Fidelity

Program-generated data obtained from the attendance log and program event tracking by the lead researcher determined that the program protocol was followed for the entire 8 weeks with the exception of 1 class which was cancelled due to winter weather conditions. In addition, there was 1 instance in which the lead researcher had to fill-in for one of the weekly speakers when

the speaker cancelled last minute. Another aspect noted was the duration of the program. The group fitness component lasted approximately 45 minutes for the barre class and one hour for the yoga class followed by 30 minutes for the speaker or discussion. However, the speaker component averaged a duration of 42 minutes and the discussion component averaged a duration of 35 minutes.

##### 3.1.3. Dose delivered and received

The program had a duration of 8 weeks with a total of 16 classes. With the exception of the cancellation for winter weather, the program was offered as planned. However, although the program was being offered as planned, mothers' attendance influenced the amount of the program they received. Overall attendance by the 7 participating mothers was 57% with an average of 4 mothers at each class. Absence reasons were typically related to illness (57.2%) or scheduling issues (i.e. had a work event) (42.8%). Interestingly, when mothers were asked in the post-program survey to report their estimated absences 4 mothers reported 0–2 absences despite the attendance log indicating they had actually had at least 4 absences.

##### 3.1.4. Engagement and acceptability

The post-program survey asked mothers to provide an overall satisfaction score between 1 and 10 for the program of which the mean response was a 9.5 indicating high satisfaction. A general theme that emerged from the focus group was high satisfaction ( $n = 7$ ) in regard to the frequency of the program (2 times per week) and the balance between 2 physical activity sessions with 1 speaker per week and 1 discussion time.

Within the focus group, all mothers noted a theme of enjoyment ( $n = 7$ ) in the physical activity portion of the program. Specifically, 5 out of 7 mothers reported they enjoyed yoga more than barre; however, the other 2 mothers felt yoga was not challenging enough and enjoyed the higher intensity of the barre class. There was also a common theme found within both the survey and focus groups regarding liking to have a scheduled time for physical activity ( $n = 3$ ). As one mother said, "I liked having forced physical activity when I would probably not do it on my own during this time in my pregnancy".

In regard to the education component of the program, all mothers reported a theme of high satisfaction ( $n = 7$ ) and most reported an increase in knowledge from the speakers ( $n = 6$ ). As one mother reported, "the topics covered a variety of information and allowed for contacts that are in my area that I can go to or reach out to if I have questions or problems". Another mother said, "I think the speakers and examples they provided were great". The discussion component also resonated themes of satisfaction and enjoyment. As one mother said, "I liked giving and receiving advice from like-minded mothers" and another mentioned, "it was my favorite part".

Mothers were also asked if they would participate in a program like this again to which all mothers reported a unanimous yes. All mothers noted they would suggest such a program to a friend or family member. When asked if they would have paid for such a program 5 mothers noted yes with 1 mother specifying, "I feel like for 8 weeks of 2 classes a week and experts and discussion I would have paid like \$150 bucks and been really happy with what I got". Interestingly, 1 mother noted, "I wouldn't have done a program like this if it hadn't been at a place like [prenatal fitness studio] like if it had been at a YMCA or something I don't know, I just trust that the instructors are knowledgeable here and that's why I liked it".

##### 3.1.5. Recommendations from participants

Mothers had several recommendations for improvement. In regard, to physical activity, the most common request was more class options ( $n = 4$ ) followed by a request for a lower-intensity



**Table 2**  
Pre and Post Comparison of Social Support

| Source of support | N | Pre-Survey |     | Post-Survey |      | Z    | P     |
|-------------------|---|------------|-----|-------------|------|------|-------|
|                   |   | Mean       | SD  | Mean        | SD   |      |       |
| Significant other | 7 | 6.4        | 1.1 | 6.8         | 0.38 | -1.4 | 0.157 |
| Family            | 7 | 5.5        | 1.4 | 6.1         | 1.1  | -.73 | 0.468 |
| Friends           | 7 | 5.4        | 1.4 | 5.9         | 1.1  | -1.5 | 0.112 |

Wilcoxon Signed Rank Test.

option instead of barre ( $n=3$ ). For the education component, 6 mothers had no recommendations for improvement and 1 reported she would have liked to have 2 weeks dedicated to childbirth education. In addition, during the focus group 1 mother suggested having the option to invite their husbands to the speakers to which many mothers agreed ( $n=4$ ). As she noted in regard to the topic of mental health, “it’s difficult enough for us to tell our husbands how we are feeling, if they were able to hear it from a professional it could really help”. Finally, for the discussion portion of the program, a recommendation of a social media group (e.g. Facebook group) was made to help moms stay in contact outside of the program and ask one another questions as they arise. As one mom explained, “maybe offer more questions or topics that we each had to answer on a Facebook group or e-mail thread for us to get to know each other more and continue our community after the program is over”.

### 3.2. Secondary outcomes

#### 3.2.1. Multidimensional scale of social support

When comparing the pre and post survey responses, mothers reported more support received from their significant other, family and friends in the post-program measurement. In regard to significant others, mothers reported a lower mean scale score ( $6.4 \pm 1.1$ ) in the pre-program scale than in the post-program scale ( $6.8 \pm 0.38$ ). The same can be seen for their responses regarding family support (pre:  $5.5 \pm 1.4$ ; post:  $6.1 \pm 1.1$ ) and support from friends (pre:  $5.4 \pm 1.1$ ; post:  $5.9 \pm 1.1$ ). Further, when measuring the scale scores for overall support the Wilcoxon Signed Rank Test along with a Cohen  $d$  effect size analysis indicates these changes were significant with a small effect ( $Z=-2.098$ ,  $p<.05$ ,  $d=.35$ ). However, when evaluating these differences by significant other, family and friends the changes were not significant. See Table 2 for additional findings.

#### 3.2.2. Exercise self-efficacy scale

Of the nine factors utilized to assess exercise self-efficacy six factors demonstrated significant differences between the pre and post survey. Specifically, negative differences were seen from pre to post for mothers’ self-efficacy for exercise when facing factors related

to boredom with the exercise program, lack of enjoyment in exercise, busyness, tiredness, stress and depression. When evaluating the total score of the scale, mothers had lower exercise self-efficacy overall after the program ended. The total mean score within the pre-survey was 27.8 and the post score total average was 25.44. The Wilcoxon Signed rank test and Cohen  $D$  test revealed this was a significant difference with a moderate effect ( $Z=-3.094$ ,  $p<.05$ ,  $d=.63$ ). See Table 3 for further details.

## 4. Discussion

MAPS offered a unique format that combined mothers’ needs for education and social support with physical activity opportunities. Our preliminary investigation suggests this format type is enjoyable and well received by mothers; however, its structure warrants some alterations to improve attendance rates. When considering the primary outcomes measured, a few key findings should be discussed. In regard to recruitment, the initial large response from eligible mothers was promising and confirms other interventions findings of social media as an effective recruitment tool.<sup>28</sup> Further, the ability to offer childcare during program sessions was helpful. However, the high rate of drop outs (46.7%) indicates recruitment strategies and overall program offerings should be adjusted in future studies. Researchers and practitioners working with pregnant populations – especially pregnant mothers with other children – may need to initially recruit a larger number of mothers to ensure appropriate size for program participation. Previous prenatal lifestyle interventions have utilized strategies such as, starting intervention sessions within 2 weeks of enrollment, offering transportation, providing food after sessions, or raffle prizes to improve attendance.<sup>29</sup> These should also be considered in addition to an online option for both the education and physical activity portions. Videotaping the speakers and group exercise classes and posting them to an online platform (e.g. Facebook) could allow women to obtain the program information even if unable to attend. Further, the utilization of a social media group (e.g. Facebook group) could also help facilitate relationships between the mothers in hopes of improving attendance and enhancing perceptions of social support.

**Table 3**  
Pre and Post Comparison of Exercise Self-Efficacy Scale

| Item                                                 | Pre  |     | Post |      | Z     | p     |
|------------------------------------------------------|------|-----|------|------|-------|-------|
|                                                      | Mean | SD  | Mean | SD   |       |       |
| The weather was bothering you                        | 5.3  | 1.6 | 7.3  | 1.8  | -1.4  | 0.157 |
| You were bored by the program <sup>*</sup>           | 7.7  | 1.5 | 4.3  | 2.6  | -2.1  | 0.03  |
| You felt pain when exercising                        | 6.3  | 2.9 | 4.2  | 2.3  | -.647 | 0.518 |
| You had to exercise alone                            | 4.7  | 2.8 | 5.2  | 3.4  | -1.89 | 0.059 |
| You did not enjoy it <sup>*</sup>                    | 7.8  | 2.7 | 2    | 0.89 | -2.04 | 0.041 |
| You were too busy with other activities <sup>*</sup> | 6    | 3.8 | 3.5  | 2.1  | -2.01 | 0.044 |
| You felt tired <sup>*</sup>                          | 6.1  | 1.6 | 5    | 1.5  | -2.07 | 0.038 |
| You felt stressed <sup>*</sup>                       | 7    | 2.1 | 4.3  | 2.4  | -2.23 | 0.026 |
| You felt depressed <sup>*</sup>                      | 7    | 2.4 | 3.5  | 2.5  | -2.04 | 0.041 |

Paired T-test.

<sup>\*</sup> Denotes significant finding at  $p<0.05$ .

When considering the fidelity aspects of the program, with the exception of the weather-related cancellation, the program's protocol was followed suggesting the program duration and structure to be effective. For the education component of the program, mothers reported enjoyment and satisfaction in the speakers and an increase in knowledge obtained during the program. The duration of one speaker per week was satisfactory, and only one mother had a recommendation for improvement which involved an increase in the amount of time spent on childbirth specific topics. Interestingly, as part of this pilot grant, we were able to offer a \$10 gift card to all speakers; however, all speakers offered of their own volition that they would have been happy to speak for free. The subject matter appears to be a passionate topic for community members and it was not difficult to find speakers. Also, although the educational speakers often went past the designated duration of 30 minutes, no mothers complained about the length of the speaker in the survey or focus group. Future programs could further evaluate fidelity by measuring perceptions of the speakers on a weekly basis via a short-survey provided to the mothers at the end of class. This would allow for a better understanding of if the mothers felt the speaker addressed the topic effectively.

Finally, when evaluating dose and engagement the largest issue at hand was the poor attendance. The underestimation of absence rates by mothers indicates they may be unaware of their absence issues. As mentioned previously, the addition of online components could allow for greater opportunities for participation. Also, per the focus group the mothers recommended an additional fitness and discussion opportunity be added in future trials so that mothers can have a third option when trying to attend two times per week. To further enhance engagement ensuring enjoyment of the physical activity type is important. As mothers were split between which activity type/intensity they enjoyed most – yoga or barre – providing several options at varying intensities.

When considering the secondary outcomes measured, the discussion of the influence this program has on exercise self-efficacy and social support should be limited due to the small sample size. Instead, it is important to recognize that the use of surveys proves a valuable tool for program assessment as all mothers were able to complete the surveys before and after the program and qualitatively, no mothers reported any issues with survey completion. The authors would like to recommend the utilization of the pregnancy self-efficacy scale (P-ESES) for future program trials as it has been validated specifically in pregnant populations.<sup>30</sup> In addition, the use of additional subjective measures such as an exercise enjoyment scale may also be beneficial.<sup>31</sup> Further, future trials should consider the utilization of objective measures. For instance, providing the mother with a fitness tracker could provide valuable insight into actual changes in their activity outside of the program. Importantly, as mothers reported via the focus group a desire to exercise in settings specifically designed for pregnant mothers (e.g. prenatal fitness studios versus community fitness centers), future interventions should also be sure to consider the setting in which the exercise is taking place.

In regard to the measurement of social support, the focus group and social support scale indicated the program increased perceptions of social support; however, these findings must be interpreted with caution given the small sample size. Further, the previous recommendation of the addition of a social media component to the program might allow for even greater improvement in perceptions of social support.

It is paramount to recognize the strengths and weaknesses of this pilot study. This program was strengthened by the use of pilot testing, as preliminary testing of program feasibility will allow alterations to be made prior to a larger trial. This study uncovered issues that would not have been previously anticipated such as the low attendance and will allow the researchers to redesign the study

to target these issues. This program was weakened by the high dropout rate and results could have been different if attendance had been better. This also weakened the strength of the quantitative measures evaluating changes in social support and exercise self-efficacy. In addition, our study had low diversity among participants as all participants were white mothers with a household income between \$75,000 and \$99,000. As research shows, white mothers of a high socioeconomic status often deal with less barriers to engaging in physical activity when compared with other populations. Future trials should evaluate additional minority and socioeconomic groups to help determine if there are specific barriers within other populations.<sup>32</sup> Further, this study was weakened by the use of purely subjective measures. In the regard to the measurement of physical health, the addition of objective study measurements such as accelerometers or other wearable devices to measure physical activity before and after the program would be beneficial.<sup>33</sup> In regard to mental health measures, the addition of a tool such as the Edinburgh Postnatal Depression Scale, which has been validated in pregnant populations could provide greater insight into participants' mental health status and thus allow program leaders to adjust the education and discussion opportunities accordingly.<sup>34</sup> However, use of such a tool should be utilized with caution and it is recommended that a psychologist or mental health expert be consulted when utilizing this instrument. Finally, the lack of use of a control group was a limitation and should be utilized in future studies.

The combination of mental and physical support opportunities appear feasible and well received. Although previous interventions have demonstrated success in improving health outcomes in a group exercise or group education setting this is one of the first programs to combine physical activity, education and social support.<sup>35</sup> MAPS offers an opportunity for mothers to engage in multiple healthy behaviors simultaneously and is an enjoyable experience. Practitioners could consider utilizing the MAPS format when creating future interventions targeted at changing prenatal health behaviors. This could also be a useful format for conducting childbirth education in hospital and community settings. Many hospitals already have childbirth education programs created that span over multiple weeks. The addition of physical activity opportunities and facilitated discussions could prove an effective strategy for supporting maternal well-being. Further, the fact that the mothers in this study indicated they would have paid for this type of programming is positive. Although we recognize their high socioeconomic status may help this decision, this does suggest this program format can be sustainable beyond grant funded opportunities. Next steps should include adjusting the format based on these findings and developing a next phase with the addition of a control group for a randomized control trial. When considering the number of live births in the United States (3,945,875) a sample size calculator with a 95% confidence level and 5% margin of error indicates an ideal sample size for a large scale trial to be 385 mothers.<sup>36</sup> The further exploration of maternal health and well-being via programs such as MAPS can help researchers and practitioners on their quest to determine the best way to support the health of a mother and her future child.

### Conflict of interest

The authors have no conflicts of interest to disclose.

### References

1. Requejo J, Bryce J, Barros AJ, Berman P, Bhutta Z, Chopra M, et al. Countdown to 2015 and beyond: fulfilling the health agenda for mothers and children. *Lancet* 2015;385:466–76.

2. Committee on Obstetric Practice. The American College of Obstetricians and Gynecologists Committee Opinion no 630. Screening for perinatal depression. *Obstet Gynecol* 2015;125:1268.
3. Fathi F, Mohammad-Alizadeh-Charandabi S, Mirghafourvand M. Maternal self-efficacy, postpartum depression, and their relationship with functional status in Iranian mothers. *Mothers Health* 2018;58:188–203.
4. Kim DR, Epperson CN, Weiss AR, Wisner KL. Pharmacotherapy of postpartum depression: an update. *Expert Opin Pharmacother* 2014;15:1223–34.
5. Milgrom J, Gemmill AW, Bilszta JL, Hayes B, Barnett B, Brooks J, et al. Antenatal risk factors for postnatal depression: a large prospective study. *J Affect Disord* 2008;108:147–57.
6. Serçekuş P, Başkale H. Effects of antenatal education on fear of childbirth, maternal self-efficacy and parental attachment. *Midwifery* 2016;34:166–72.
7. Stoll K, Hall W. Childbirth education and obstetric interventions among low-risk Canadian mothers: is there a connection? *J Perinat Educ* 2012;21:229.
8. Toughyani R, Ramezani M, Izadi M, Motie Z. The effect of prenatal care group education on pregnant mothers' knowledge, attitude and practice. *Iran J Med Educ* 2008;7:317–24.
9. Dennis C, Chung-Lee L. Postpartum depression help-seeking barriers and maternal treatment preferences: a qualitative systematic review. *Birth* 2008;33:323–31.
10. Daley A, Winter H, Grimmett C, McGuinness M, McManus R, MacArthur C. Feasibility of an exercise intervention for mothers with postnatal depression: a pilot randomised controlled trial. *J Gen Pract* 2008;58:178–83.
11. Hesketh K, Evenson K. Prevalence of US pregnant mothers meeting 2015 ACOG physical activity guidelines. *Am J Prev Med* 2016;51:e87–9.
12. Nascimento S, Surita F, Godoy A, Kasawara K, Morais S. Physical activity patterns and factors related to exercise during pregnancy: a cross sectional study. *PLoS ONE* 2015;10:e0128953.
13. Gaston A, Cramp A. Exercise during pregnancy: a review of patterns and determinants. *J Sci Med Sport* 2011;14:299–305.
14. Mudd L, Owe K, Mottola M, Pivarnik J. Health benefits of physical activity during pregnancy: an international perspective. *Med Sci Sports Exerc* 2013;45:268–77.
15. Perales M, Santos-Lozano A, Ruiz JR, Lucia A, Barakat R. Benefits of aerobic or resistance training during pregnancy on maternal health and perinatal outcomes: a systematic review. *Early Hum Dev* 2016;94:43–8.
16. Flynn A, Dalrymple K, Barr S, Poston L, Goff L, Rogozińska E, et al. Dietary interventions in overweight and obese pregnant mothers: a systematic review of the content, delivery, and outcomes of randomized controlled trials. *Nutr Rev* 2016;74:312–28.
17. Seneviratne S, McCowan L, Cutfield WS, Derraik J, Hofman P. Exercise in pregnancies complicated by obesity: achieving benefits and overcoming barriers. *Am J Obstet Gynecol* 2015;212:442–9.
18. Bartholomew L, Parcel G, Kok G. Intervention mapping: a process for developing theory and evidence-based health education programs. *Health Educ Behav* 1998;25:545–63.
19. Ryan R, Patrick H, Deci E, Williams G. Facilitating health behaviour change and its maintenance: interventions based on self-determination theory. *Eur Health Psychol* 2008;10:2–5.
20. Saunders R, Evans M, Joshi P. Developing a process-evaluation plan for assessing health promotion program implementation: a how-to guide. *Health Promot Pract* 2005;6:134–47.
21. Wolfe L, Mottola M. *PARmed-X for pregnancy*. vol. 1. Ottawa: Canadian Society for Exercise Physiology; 2002:4.
22. Gattly H, Axinn W. Willingness to participate in research during pregnancy: race, experience, and motivation. *Field Methods* 2012;24:135–54.
23. Bauer P, Pivarnik J, Feltz D, Paneth N, Womack C. Relationship of past-pregnancy physical activity and self-efficacy with current physical activity and postpartum weight retention. *Am J Lifestyle Med* 2014;8:68–73.
24. Zimet G, Dahlem N, Zimet S, Farley G. The multidimensional scale of perceived social support. *J Pers Assess* 1988;52:30–41.
25. Resnick B, Jenkins L. Testing the reliability and validity of the self-efficacy for exercise scale. *Nurs Res* 2000;49:154–9.
26. Jick T. Mixing qualitative and quantitative methods: triangulation in action. *Adm Sci Q* 1979;24:602–11.
27. Morse J. Approaches to qualitative-quantitative methodological triangulation. *Nurs Res* 1991;40:120–3.
28. Korda H, Itani Z. Harnessing social media for health promotion and behavior change. *Health Promot Pract* 2013;14:15–23.
29. Gesell S, Katula J, Strickland C, Vitolins M. Feasibility and initial efficacy evaluation of a community-based cognitive-behavioral lifestyle intervention to prevent excessive weight gain during pregnancy in Latina women. *Matern Child Health J* 2015;19:1842–52.
30. Bland H, Melton B, Marshall ES, Nagle J. Measuring exercise self-efficacy in pregnant women: psychometric properties of the pregnancy-exercise self-efficacy scale (P-ESES). *J Nurs Meas* 2013;21:349–59.
31. Kendzierski D, DeCarlo KJ. Physical activity enjoyment scale: two validation studies. *J Sport Exer Psychol* 1991;13:50–64.
32. Eyler A, Wilcox S, Matson-Koffman D, Evenson K, Sanderson B, Thompson J, et al. Correlates of physical activity among mothers from diverse racial/ethnic groups. *J Moth Health Gend-Based Med* 2002;11:239–53.
33. Troiano R, Berrigan D, Dodd K, Masse L, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc* 2008;40:181.
34. Kozinszky Z, Dudas RB. Validation studies of the Edinburgh Postnatal Depression Scale for the antenatal period. *J Affect Disord* 2015;176:95–105.
35. Brixval C, Axelsen S, Thygesen L, Due P, Koushede V. Antenatal education in small classes may increase childbirth self-efficacy: results from a Danish randomised trial. *Sex Reprod Healthcare* 2016;10:32–5.
36. Martin J, Hamilton BE, Osterman M, Driscoll A, Drake P. *Births: final data for 2016*; 2018.