

Longitudinal Analysis of Patterns and Correlates of Physical Activity and Sedentary Behavior in Women From Preconception to Postpartum: The Singapore Preconception Study of Long-Term Maternal and Child Outcomes Cohort

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Objective: Longitudinal changes in physical activity (PA) and sedentary behavior patterns from preconception to postpartum are not fully characterized. We examined changes and baseline sociodemographic/clinical correlates of PA and sedentary behavior in women from preconception to postpartum. **Methods:** The Singapore Preconception Study of Long-Term Maternal and Child Outcomes cohort recruited 1032 women planning pregnancy. Participants completed questionnaires at preconception, 34 to 36 weeks gestation, and 12 months postpartum. Repeated-measures linear regression models were used to analyze changes in walking, moderate to vigorous PA (MVPA), screen time, and total sedentary time, and to identify sociodemographic/clinical correlates associated with these changes. **Results:** Of the 373 women who delivered singleton live births, 281 provided questionnaires for all time points. Walking time increased from preconception to late pregnancy but decreased postpartum (adjusted means [95% CI]: 454 [333–575], 542 [433–651], and 434 [320–547] min/wk, respectively). Vigorous-intensity PA and MVPA decreased from preconception to late pregnancy but increased postpartum (vigorous-intensity PA: 44 [11–76], 1 [–3–5], and 11 [4–19] min/wk, MVPA: 273 [174–372], 165 [95–234], and 226 [126–325] min/wk, respectively). Screen time and total sedentary time remained consistent from preconception to pregnancy but decreased postpartum (screen: 238 [199–277], 244 [211–277], and 162 [136–189] min/d, total: 552 [506–598], 555 [514–596], and 454 [410–498] min/d, respectively). Individual characteristics of ethnicity, body mass index, employment, parity, and self-rated general health significantly influenced women's activity patterns. **Conclusion:** During late pregnancy, walking time increased, while MVPA declined significantly, and partially returned to preconception levels postpartum. Sedentary time remained stable during pregnancy but decreased postpartum. The identified set of sociodemographic/clinical correlates underscores need for targeted strategies.

Keywords: longitudinal study, physical activity behavior, pregnancy, sedentary lifestyle, women's health

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Physical activity (PA) and sedentary behavior are crucial lifestyle factors that affect physical and mental health.¹ Regular PA, whether of low, moderate, or vigorous intensity, has been linked to several health benefits, including a decreased risk of all-cause mortality and favorable cardiometabolic profiles.² However, with the advent of electronic technology, sedentary behaviors such as using electronic devices while sitting, reclining, or lying down have become increasingly common. In women, regular PA during preconception was associated with a range of benefits, including improved assisted reproductive therapy outcomes, prevention of weight gain, and improved mental health. Moreover, it has been identified as a strong correlate of continued PA during pregnancy.^{3,4} Beyond preconception, moderate-intensity PA during pregnancy and postpartum has also been linked to reduced risks

of gestational diabetes, excessive gestational weight gain, medical intervention during labor, and postpartum depression.⁵ Additionally, women who remain active during pregnancy have a lower risk of gestational weight gain, which in turn reduces the risk of postpartum overweight, macrosomia, future obesity, and type 2 diabetes for both the mother and child.^{4,6} High levels of sedentary behavior during pregnancy, on the other hand, have been associated with higher levels of C-reactive protein and low-density lipoprotein cholesterol in pregnancy, greater neonatal abdominal circumference, and larger babies.⁷ Thus, it is important to maintain an active lifestyle before, during, and after pregnancy.

Similar to the general population, the latest World Health Organization guidelines on PA recommend that pregnant women without contraindications should perform at least 150 minutes per week of moderate-intensity PA during pregnancy (and postpartum), while minimizing sedentary behavior.¹ Yet, despite this recommendation, a majority of pregnant women are sedentary for over 12 hours per day,⁷ exceeding the median sedentary time of 4.7 hours per day for the general adult population.⁸

There is a scarcity of prospective research that examines changes in PA and sedentary behavior during the transition from preconception to postpartum. Prior studies have reported changes in PA related to pregnancy, but these studies have limitations such as retrospective assessments of preconception PA,^{9–11} cross-sectional assessments of pregnancy PA at a single time point,¹² or repeated measurements only during pregnancy.^{13,14} Although a recent study compared PA patterns during pregnancy and up to 8 months postpartum to those during preconception,¹⁵ PA data from preconception to 2 months postpartum were collected retrospectively, raising concerns of recall bias. Also, the PA information was not collected using validated questionnaires,¹⁵ which complicates comparison of findings with other studies. Furthermore, most previous studies were conducted in Western populations, while some studies in Asia reported low PA levels during pregnancy that declined over time.¹⁶ Cultural differences might influence attitudes and participation in PA.¹⁷ Therefore, to inform the development of evidence-based strategies for promoting better maternal and child health, it is important to understand how PA and sedentary behavior change over time across different populations during complex and challenging life stages.

Gaining insight into the correlates of PA and sedentary behavior lays the groundwork for effective interventions to encourage active lifestyles.¹⁸ Nonmodifiable factors (correlates) can help identify groups that need targeted interventions, while modifiable factors can determine how to improve health and well-being.¹⁹ Previous reviews have identified certain correlates of pregnancy PA,^{20,21} such as higher education and income, as well as pregnancy-related correlates including fewer previous pregnancies and less discomfort during pregnancy, which were positively associated with pregnancy PA. Another review reported correlates linked to reduced sedentary behavior during pregnancy, such as higher education, nulliparity, and adherence to PA guidelines.⁷ Nonetheless, the correlates influencing long-term changes in PA and sedentary behavior from preconception to postpartum, which may ultimately affect health, remain unclear. This is important because individuals may respond differently to pregnancy, resulting in varying levels of risk for persistent changes in PA or sedentary behavior. In this study, we aimed to examine changes and correlates of walking time, moderate- to vigorous-intensity PA (MVPA), screen time, and total sedentary time in Asian women from preconception through pregnancy and postpartum.

Methods

Study Cohort

The Singapore Preconception Study of Long-Term Maternal and Child Outcomes (S-PRESTO) study (ClinicalTrials.gov, NCT03531658) is a prospective preconception cohort study that is currently ongoing.²² It involves the recruitment of women from Singapore's largest public maternity unit, KK Women's and Children's Hospital, making it a unique resource for studying the longitudinal changes in PA and sedentary behavior. The S-PRESTO cohort is designed to study the long-term impact of women's health on the health outcomes of their pregnancy and offspring.^{22–24} Between 2015 and 2017, a total of 1032 nonpregnant women aged 18–45 years were recruited with the following eligibility criteria: actively trying to conceive within 1 year of recruitment and being off-contraception in the previous month; of Chinese, Malay, or Indian ethnicity (or a combination thereof); and intending to reside in Singapore for the next 5 years after enrollment. Exclusion criteria were known type 1 or type 2 diabetes and use of systemic steroids, anticonvulsants, human immunodeficiency virus, or hepatitis B or C medications within the past month. The SingHealth Centralized Institutional Review Board granted ethical approval (reference 2014/692/D), and written informed consent was obtained from all study participants.

PA and Sedentary Behavior Assessment

The validated short-form International PA Questionnaire²⁵ and a sedentary behavior questionnaire²⁶ were administered through interviews by qualified personnel during preconception, pregnancy (34–36 wk of gestation), and postpartum (12 mo after delivery). The International PA Questionnaire, which is reliable and validated for use in pregnant women,¹⁶ collects information about the duration and frequency of walking, moderate-intensity PA, and vigorous-intensity PA (VPA) over the past 7 days. The moderate-intensity PA and VPA responses were summed as MVPA.

Sedentary behavior questions included daily time spent sitting or lying down over the past 7 days in the following contexts:

- At work—"Occupational";
 - Watching television (TV) for leisure—"TV viewing";
 - Viewing other electronic devices for leisure (excluding TV time)—"Electronic devices"; and
 - When eating, driving/traveling, reading, or other sedentary activity (other than viewing TV/electronic devices)—"Other."
- Sedentary time was subsequently analyzed as:

- Sum of TV and other electronic devices time—"Screen time," and
- Sum of all sedentary behaviors—"Total sedentary time."

Correlates

We identified potential correlates of PA/sedentary time a priori from the literature.^{27,28} During the first preconception clinic visit for eligibility screening, baseline sociodemographic and clinical characteristics were obtained from the enrollment questionnaire. This included age, ethnicity, education level, employment status, parity (number of previous pregnancies) at recruitment, and self-rated general health, which was measured by asking a single question, "How is your health in general?" with response options: 1. very good, 2. good, 3. fair, 4. bad, and 5. very bad.

Height was measured with a SECA 213 portable rangefinder to the nearest 0.1 cm, and weight with a SECA 803 weighing machine to the nearest 0.1 kg. Body mass index (BMI) was computed by dividing weight in kilograms by the square of height in meters.

Statistical Analysis

Among women who had a singleton live birth and received postpartum follow-up, differences in baseline characteristics between women included in the analysis and those not included due to missing PA/sedentary time data were assessed using unpaired *t* tests for continuous variables and chi-square tests for categorical variables. We then analyzed the changes of PA/sedentary time variables (representing changes across time points for each intensity/domain-specific behavior) and the associations between baseline sociodemographic/clinical correlates and PA/sedentary time (each intensity/domain-specific behaviors) using generalized estimating equations, that is, PA/sedentary time at preconception, pregnancy, and postpartum were treated as repeated measures in multivariable linear models. The 3 time points were treated as an ordinal variable (0, 1, and 2), with an unstructured working correlation matrix. To examine whether the associations between sociodemographic/clinical correlates and PA/sedentary time differed by time points, we included interaction terms between each correlate and the time point variable in a single model. We reported adjusted means and 95% confidence intervals of the outcome variables, and the adjusted mean differences for the correlates. This paper presents the baseline sociodemographic and clinical correlates of 4 main outcome measures: walking, MVPA, screen time, and total sedentary time. Other individual PA/sedentary time components are additionally examined and described in [Supplementary Tables S1–S5](#) (available online). The statistical analysis was conducted using Stata Statistical Software (version 14).

Results

Participants

Of the 1032 women enrolled, 475 became pregnant within 12 months, 373 delivered singleton live births, and 342 were followed through postpartum (Figure 1). In the analysis, 281 women who provided PA and sedentary time data at all 3 time points (preconception, 34–36 wk gestation, and 12 mo postpartum) were included. Most of the women were ≤ 30 years old, underweight or normal weight, Chinese, university educated, employed, nulliparous, and reported very good/good health at recruitment (Table 1). Among all women who had singleton live births and underwent postpartum follow-up, there were more Chinese women included in the analysis compared to those who were not included due to missing PA/sedentary time data.

Changes in PA

Walking time increased during pregnancy compared to preconception but returned to nearly preconception levels at postpartum (Figure 2A). Conversely, VPA decreased to nearly 0 during pregnancy and slightly increased at postpartum, while MVPA also declined during pregnancy and partially recovered at postpartum.

Changes in Sedentary Time

Occupational sedentary time was steady across all 3 time points (Figure 2B). Both screen time and total sedentary time remained consistent from preconception to pregnancy but decreased at postpartum. Other sedentary behaviors decreased gradually from preconception to postpartum.

Correlates of Change in PA

Compared to those who were unemployed at baseline, being employed was associated with higher overall walking time

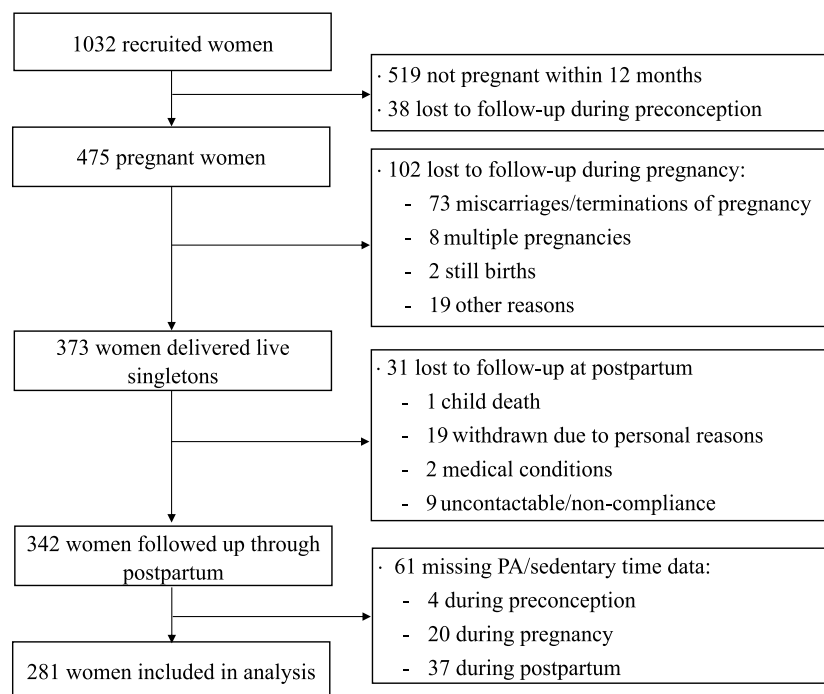


Figure 1 — Flowchart of the S-PRESTO women included in the analysis from preconception to postpartum. PA indicates physical activity; S-PRESTO, Singapore Preconception Study of Long-Term Maternal and Child Outcomes.

Table 1 Comparison of Baseline Characteristics Between Included and Not Included Women

Baseline characteristics	Analyzed (n = 281)		Not included (n = 61)		P ^a
	n (%)	Mean (SD)	n (%)	Mean (SD)	
Age, y	281 (100.0)	29.9 (3.1)	61 (100.0)	30.4 (3.5)	.260
Age, %					.079
≤30 y	168 (59.8)		29 (47.5)		
>30 y	113 (40.2)		32 (52.5)		
Height, cm	279 (99.3)	159.8 (5.5)	61 (100.0)	159.9 (5.0)	.937
Weight, kg	280 (99.6)	58.3 (11.1)	61 (100)	60.5 (11.5)	.171
BMI, kg/m ²	279 (99.3)	22.8 (4.2)	339 (99.1)	23.0 (4.3)	.559
BMI, Asian cut-offs, %					.192
Under and normal weight (<23 kg/m ²)	181 (64.9)		32 (52.5)		
Overweight (23–27.4 kg/m ²)	58 (20.8)		17 (27.9)		
Obese (≥27.5 kg/m ²)	40 (14.3)		12 (19.6)		
Ethnicity, %					.029
Chinese	221 (78.6)		40 (65.6)		
Non-Chinese	60 (21.4)		21 (34.4)		
Education, %					.208
Postsecondary and below	75 (26.7)		19 (31.1)		
Undergraduate	170 (60.5)		30 (49.2)		
Postgraduate	36 (12.8)		12 (19.7)		
Employment status, %					.243
Unemployed	31 (11.0)		10 (16.4)		
Employed	250 (89.0)		51 (83.6)		
Parity, %					.915
Nulliparous	173 (61.6)		38 (62.3)		
Primiparous/multiparous	108 (38.4)		23 (37.7)		
Self-rated general health					.778
Very good/good	207 (73.7)		46 (75.4)		
Fair/bad/very bad	74 (26.3)		15 (24.6)		

Abbreviation: BMI, body mass index.

^aAmong women with singleton live births and postpartum follow-up, *t* tests (for continuous variables) and chi-square tests (for categorical variables) were used to assess the difference between women included in the analysis and those not included due to missing physical activity/sedentary time data.

(Figure 3; [Supplementary Table S1](#) [available online]). A significant interaction was found between employment status and time point for the outcome of walking time, such that employed women had higher walking time, particularly at preconception, than unemployed women. Based on single time-point comparisons, non-Chinese women were associated with more walking during pregnancy than Chinese women. Notably, the association between worse self-reported general health and lower overall walking time approached statistical significance.

Compared to Chinese women, non-Chinese women consistently reported higher overall MVPA. A significant interaction of ethnicity or age with time points on MVPA was found (Figure 4; [Supplementary Table S2](#) [available online]). From single time-point comparisons, no difference in MVPA was reported between older and younger women at preconception; however, older women reported lower MVPA during pregnancy and postpartum compared to younger women. Primi/multiparous women had with higher MVPA at postpartum than nulliparous women.

Compared to nulliparous women, primi/multiparous women had lower overall VPA, with a significant interaction indicating that primi/multiparous women had lower VPA, particularly at preconception ([Supplementary Table S3](#) [available online]). The analysis

of the interaction revealed that worse self-rated general health at baseline (compared to very good/good) was linked to lower overall VPA, particularly at preconception and postpartum.

Correlates of Change in Sedentary Behavior

Compared to those who were under/normal weight, higher BMI at baseline was associated with higher overall screen time (Figure 5; [Supplementary Table S4](#) [available online]). A significant interaction term suggested that the association between BMI and screen time varied by time. Women who were overweight had higher screen time especially at postpartum, while those who were obese had higher screen time at preconception and pregnancy. In terms of parity, primi/multiparous women had shorter screen time compared to nulliparous women, and this was consistent across all 3 time points as indicated by the significant interaction term. Employment status was also associated with screen time, with employed women reporting lower overall screen time, especially at preconception compared to unemployed women. From single time-point comparisons, having an undergraduate education was associated with less screen time during pregnancy and postpartum compared to having a postsecondary education or below. Those with a postgraduate

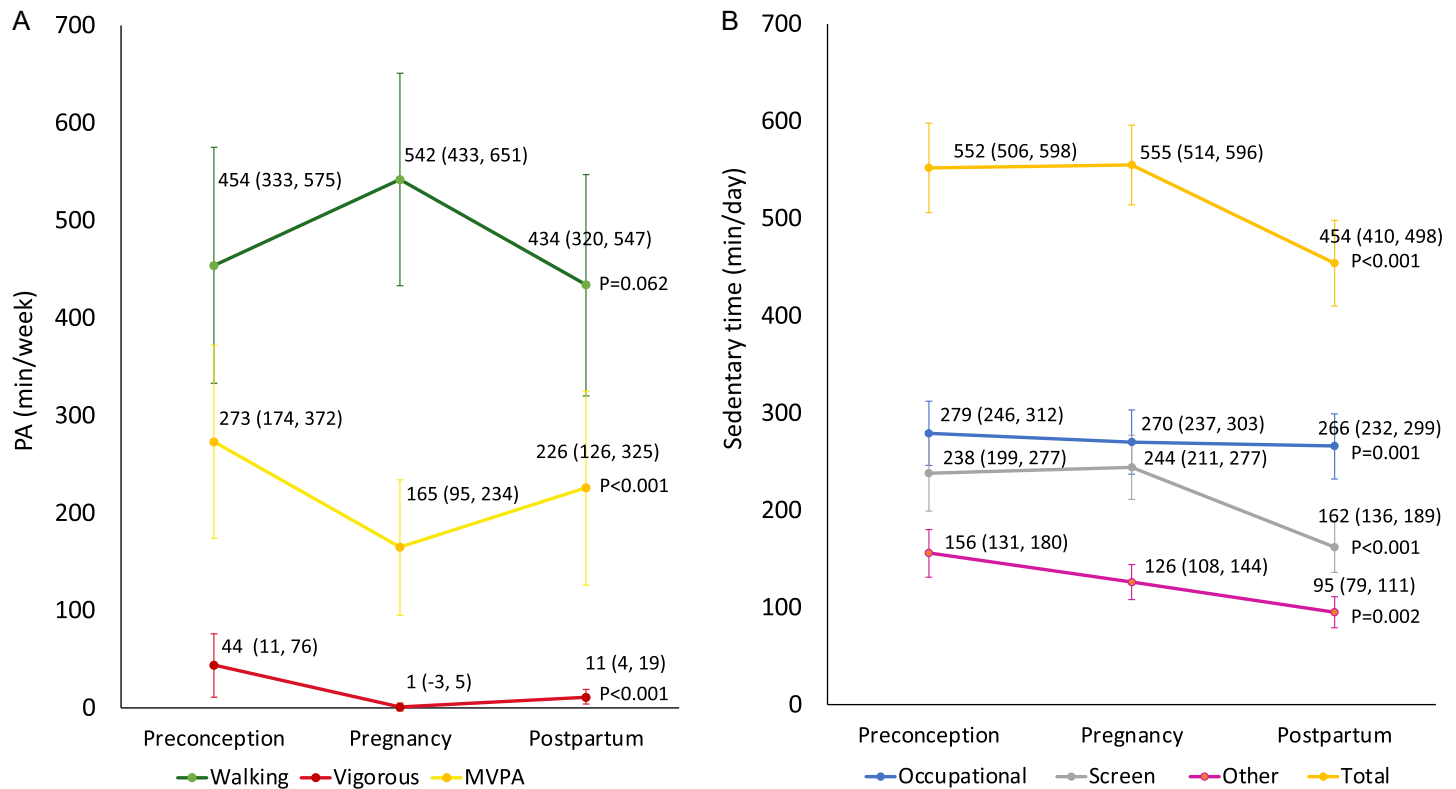


Figure 2 — Adjusted mean change in (A) PA and (B) sedentary behavior across time points for all intensity/domain-specific behaviors. Data are means (95% CIs) adjusted for baseline characteristics: age, body mass index, ethnicity, education, employment status, parity, and self-rated general health. For occupational sedentary time, model was not adjusted for employment status. *P* values relate to the overall change from preconception to postpartum. CI indicates confidence interval; MVPA, moderate to vigorous physical activity; PA, physical activity.

education had with less screen time during pregnancy compared to those with a postsecondary education or below.

Compared to women with under/normal weight, those with higher BMI had higher overall total sedentary time, with a significant interaction suggesting that being obese was associated with higher total sedentary time especially at preconception (Figure 6; Supplementary Table S5 [available online]). Employment status was associated with higher overall total sedentary time, with employed women having higher sedentary time than unemployed women at all time points. Primiparous/multiparous women had lower overall change in total sedentary time than nulliparous women, especially at preconception and pregnancy. Self-reported fair/bad/very bad general health (vs very good/good) was associated with higher overall total sedentary time. From single time-point comparisons, women of older age had higher total sedentary time during pregnancy than younger women. Having an undergraduate education was associated with lower total sedentary time at all time points compared to having a postsecondary education or below.

Discussion

This study is the first to provide a prospective examination of PA and sedentary behavior during the preconception, pregnancy, and postpartum periods. In this multiethnic longitudinal cohort of Asian women, we found that MVPA decreased from preconception to pregnancy and only partially recovered at 12 months postpartum, particularly because VPA remained very low, and this continued until postpartum. While walking was the only activity that increased

from preconception during pregnancy, it returned to slightly lower than preconception levels after delivery. Screen time and total sedentary time remained stable during preconception and pregnancy but decreased postpartum. Furthermore, different correlates were linked to PA and sedentary behavior at distinct life stages. Women with higher overall walking time were employed, those with higher overall MVPA were non-Chinese, and those with lower overall VPA were primi/multiparous and had worse self-rated general health. For sedentary behavior, women with higher overall screen time had a higher BMI, and those with lower overall screen time were employed and primi/multiparous. Overall total sedentary time was higher in women who had a higher BMI, were employed, and had worse self-rated general health, whereas overall total sedentary time was lower in women who were primi/multiparous.

Prior research using self-reported PA data showed an increase in walking time from preconception to pregnancy, which is in line with our findings.^{15,29} Conversely, while we observed a decline in MVPA during pregnancy, a previous study reported no significant changes in women's overall PA levels from preconception to postpartum.¹⁵ Although postpartum MVPA did not fully return to preconception levels, a partial rebound was observed, whereas a US cohort study of low-income, predominantly Black women showed a decrease in accelerometry-measured MVPA from pregnancy to postpartum.³⁰ These discrepancies may be attributed to different PA measuring methods and social-ecological factors. In agreement with general population studies, moderate-intensity PA, rather than VPA, contributed mostly to overall MVPA levels. In our study, VPA levels were very low during pregnancy and

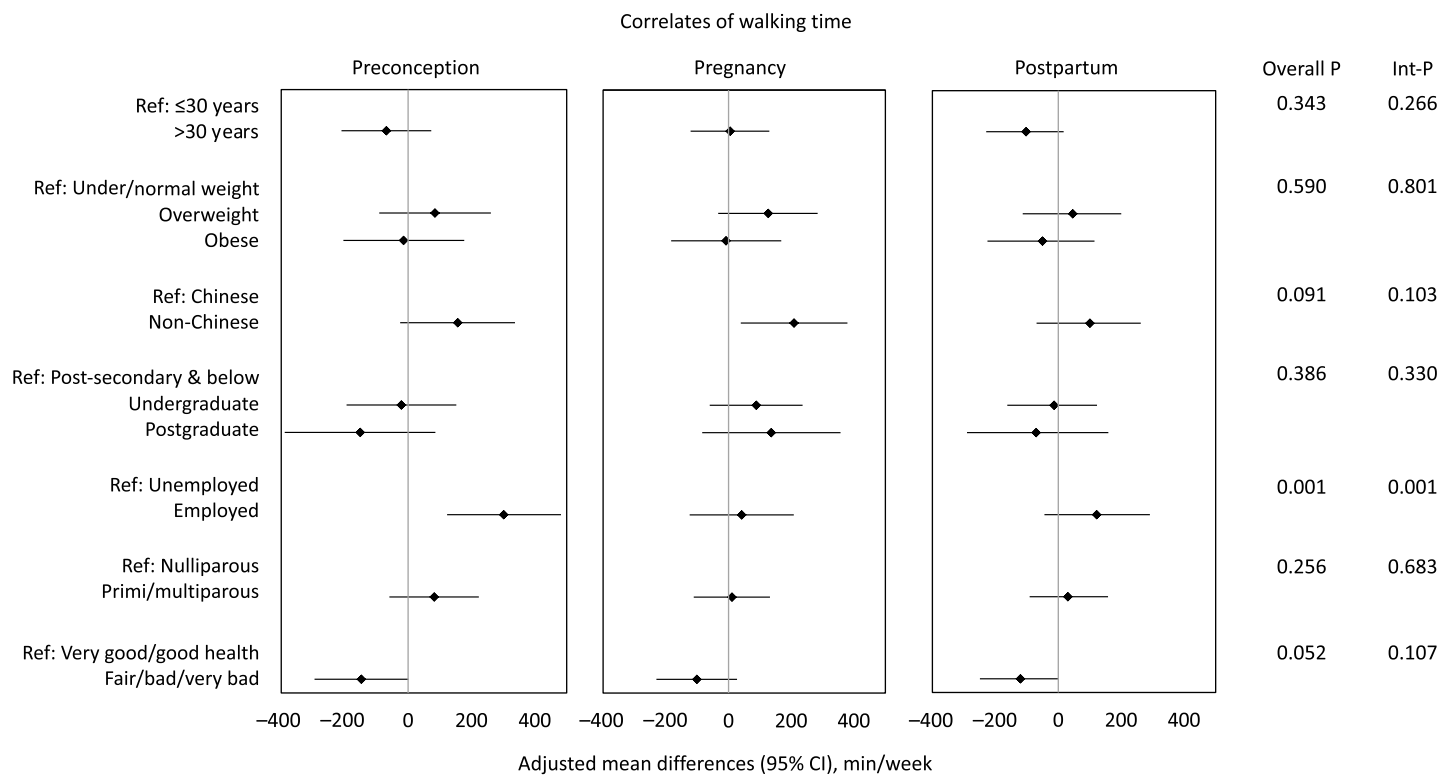


Figure 3 — Associations of correlates with walking time from preconception to pregnancy and postpartum in women. Values are mean differences (95% CIs) from repeated-measures linear regression models. Overall *P* values relate to the overall association of exposure (correlates) on physical activity levels regardless of time. Interaction *P* values relate to the interaction term exposure \times time. CI indicates confidence interval.

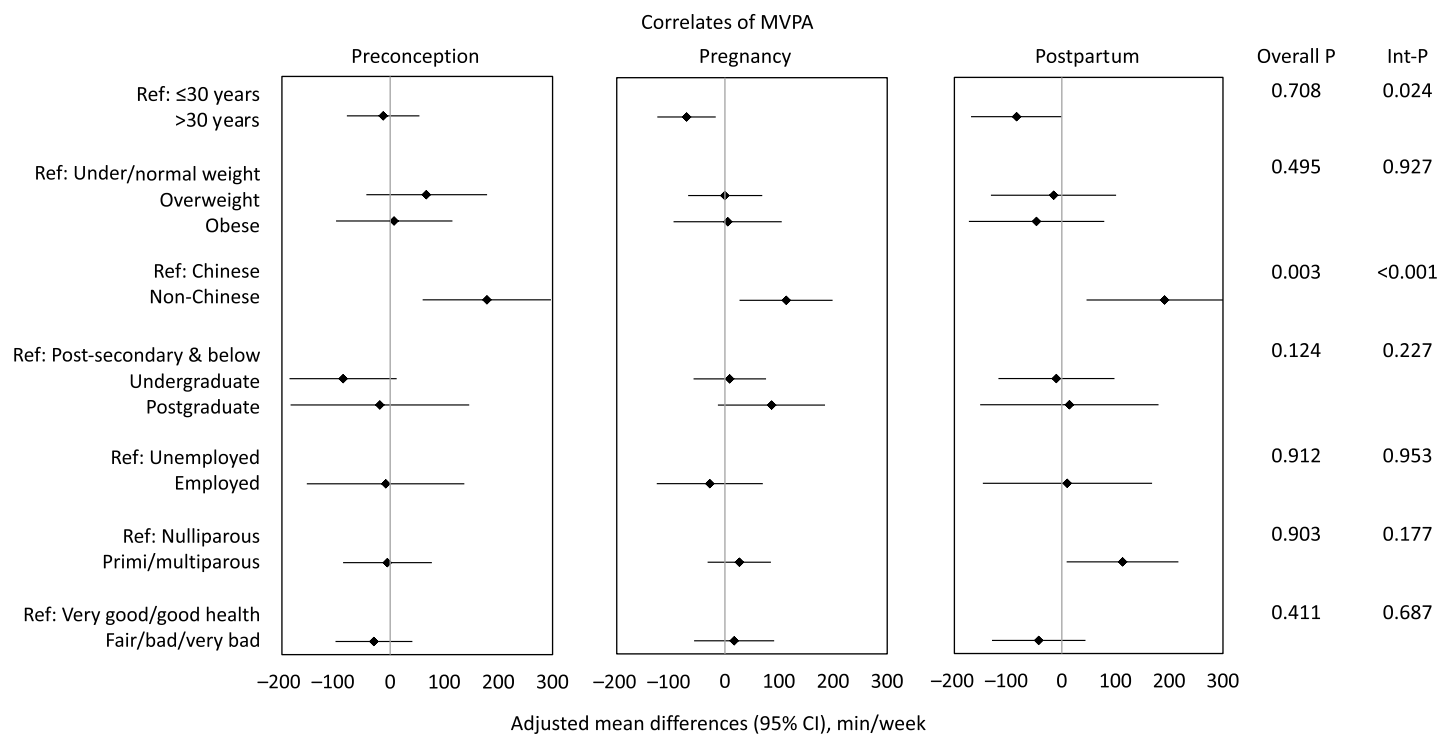


Figure 4 — Associations of correlates with MVPA from preconception to pregnancy and postpartum in women. Values are mean differences (95% CIs) from repeated-measures linear regression models. Overall *P* values relate to the overall association of exposure (correlates) on physical activity levels regardless of time. Interaction *P* values relate to the interaction term exposure \times time. CI indicates confidence interval; MVPA, moderate to vigorous physical activity.

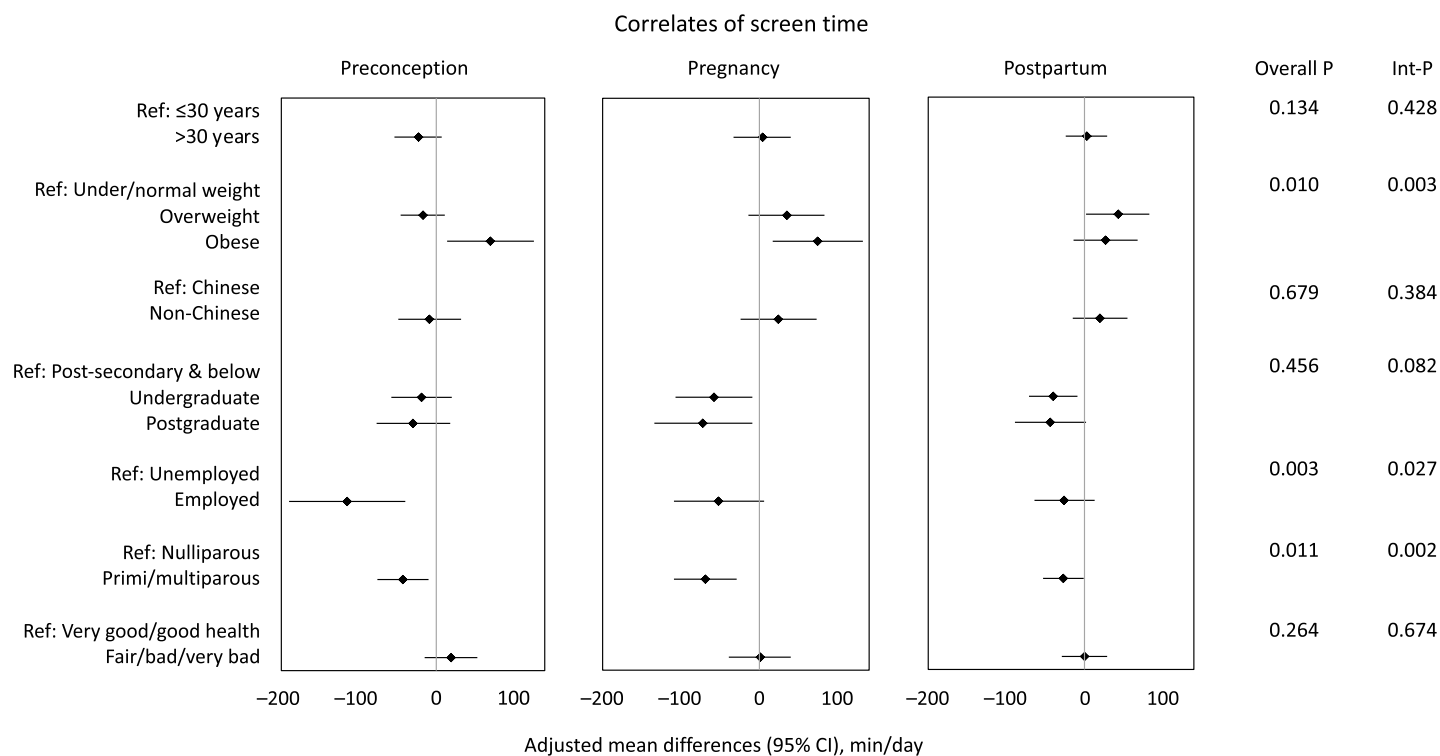


Figure 5 — Associations of correlates with screen time from preconception to pregnancy and postpartum in women. Screen time includes TV time and electronic device time. Values are mean differences (95% CIs) from repeated-measures linear regression models. Overall *P* values relate to the overall association of exposure (correlates) on sedentary behavior levels regardless of time. Interaction *P* values relate to the interaction term exposure × time. CI indicates confidence interval; TV, television.

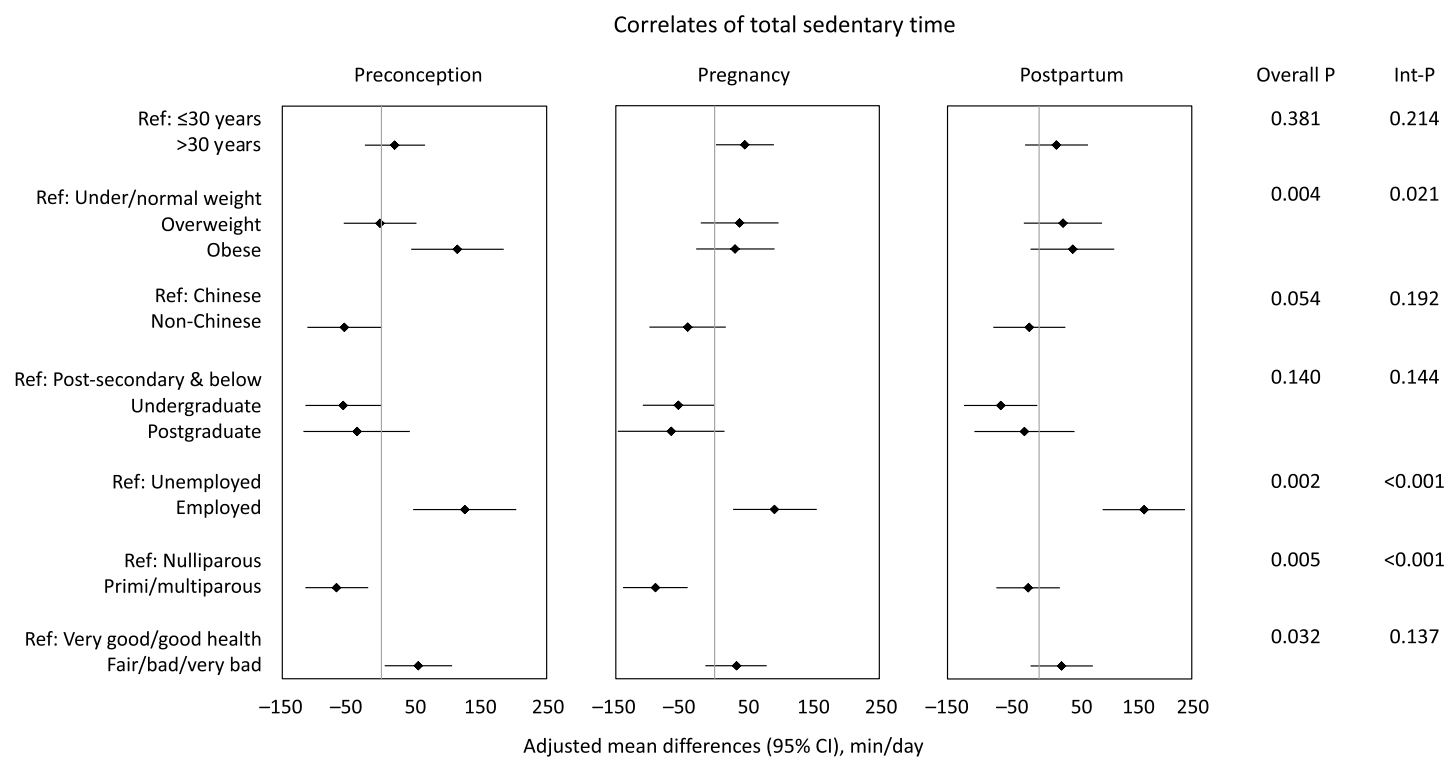


Figure 6 — Associations of correlates with total sedentary time from preconception to pregnancy and postpartum in women. Values are mean differences (95% CIs) from repeated-measures linear regression models. Overall *P* values relate to the overall association of exposure (correlates) on sedentary behavior levels regardless of time. Interaction *P* values relate to the interaction term exposure × time. CI indicates confidence interval.

remained low postpartum. This may be due to the safety and health benefits of VPA not being as well documented as with low- to moderate-intensity activities, and some health care providers may advise against VPA.⁵ Additionally, women may prefer low-impact activities such as walking and resulting in reduced levels of MVPA, which could explain why walking activity increases during pregnancy. It should be noted that our findings on decreased levels of MVPA and VPA during pregnancy and postpartum are not consistent with the current World Health Organization PA guidelines,¹ which recommend consistent levels of PA and do not discourage VPA per se, particularly for women who regularly performed VPA or were physically active before pregnancy.¹

Our study's results align with a previous systematic review, indicating that employed and primi/multiparous women have higher levels of PA.²⁰ Walking may be part of working women's daily commutes to and from work. Women who had lower self-rated health reported engaging in less VPA. This could hinder PA, especially for VPA that demands more energy. Our observation of higher levels of MVPA among non-Chinese individuals is a unique finding. This could be because traditional pregnancy customs, known as "antenatal taboos," which advocate reducing or avoiding PA to protect the fetus, are still culturally relevant among Chinese populations,³¹ despite modern pregnancy-related programs generally recommend regular PA.

We also ascertained correlates of changes in PA during each preconception, pregnancy, and postpartum phase. While a review by Garland et al²⁰ reported a positive association between education levels and PA during pregnancy, our findings contrast with this. This disparity may be due to the predominantly White participants in the studies reviewed and the complex interplay of various socioecological factors.²⁰ Continuous evaluation of factors that promote PA, including cultural expectations and knowledge about PA during pregnancy, would be valuable.

In our study, total sedentary time remained consistent at around 9.2 hours per day before and during pregnancy. However, some other studies have reported an increase in sedentary time from preconception to pregnancy.^{7,32} Our results are similar to a previous study that found a decrease in accelerometry-measured total sedentary time from pregnancy to postpartum.³⁰ As prolonged sedentary time can have negative effects on maternal health, reducing sedentary behavior could be an important daily habit to target in future interventions.

Although there is a paucity of studies investigating the correlates of sedentary time in women around the pregnancy period, the 2003–2006 National Health and Nutrition Examination Survey found no significant associations between accelerometry-measured sedentary time and a range of correlates (eg, age, gestational age, ethnicity, education, household income, and marital status) in 359 pregnant women.³³ Our findings on the association between primi/multiparous women and lower overall screen time/total sedentary time align with those of a systematic review of studies in the general adult population³⁴ and a cross-sectional study of adults in Singapore.³⁵ This may be due to the fact that women with no children tend to engage in more screen time and other sedentary behaviors during leisure time.³⁶ In this study, worse self-rated health was a correlate of higher sedentary time from preconception to postpartum; likewise, a cross-sectional study of Canadian women reported stress as a correlate of sedentary time during pregnancy.³⁷ The physical discomfort experienced during pregnancy may lead to a decrease in PA, which could worsen mental health. Therefore, it is important to evaluate self-perceived health and mental well-being to develop effective strategies promoting PA and reducing sedentary time from preconception to postpartum.

This study's findings indicate that there is a correlation between different levels of education and sedentary behavior at various points in time. Exploring factors such as profession and knowledge of PA can aid health care providers in comprehending obstacles and encouraging women to embrace a healthy lifestyle. In addition, older age was associated with higher total sedentary time in pregnancy. These results demonstrate the potential for interventions targeted at decreasing screen time and overall sedentary time during significant life transitions. Regarding correlates of changes in sedentary time, the results of this study suggest that different levels of education are associated with sedentary lifestyles at individual time point.

Collectively, our results highlight groups of women at risk who can be targeted for interventions aimed at walking, MVPA, and reducing screen time/total sedentary time. Walking is a practical activity that can be easily incorporated into the daily routine of unemployed women. A meta-analysis has shown that engaging in VPA up to the third trimester is safe for most healthy pregnancies and can lead to small beneficial effects such as increased gestational age at delivery and reduced risk of preterm delivery.³⁸ Nonetheless, it should be noted that women who engage in VPA and/or choose to participate in exercise studies may have lower pregnancy risk and better health overall.³⁸ The differential effects of various correlates of PA/sedentary time suggest that interventions should be tailored to specific life stages.

Strengths and Limitations

The prospective design of our study helped to reduce recall bias, which is a common limitation of previous studies that rely on retrospective data collection. Furthermore, we gathered information on different types, intensities, and domains of PA and sedentary time, instead of relying on a single estimate. This approach is particularly crucial because our results highlighted diverse patterns of activity. However, our study has several limitations. First, PA and sedentary time were self-reported, which is common practice but may still be subject to a degree of recall bias even with prospective data collection. Nevertheless, it allowed us to collect information on specific domains that accelerometers may not easily distinguish. Second, while the sedentary behavior questionnaire was validated among nonpregnant adults in Singapore,²⁶ its validity and reliability in pregnant women were not evaluated. Third, data collection at different time points does not allow direct comparisons of our results with previous studies. Additionally, assessments of sedentary time were heterogeneous across studies (eg, single item vs summary responses from various domains). Finally, because PA may affect fertility rates,³⁹ and women who did not conceive were not included in the analysis, the generalizability/external validity of our results, particularly during the preconception phase, to other study populations is limited.

Conclusions

In this prospective cohort study, walking time was the only activity that increased from preconception to pregnancy, but postpartum decreased to a level close to preconception. MVPA and VPA, however, decreased during pregnancy and even after delivery did not return to their preconception levels. Hence, postpartum PA interventions are also crucial to address this persistent reduction in PA. This study also identified high levels of screen time and total sedentary time before pregnancy and persisted throughout pregnancy, highlighting the importance of counseling to reduce

sedentary behavior, starting as early as the preconception period. Understanding the characteristics that influence healthy behaviors in mothers during different life stages is essential for policymakers and health professionals to develop targeted interventions.

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