

FACTORS INFLUENCING ATTITUDES TOWARD PHYSICAL ACTIVITY AND EXERCISE EDUCATION IN PREGNANT WOMEN

Varun Nukala, BS^a, Lisa Baute, MD^b, Maria V. Velasquez Hammerle, MD^a, Sabrina Neimark^a,
Michael Galetta, BS^a, Miho J. Tanaka, MD, PhD^a

^a Department of Orthopaedic Surgery, Massachusetts General Hospital, Harvard Medical School,
Boston, Massachusetts, U.S.A.

^b Department of Obstetrics and Gynecology, Massachusetts General Hospital, Harvard Medical School,
Boston, Massachusetts, U.S.A.

BACKGROUND: The aim of this study was to report on attitudes of pregnant women regarding exercise and exercise education, and to identify factors influencing their interest in receiving exercise education.

METHODS: A cross-sectional survey was completed by 134 women being evaluated during a routine obstetrical visit at Massachusetts General Hospital (Boston, MA). Self-reported information regarding demographics, physical activity participation, confidence in knowledge about pregnancy exercise guidelines, and interest in receiving information about exercise during pregnancy was obtained. Descriptive statistics were used to summarize the data. Multiple logistic regressions were performed to measure associations between patient characteristics and exercise decline, confidence, and interest.

RESULTS: Participants had a mean age of 33.6 ± 4.3 years, mean BMI of 27.9 ± 5.0 , and a mean gestational age of 26 ± 10 weeks. Reported level of physical activity decreased during pregnancy for 73.9 % of women. A significant association was found between higher pre-pregnancy physical activity (OR 2.00 [1.21-3.52], $p = 0.010$) and exercise decline. Significant, independent relationships were identified between increased confidence in exercise education and patient age (OR 0.89 [0.82-0.98], $p = 0.015$), nulliparity (OR 0.43 [0.21-0.86], $p = 0.060$), higher level of pre-pregnancy exercise (OR 1.73 [1.19-2.53], $p = 0.004$), and more education received from physicians (OR 1.94 [1.54-2.49], $p < 0.001$). Interest in education was associated with higher level of physical activity before pregnancy (OR 1.75 [1.21-2.57], $p = 0.004$) and lower amount of education received from physicians (OR 0.78 [0.63-0.97], $p = 0.025$).

CONCLUSION: Women commonly report a decline in exercise during pregnancy, particularly among women with high levels of physical activity prior to pregnancy. Attitudes toward pregnancy exercise education were found to be correlated with patient characteristics including age, nulliparity, level of physical activity before pregnancy, and education received from physicians. These associations can be used to identify target populations for future interventions.

INTRODUCTION

Exercise during pregnancy has been shown to be beneficial and safe for both the mother and the developing fetus.¹ Regular exercise at least three times a week has been shown to reduce the odds of excessive new-born birth weight.² A review of seventeen randomized controlled trials found that participation in weekly aerobic exercise regimens was associated with significant reductions in the risk of gestational hypertension and incidence of caesarean delivery.³ Furthermore, physical activity

during pregnancy has also been shown to be effective in managing glucose levels and reducing insulin usage among women with gestational diabetes.⁴⁻⁷ Exercise can also have beneficial impacts on mental health, and regular exercise during pregnancy has been shown to reduce the risk of postpartum depression.⁸⁻¹¹ Due to these factors, the American College of Obstetricians and Gynecologists (ACOG) recommends that pregnant women engage in aerobic and strength conditioning exercises throughout pregnancy while

consulting obstetric care providers about medical complications and individualized exercise recommendations.¹²

Despite demonstrated benefits of exercise, total level of physical activity tends to decrease during pregnancy.¹ Studies have found that walking as a form of physical activity increases during pregnancy, but participation in high intensity activities and competitive sports decreases.¹³⁻¹⁶ Levels of physical activity generally decrease as pregnancy progresses over the first, second, and third trimesters.^{15,17} Smoking has been found to be inversely correlated with levels of physical activity during pregnancy.^{13,18} Pre-partum physical activity has also been shown to impact changes in physical activity during pregnancy.^{13,15,16,19} A systematic review of ten studies found that attitudinal factors, such as self-efficacy and belief in the benefits of physical exercise, were positively associated with physical activity during pregnancy, suggesting that education may play an important role in optimizing physical activity levels during pregnancy.²⁰

Recommendations and interventions in healthcare settings can impact levels of physical activity among pregnant women. Women who were advised by healthcare providers to reduce physical activity or sports participation demonstrated decreased activity during pregnancy.¹⁶ A review of fourteen studies found that interventions such as counselling, structured exercises, and education can lead to increases in physical activity.²¹ However, further study is needed to identify factors influencing levels of activity and the most effective methods for intervention regarding exercise counselling.

The aim of this study is to measure changes in exercise during pregnancy, report on patient characteristics associated with changes in physical activity among pregnant women and explore how these characteristics influence attitudes toward exercise education. We also aim to identify the level of knowledge and attitudes toward pregnancy exercise guidelines and recommendations in this population.

METHODS

During the 2021-2022 academic year, a cross-sectional survey (Appendix) was distributed to women receiving obstetrical care in the Department of Obstetrics and Gynecology at Massachusetts General Hospital (Boston, MA). The survey was administered as an anonymous quality

improvement tool to patients in the waiting room and was exempt from IRB approval. Inclusion criteria were female patients who were currently pregnant and being evaluated at our institution for a pregnancy-related visit. Exclusion criteria were the lack of current pregnancy, or lack of completion of the questionnaire.

The questionnaire collected self-reported patient characteristics and demographic data, including age, height, weight, body mass index (BMI) in kg/m², gestational age, and patient gravidity and parity.

To assess changes in physical activity, patients were asked about the number of hours they spent exercising per week before and during pregnancy. Respondents also reported the types of physical activities they participated in, which were categorized into walking, running, cycling, strength training, flexibility (yoga, barre, Pilates), and high intensity activities (HIIT, team sports, martial arts).

On a scale of 1 to 7 (1 being “not at all” and 7 being “definitely”), respondents were asked to report the amount of education received from their physician about pregnancy fitness guidelines, confidence in their knowledge about pregnancy fitness guidelines, and their level of interest in receiving information about exercise recommendations during pregnancy. Patients were asked about the sources of information that they used to learn about pregnancy exercise recommendations and the resources they were interested in pursuing in the future. Respondents were also asked to list their top concerns during pregnancy and to rate how often they used tools such as social media, fitness apps, text notifications and calendar alerts.

Sample Size Calculation

In a previous study, Merckx et al. used logistic regression to examine factors associated with reduction in physical activity during pregnancy.¹⁶ They found a significant association between physical activity prior to pregnancy and reduction in physical activity during pregnancy (OR 1.78 (1.41-2.26), $p = 0.000$). To achieve an 80% statistical power for detecting an effect size of 1.78 on changes in physical activity during pregnancy with a 2-tailed Type I error rate of 5%, we determined that a sample size of 111 women would be necessary. The sample size calculation was performed using G*Power Version 3.1.9.2 (Dusseldorf, Germany).

Statistical Analysis

Descriptive statistics were used to summarize demographic and clinical data. McNemar's test was used to measure changes in the proportions of women participating in various categories of physical activity. A binary logistic regression model was used to measure predictors of decline in physical activity. Ordered multiple logistic regression models were used to measure associations between patient characteristics and levels of confidence and interest regarding exercise guidelines during pregnancy. A pairwise deletion approach was used to account for missing data during statistical analysis. Statistical significance

was set at $p < 0.05$. All analyses were performed using R version 4.2.2 (The R Foundation, Vienna, Austria) and Python Version 3.11.1 (Python Software Foundation, Wilmington, DE, USA).

RESULTS

The survey was completed by 134 women, among whom 116 provided answers to all questions. Patient characteristics and demographic information are summarized in Table 1. At the time of survey administration, patients had a mean age of 33.6 ± 4.3 years, a mean BMI of 27.9 ± 5.0 , and a mean gestational age of 26 ± 10 weeks.

Table 1. Patient Characteristics, N (%)

Variable	Total (n = 134)	Change in Physical Activity During Pregnancy N (%)		
		Decreased (n = 99)	Maintained (n = 31)	Increased (n = 4)
Age (n = 134)				
<25	4 (3.0)	4 (4.0)	0 (0.0)	0 (0.0)
25-29	14 (10.4)	9 (9.1)	4 (12.9)	1 (25.0)
30-34	59 (44.0)	43 (43.4)	15 (48.4)	1 (25.0)
≥35	57 (42.5)	43 (43.4)	12 (38.7)	2 (50.0)
BMI (n = 119)				
<18.5	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
18.5-24.9	35 (26.1)	23 (23.2)	12 (38.7)	0 (0.0)
25-29.9	47 (35.1)	36 (36.4)	9 (29.0)	2 (50.0)
≥30	37 (27.6)	27 (27.3)	8 (25.8)	2 (50.0)
Gestational Age (Weeks) (n = 130)				
0-9	3 (2.2)	0 (0.0)	2 (6.5)	1 (25.0)
10-19	39 (29.1)	27 (27.3)	10 (32.3)	0 (0.0)
20-29	32 (23.9)	36 (36.4)	8 (25.8)	3 (75.0)
≥30	56 (41.8)	47 (47.5)	9 (29.0)	0 (0.0)
Number of previous pregnancies (n = 134)				
0	70 (52.2)	55 (55.6)	12 (38.7)	3 (75.0)
1	31 (23.1)	23 (23.2)	7 (22.6)	1 (25.0)
≥2	33 (24.6)	21 (21.2)	12 (38.7)	0 (0.0)
Level of physical activity before pregnancy (n = 134)				
None	8 (6.0)	2 (2.0)	6 (19.4)	0 (0.0)
<1h per week	19 (14.2)	12 (12.1)	6 (19.4)	1 (25.0)
1-5h per week	73 (54.5)	56 (56.6)	15 (48.4)	2 (50.0)
5-10h per week	22 (16.4)	19 (19.2)	3 (9.7)	0 (0.0)
>10h per week	12 (9.0)	10 (10.1)	1 (3.2)	1 (25.0)

Among the study population, 52% of pregnant women had no prior pregnancies. Levels of physical activity decreased during pregnancy for 73.9% of women, remained the same for 23.1%, and increased among 3% of women.

Prior to pregnancy, the most common activities were flexibility (32.1%), walking (31.3%), running (27.6%), cycling (23.9%), and strength training (20.9%). During pregnancy, the most common

activities were walking (42.5%), flexibility (20.8%), cycling (16.4%), strength training (13.4%) and running (7.46%). Among activity types, McNemar's test found a statistically significant increase in the proportion of women who listed walking as a form of physical activity. There were significant decreases in the proportions of women engaging in running, cycling, strength training, flexibility, and high intensity exercises (Table 2).

Table 2. Changes in types of physical activity during pregnancy

Activity Type	No Change during pregnancy		Change during pregnancy		P-value
	Active	Not Active	Yes to No	No to Yes	
Walking	36 (26.9)	71 (53.0)	6 (4.5)	21 (15.7)	<0.001
Running	10 (7.5)	97 (72.4)	27 (20.1)	0 (0.0)	<0.001
Flexibility	21 (15.7)	94 (70.1)	15 (11.2)	4 (3.0)	<0.001
Cycling	21 (15.7)	101 (75.4)	11 (8.2)	1 (0.7)	<0.001
Strength Training	15 (11.2)	103 (76.9)	13 (9.7)	3 (2.2)	<0.001
High Intensity Activities	1 (0.7)	109 (81.3)	24 (17.9)	0 (0.0)	<0.001

On a 7-point Likert Scale, participants rated their confidence in knowledge about pregnancy fitness guidelines with a mean score of 4.93 ± 1.5 , and 37.3% of participants reported a score of 6 or 7 (Figure 1). Participants rated their interest in receiving information about pregnancy fitness guidelines with a mean score of 5.19 ± 2.0 , and 56.7% of respondents reported a score of 6 or 7 (Figure 2). The amount of education received from physicians received an average score of 4.20 ± 1.7 , with 23.9% of participants reporting a score of 6 or 7 (Figure 3).

When asked about methods used to obtain education regarding exercise/fitness guidelines during pregnancy, respondents listed reading online (61.9%), fitness videos (38.8%), and physician's office (36%) as their top three sources (Figure 4). The most frequently reported concerns during pregnancy were weight gain (43.3%), feeling out of shape (42.54%), and back pain (41.79%) (Figure 5). The resources that patients were most interested in receiving were discussions with physicians (41.8%), video instruction (26.9%), and reading materials (26.9%) (Figure 6).

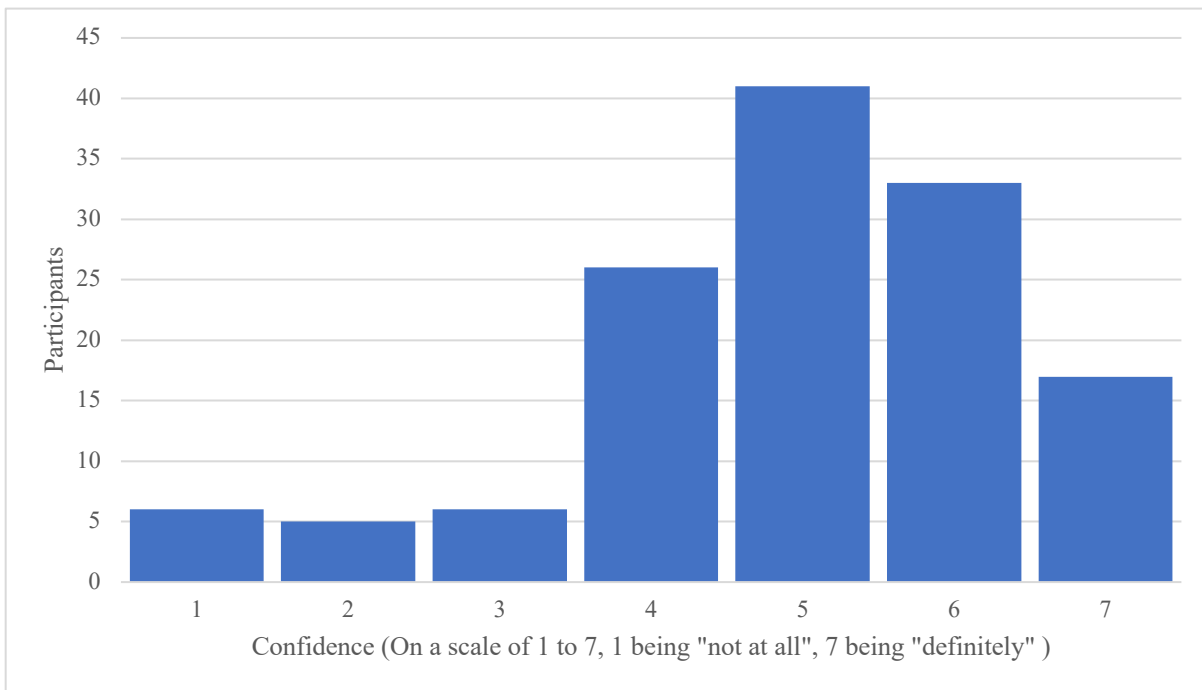


Figure 1. Reported confidence levels regarding knowledge about pregnancy exercise guidelines

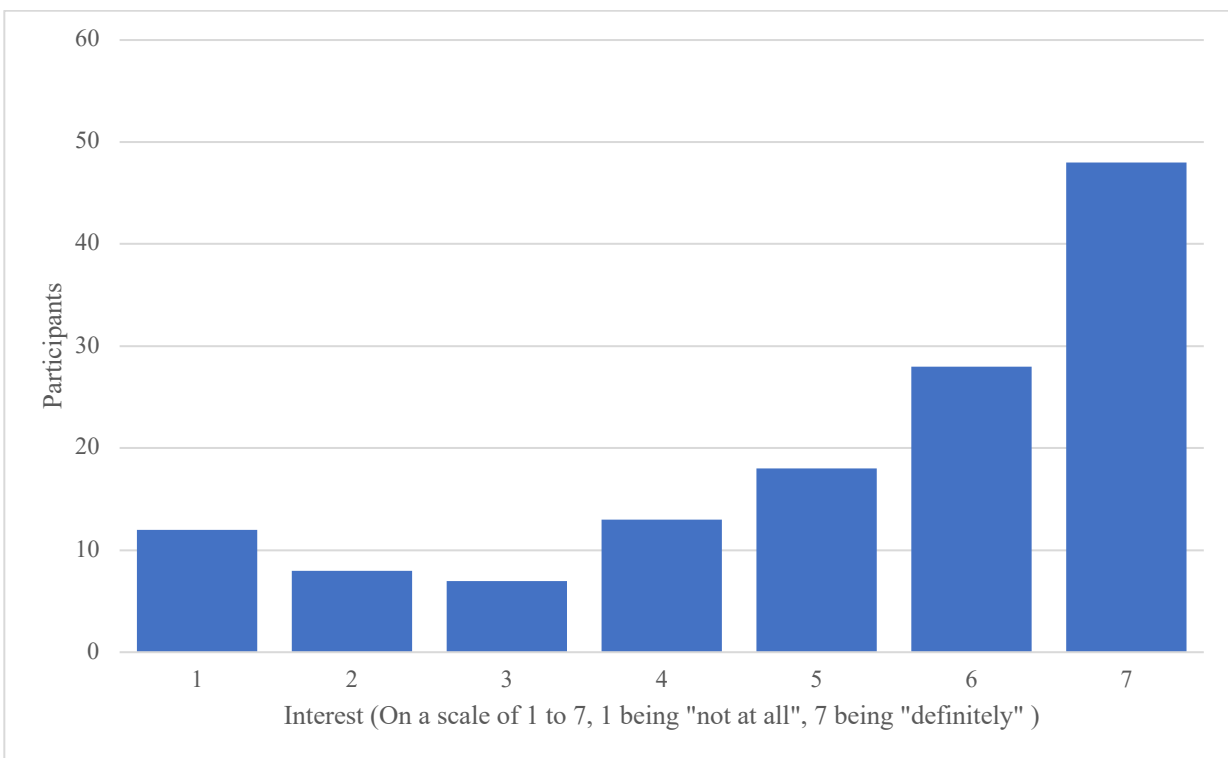


Figure 2. Reported interest levels in receiving further information about pregnancy exercise guidelines

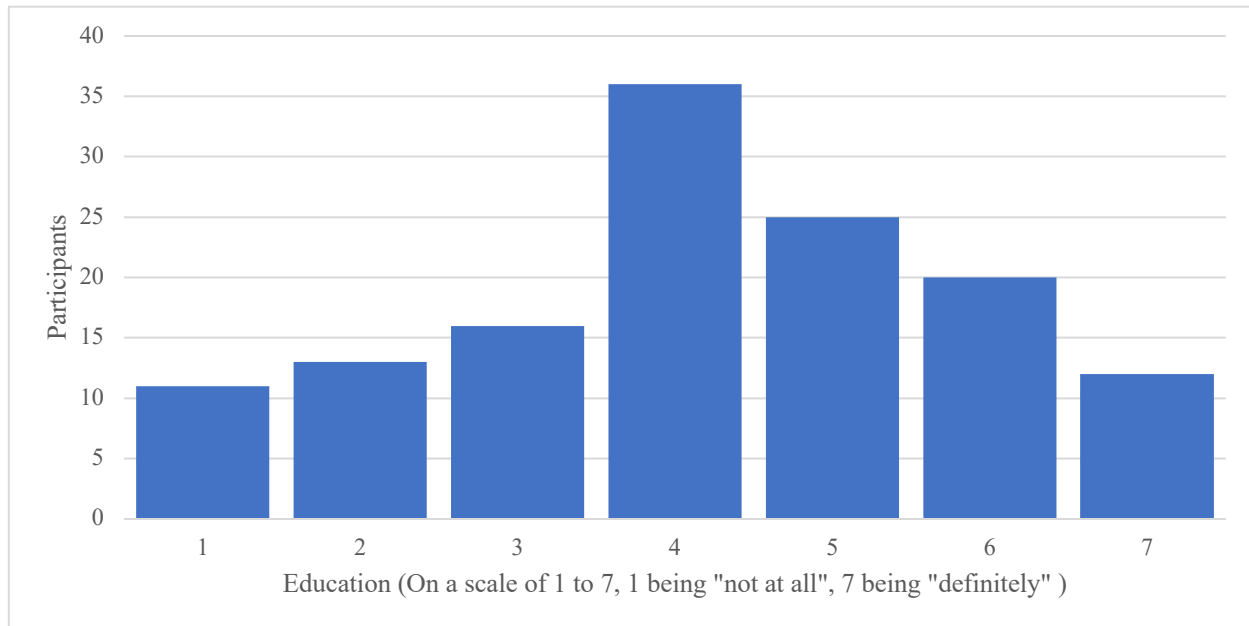


Figure 3. Reported education received from physician regarding exercise/fitness guidelines

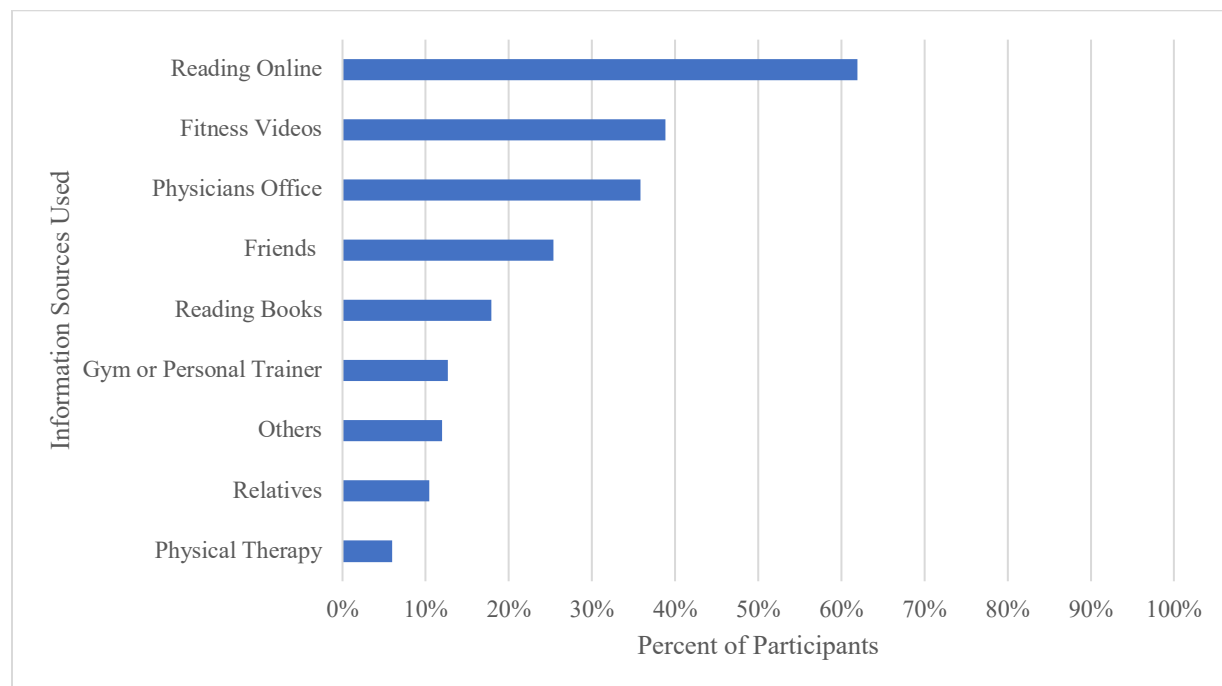


Figure 4. Sources used to obtain education regarding exercise/fitness guidelines during pregnancy

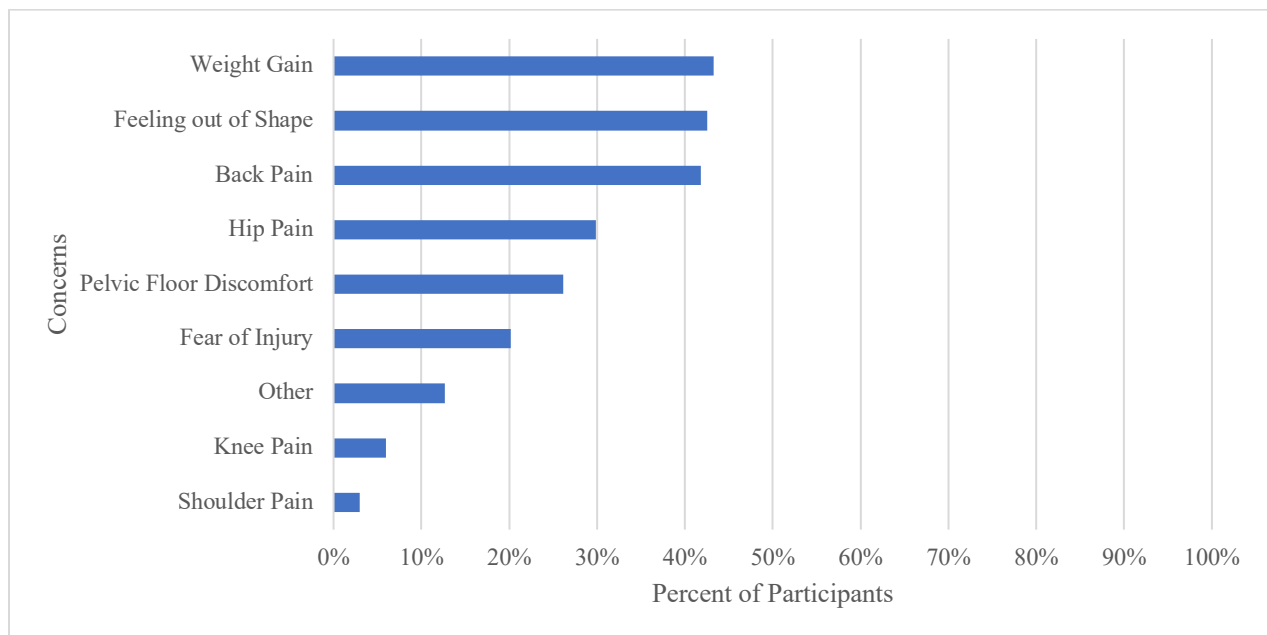


Figure 5. Concerns reported by participants during pregnancy

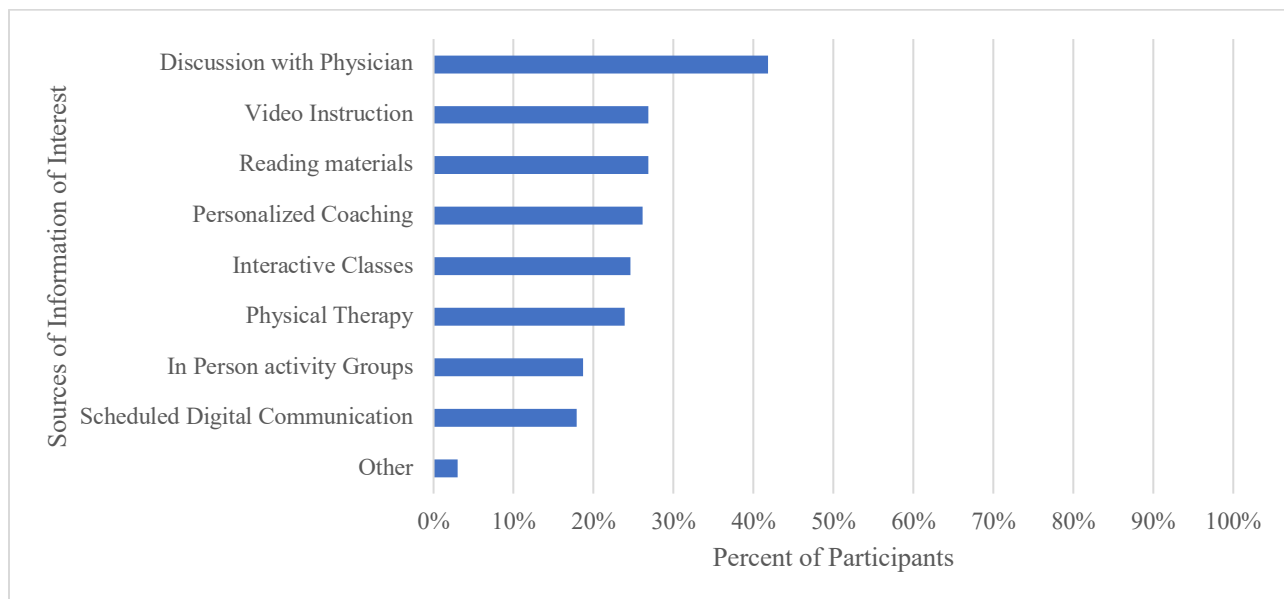


Figure 6. Information Sources that participants reported interest in receiving to help improve exercise/fitness activity levels

Participants were also asked to rate their usage of various technologies on a seven-point Likert scale. Social media received the highest rating with an average score of 5.42 ± 1.84 , and 50% of participants rated their usage of social media as a 6 or 7. Text notifications and calendar alerts received scores of

4.79 ± 2.16 and 4.80 ± 2.14, respectively. Fitness apps received the lowest rating, with an average of 2.86 ± 1.98 and 49.3% of women reporting a score of 1 or 2. Table 3 displays a binary logistic regression with exercise decline as the dependent variable. Women who reported a higher level of self-reported physical activity before pregnancy were more likely to experience decreases in their level of physical activity intra-partum (OR 2.00 [1.21-3.52], p = 0.010). Table 4 depicts an ordered logistic regression of

factors associated with confidence in knowledge about exercise guidelines during pregnancy. Higher levels of physical activity before pregnancy (OR 1.73 [1.19-2.53], p = 0.004) and greater amount of reported education received from physicians (OR 1.94 [1.54-2.49], p < 0.001) were positively associated with confidence. Nulliparity (OR 0.43 [0.21-0.86], p = 0.060) and older age (OR 0.89 [0.82-0.98], p = 0.015) were independently and negatively associated with confidence.

Table 3. Binary logistic regression model of factors associated with decline in physical activity during pregnancy

<i>Variable</i>	<i>Odds Ratio (95% CI)</i>	<i>P-value</i>
Age (Years)	0.99(0.89-1.11)	0.910
Body Mass Index (kg/m²)	1.00(0.91-1.10)	0.953
Gestational Age (Weeks)	1.04(1.00-1.09)	0.071
Nulliparous	1.56(0.63-3.97)	0.337
Level of Physical Activity Before Pregnancy	2.00(1.21-3.52)	0.010
Amount of education received from physician about pregnancy fitness guidelines	1.11(0.86-1.44)	0.426

Table 4. Ordinal logistic regression model of factors associated with confidence in knowledge about pregnancy exercise/fitness guidelines

<i>Variable</i>	<i>Odds Ratio (95% CI)</i>	<i>P-value</i>
Age (Years)	0.89(0.82-0.98)	0.015
Body Mass Index (kg/m²)	0.96(0.90-1.04)	0.314
Gestational Age (Weeks)	1.04(1.00-1.07)	0.060
Nulliparous	0.43(0.21-0.86)	0.019
Level of Physical Activity Before Pregnancy	1.73(1.19-2.53)	0.004
Amount of education from physician about pregnancy fitness guidelines	1.94(1.54-2.49)	<0.001

Table 5 presents an ordered logistic regression of factors associated with interest in receiving information about exercise and fitness guidelines during pregnancy. The analysis found that interest in receiving pregnancy exercise education was

positively associated with pre-pregnancy exercise levels (OR 1.75 [1.21-2.57], $p = 0.004$) and negatively associated with the amount of education received from physicians (OR 0.78 [0.63-0.97], $p = 0.025$).

Table 5. Ordinal logistic regression model of factors associated with interest in receiving information about pregnancy fitness guidelines

<i>Variable</i>	<i>Odds Ratio (95% CI)</i>	<i>P-value</i>
Age (Years)	1.03(0.94-1.13)	0.547
Body Mass Index (kg/m²)	0.97(0.90-1.04)	0.393
Gestational Age (Weeks)	0.98(0.95-1.02)	0.292
Nulliparous	1.22(0.61-2.41)	0.574
Level of Physical Activity Before Pregnancy	1.75(1.21-2.57)	0.004
Amount of education from physician about pregnancy fitness guidelines	0.78(0.63-0.97)	0.025

DISCUSSION

The most important finding of this study was that level of physical activity decreased among 73.9% of women in our sample and that higher level of pre-partum physical activity was positively associated with exercise decline. The overall decline in physical activity over the course of pregnancy is consistent with previous literature. Mitro et al. conducted a study of 2778 pregnant women, observing that the level of sports and exercise activity declined by 55% during pregnancy.¹⁹ In a study of 455 pregnant women, Merckx et al. found that 51.6% of women reduced their physical activity during pregnancy, 44.7% of women maintained the same level of physical activity, and 3.7% of women increased activity during pregnancy.¹⁶ They also found a significant, independent association between higher pre-pregnancy exercise level and reduction of physical activity during pregnancy.¹⁶ Studies have also shown that higher level of exercise prior to pregnancy is positively associated with greater overall level of exercise during pregnancy. In a study of 4718 nulliparous women, Hegaard et al. found that while women with high levels of pre-pregnancy exercise saw reductions in

physical activity, they maintained higher levels of physical activity relative to the overall study population.¹⁵ This suggests that, while women with high baseline levels of physical activity generally decrease their level of activity, their overall level of activity during pregnancy is still high relative to the average pregnant woman.

Women in our study were found to increase participation in walking as a form of physical exercise, but decreased participation in other exercise activities such as running, strength training, flexibility, cycling, and high intensity training. This pattern is consistent with previous studies on the topic, which have found that walking is the primary form of physical activity among pregnant women and that participation in high intensity activity generally decreases. In a study of 1175 pregnant women, Amezcua-Prieto observed increases in walking and decreases in other activities such as cycling and swimming.¹⁴ Lu et al. conducted a study of 2485 pregnant Chinese women and found that walking was the dominant form of physical activity during pregnancy.¹³ ACOG guidelines indicate that activities such as stationary cycling, aerobic exercises, resistance

exercises, and stretching exercise are safe and beneficial during pregnancy.¹² Thus, a future aim of potential interventions may be to understand why participation in these activities is declining and to ensure that women are informed about the safety and health benefits of these activities.

Participants rated their level of confidence in knowledge about pregnancy exercise guidelines an average of 4.93 ± 1.5 . Studies have suggested that self-efficacy among pregnant women is associated with the maintenance of physical activity.^{16,20} To our knowledge, the factors influencing confidence in knowledge about pregnancy guidelines have not previously been reported. In our analysis, older age and nulliparity were negatively associated with confidence. Women with previous pregnancies may be more confident due to their personal experiences and healthcare consultations during previous pregnancies. Women reporting high levels of physical activity before pregnancy were more confident about their knowledge of pregnancy fitness guidelines. However, the relationship between activity levels and exercise confidence during pregnancy must be further defined. We also found that the amount of education received from physicians about pregnancy fitness guidelines was associated with increased confidence among pregnant women but was unrelated to changes in activity level during pregnancy. This suggests that an increase in confidence resulting from physician advice may not always result in the maintenance of physical activity. Previous studies have demonstrated that although many pregnant women receive information about physical activity from healthcare providers, there is high variation within the nature of advice given. Hayman et al. found that among 70 women who received exercise advice during clinic visits, 34% reported discussing exercise frequency and 39% reported discussing exercise duration.²² Evins et al. found that among 130 women who received exercise counselling during pregnancy, 91.5% did not receive advice about exercise frequency.²³ Future investigations could seek to better understand the content of education received from physicians and the barriers patients may face in maintaining exercise levels.

Women rated their interest in obtaining further pregnancy exercise education as 5.19 ± 2.0 on a seven-point Likert scale. This is consistent with the work of Merckx et al., which found that on a seven-point Likert scale, women's average level of interest in seeking information about pregnancy was $5.1 \pm$

1.3 .¹⁶ Greater level of physical activity before pregnancy was strongly linked with interest in receiving information about pregnancy fitness guidelines. While previous studies have investigated the role of pre-partum exercise levels on changes in physical activity, this result sheds new light on the attitudes and interests of highly active pregnant women. Women who are athletes or who spend significant amounts of time on physical activity may be more motivated to learn about pregnancy fitness guidelines. Future interventions may consider developing specific recommendations for athletes and women with specific fitness goals.

We found that the amount of education received from physicians was negatively associated with interest in receiving exercise information. Previous research has found that education from healthcare providers can impact level of exercise during pregnancy and greater level of intent to exercise. In a study of 513 Italian pregnant women, Skjold et al. found that women who received advice from a doctor or midwife about exercise were significantly more likely to regularly engage in exercise.²⁴ Merckx et al. found that women who were advised to stop their favourite sport or activity were more likely to decrease their level of physical activity.¹⁶ Whitaker et al. found that among 188 pregnant women, there was a significant association between receipt of provider advice and intention to meet physical activity.²⁵ The findings of our study indicate that education from physicians may also impact the information-seeking behaviours of pregnant women. The reduction in interest in obtaining further exercise education among women who received information from physicians may have occurred because women felt the advice received was sufficient to meet their needs.

The sources of information most frequently used by pregnant women were reading online, fitness videos and the physician's office. These findings are consistent with the results of previous studies, which have found that women frequently consult the internet and healthcare providers during pregnancy. In a study of 293 pregnant and postpartum women, Huberty et al. found that over 44% had used the internet for pregnancy exercise education at least somewhat, and that 26% of the women had increased physical activity as a result.²⁶ In a study by Hayman et al. of 131 pregnant women, 53% reported receiving advice about exercise from

their healthcare providers.²² The sources of information identified as of greatest interest to the women in our study were discussions with physicians, video instructions, and reading materials. The use of these mediums as educational tools may be a potential target for future investigations and interventions.

This survey also examined how often pregnant women used tools such as social media, fitness apps, text notifications, and calendar alerts. Among these tools, social media was the most frequently used. This is consistent with previous research by Sercekus et al, which found that among 162 pregnant women, 58.1% used social media to gather information about childbirth.²⁷ Fitness apps received the lowest rating among tools surveyed. While past studies have examined the use of mobile applications among pregnant women, the levels of interest and usage of fitness focused apps require further investigation. In a cross-sectional study of 193 pregnant women, Lee et al found that 55% used mobile apps related to pregnancy or childbirth.²⁸ Hayman et al conducted a systematic search and content analysis of mobile apps designed to increase physical activity during pregnancy and found that apps scored high in functionality but had limited incorporation of evidence based behavioural change techniques.²⁹

This study has several methodological limitations. The survey was only available in English. Due to the nature of survey administration as a quality improvement study, an exact response rate was not calculated. Additionally, survey questions were developed by investigators to address the goals of this study and were not derived from validated questionnaires. Because information was self-reported, recall bias may have impacted participant responses. Levels of physical activity may have been impacted by the COVID-19 pandemic, which reduced access to public exercise facilities and may have created barriers that reduced the exercise levels of women in the study.

CONCLUSION

In our study, 73.9% of pregnant women reported declines in physical activity despite known benefits of exercise to maternal and fetal health. Patient characteristics such as increased physical activity prior to pregnancy, younger age, nulliparity, and lower levels of education from physicians can impact physical activity and attitudes toward exercise recommendations. These

factors can be used to identify target populations and design interventions to address the need for education regarding exercise during pregnancy.

Conflicts of Interest

The authors declare no conflicts of interest with the contents of this study.

Corresponding Author

Miho J. Tanaka, MD, PhD
Department of Orthopaedic Surgery
Massachusetts General Hospital
Harvard Medical School
175 Cambridge St. Suite 400
Boston, Massachusetts 02114
Telephone: 617-643-3866
Fax: 617-643-0808
E-mail: mtanaka5@mgh.harvard.edu

REFERENCES

1. Hinman SK, Smith KB, Quillen DM, Smith MS. Exercise in Pregnancy: A Clinical Review. *Sports Health*. 2015;7(6):527-531. doi:10.1177/1941738115599358
2. Owe KM, Nystad W, Bø K. Association between regular exercise and excessive newborn birth weight. *Obstet Gynecol*. 2009;114(4):770-776. doi:10.1097/AOG.0b013e3181b6c105
3. Magro-Malosso ER, Saccone G, Di Tommaso M, Roman A, Berghella V. Exercise during pregnancy and risk of gestational hypertensive disorders: a systematic review and meta-analysis. *Acta Obstet Gynecol Scand*. 2017;96(8):921-931. doi:10.1111/aogs.13151
4. Ruchat SM, Mottola MF. The important role of physical activity in the prevention and management of gestational diabetes mellitus. *Diabetes Metab Res Rev*. 2013;29(5):334-346. doi:10.1002/dmrr.2402
5. Wang C, Wei Y, Zhang X, et al. A randomized clinical trial of exercise during pregnancy to prevent gestational diabetes mellitus and improve pregnancy outcome in overweight and obese pregnant women. *Am J Obstet Gynecol*. 2017;216(4):340-351. doi:10.1016/j.ajog.2017.01.037
6. Liu J, Laditka JN, Mayer-Davis EJ, Pate RR. Does physical activity during pregnancy reduce the risk of gestational diabetes among previously inactive women?. *Birth*. 2008;35(3):188-195. doi:10.1111/j.1523-536X.2008.00239.x
7. Cordero Y, Mottola MF, Vargas J, Blanco M, Barakat R. Exercise Is Associated with a Reduction in Gestational Diabetes Mellitus. *Med Sci Sports Exerc*. 2015;47(7):1328-1333. doi:10.1249/MSS.0000000000000547

8. Kołomańska-Bogucka D, Mazur-Biały AI. Physical Activity and the Occurrence of Postnatal Depression- A Systematic Review. *Medicina (Kaunas)*. 2019;55(9):560. Published 2019 Sep 2. doi:10.3390/medicina55090560
9. Nakamura A, van der Waerden J, Melchior M, Bolze C, El-Khoury F, Pryor L. Physical activity during pregnancy and postpartum depression: Systematic review and meta-analysis. *J Affect Disord*. 2019;246:29-41. doi:10.1016/j.jad.2018.12.009
10. Gaston A, Prapavessis H. Tired, moody and pregnant? Exercise may be the answer. *Psychol Health*. 2013;28(12):1353-1369. doi:10.1080/08870446.2013.809084
11. Gjestland K, Bø K, Owe KM, Eberhard-Gran M. Do pregnant women follow exercise guidelines? Prevalence data among 3482 women, and prediction of low-back pain, pelvic girdle pain and depression. *Br J Sports Med*. 2013;47(8):515-520. doi:10.1136/bjsports-2012-091344
12. Physical Activity and Exercise During Pregnancy and the Postpartum Period: ACOG Committee Opinion, Number 804. *Obstet Gynecol*. 2020;135(4):e178-e188. doi:10.1097/AOG.0000000000003772
13. Lü Y, Feng Y, Ma S, Jiang Y, Ma L. Changes in physical activity across pregnancy among Chinese women: a longitudinal cohort study. *BMC Womens Health*. 2021;21(1):236. Published 2021 Jun 6. doi:10.1186/s12905-021-01377-3
14. Amezcua-Prieto C, Olmedo-Requena R, Jiménez-Mejías E, et al. Changes in leisure time physical activity during pregnancy compared to the prior year. *Matern Child Health J*. 2013;17(4):632-638. doi:10.1007/s10995-012-1038-3
15. Hegaard HK, Damm P, Hedegaard M, et al. Sports and leisure time physical activity during pregnancy in nulliparous women. *Matern Child Health J*. 2011;15(6):806-813. doi:10.1007/s10995-010-0647-y
16. Merckx A, Ausems M, Budé L, de Vries R, Nieuwenhuijze MJ. Factors affecting perceived change in physical activity in pregnancy. *Midwifery*. 2017;51:16-23. doi:10.1016/j.midw.2017.05.007
17. Evenson KR, Wen F. Prevalence and correlates of objectively measured physical activity and sedentary behavior among US pregnant women. *Prev Med*. 2011;53(1-2):39-43. doi:10.1016/j.ypmed.2011.04.014
18. Amezcua-Prieto C, Olmedo-Requena R, Jiménez-Mejías E, Mozas-Moreno J, Lardelli-Claret P, Jiménez-Moleón JJ. Factors associated with changes in leisure time physical activity during early pregnancy. *Int J Gynaecol Obstet*. 2013;121(2):127-131. doi:10.1016/j.ijgo.2012.11.021
19. Mitro SD, Peddada S, Gleason JL, et al. Longitudinal Changes in Physical Activity during Pregnancy: National Institute of Child Health and Human Development Fetal Growth Studies. *Med Sci Sports Exerc*. 2022;54(9):1466-1475. doi:10.1249/MSS.0000000000002947
20. Garland M, Wilbur J, Semanik P, Fogg L. Correlates of Physical Activity During Pregnancy: A Systematic Review with Implications for Evidence-based Practice. *Worldviews Evid Based Nurs*. 2019;16(4):310-318. doi:10.1111/wvn.12391
21. Currie S, Sinclair M, Murphy MH, Madden E, Dunwoody L, Liddle D. Reducing the decline in physical activity during pregnancy: a systematic review of behaviour change interventions. *PLoS One*. 2013;8(6):e66385. Published 2013 Jun 14. doi:10.1371/journal.pone.0066385
22. Hayman M, Reaburn P, Alley S, Cannon S, Short C. What exercise advice are women receiving from their healthcare practitioners during pregnancy?. *Women Birth*. 2020;33(4):e357-e362. doi:10.1016/j.wombi.2019.07.302
23. Evins C, Dennis J, Mostert K, et al. Exercise Counseling in Pregnancy: Do Women Perceive Receiving the Information They Need?. *Am J Lifestyle Med*. 2021;15(4):441-452. Published 2021 Feb 16. doi:10.1177/1559827621991851
24. Skjold I, Benvenuti MB, Haakstad LA. Why do so many pregnant women give up exercise? An Italian cross-sectional study. *Womens Health (Lond)*. 2022;18:17455057221117967. doi:10.1177/17455057221117967
25. Whitaker KM, Becker C, Healy H, Wilcox S, Liu J. Women's Report of Health Care Provider Advice and Gestational Weight Gain: A Systematic Review. *J Womens Health (Larchmt)*. 2021;30(1):73-89. doi:10.1089/jwh.2019.8223
26. Huberty J, Dinkel D, Beets MW, Coleman J. Describing the use of the internet for health, physical activity, and nutrition information in pregnant women. *Matern Child Health J*. 2013;17(8):1363-1372. doi:10.1007/s10995-012-1160-2
27. Serçekuş P, Değirmenciler B, Özkan S. Internet use by pregnant women seeking childbirth information. *J Gynecol Obstet Hum Reprod*. 2021;50(8):102144. doi:10.1016/j.jogoh.2021.102144
28. Lee Y, Moon M. Utilization and Content Evaluation of Mobile Applications for Pregnancy, Birth, and Child Care. *Healthc Inform Res*. 2016;22(2):73-80. doi:10.4258/hir.2016.22.2.73
29. Hayman MJ, Alfrey KL, Waters K, et al. Evaluating Evidence-Based Content, Features of Exercise Instruction, and Expert Involvement in Physical Activity Apps for Pregnant Women: Systematic Search and Content Analysis. *JMIR Mhealth Uhealth*. 2022;10(1):e31607. Published 2022 Jan 19. doi:10.2196/31607

APPENDIX

1. Patient information
 - a. Age
 - b. Height (in)
 - c. Weight (lb)
2. Is this your first pregnancy?
 - a. If your answer is No, how many PRIOR pregnancies have you had?
3. Prior to this pregnancy, how many hours per week did you exercise?
4. Prior to this pregnancy, in what types of sports/fitness did you participate?
5. Currently, how many hours per week do you exercise?
6. Currently, in what types of sports/fitness do you participate?
7. What is your level of current exercise compared to prior to this pregnancy?

Please answer the following questions on a scale of 1 to 7 (1 being "not at all", 7 being "definitely")

8. How confident do you feel about your knowledge of exercise/fitness guidelines during pregnancy?
9. How much education have you had from your physician regarding exercise/fitness guidelines during pregnancy?
10. How much interest do you have in receiving information about exercise/fitness guidelines during pregnancy?
11. What sources have you used to obtain education regarding exercise/fitness guidelines during pregnancy? (Please mark all that apply)
 - a. Physician's Office
 - b. Reading Books
 - c. Reading Online
 - d. Gym or personal trainer
 - e. Physical therapy
 - f. Fitness Videos
 - g. Relatives
 - h. Friends
 - i. Other
12. Which of the following concerns have you had during pregnancy? (Please mark all that apply)
 - a. Weight gain
 - b. Fear of Injury
 - c. Feeling out of shape
 - d. Back pain
 - e. Hip pain
 - f. Knee pain
 - g. Shoulder pain
 - h. Pelvic floor discomfort
 - i. Other
13. Which of the following resources would you be interested in receiving to help improve exercise/fitness activity during your pregnancy? (Please mark all that apply)
 - a. Discussion during visits with my physician
 - b. Physical therapy
 - c. Reading materials
 - d. Video instruction
 - e. Personalized coaching
 - f. Scheduled digital communication
 - g. Interactive classes

- h. In person activity groups
 - i. Online activity groups
 - j. Other
14. On a scale of 1 to 7, how often do you utilize the following in your day-to-day activities?
- Social Media
 - Fitness Apps
 - Text Notifications
 - Calendar Alerts