

Domain-inclusion criteria in the assessment of physical activity guideline adherence during pregnancy and its association with gestational weight gain: a cross-sectional study of 335 women in China

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Abstract

Background. Reported adherence to physical activity (PA) guidelines in pregnancy varies widely, partly because studies differ in whether activity accumulated in non-leisure domains is counted when defining adherence. This decision is rarely reported explicitly, yet it determines who is classified as active. This study quantified adherence and classification agreement under two domain-inclusion criteria and examined their association with the rate of gestational weight gain (GWG).

Methods. A cross-sectional survey was conducted among 335 pregnant women in three provinces of China (Guangdong, Zhejiang, Shaanxi). PA was assessed with the Pregnancy Physical Activity Questionnaire (PPAQ). Two adherence criteria were applied, both defined as at least 7.5 MET-hours per week of moderate-intensity activity: all-domain adherence (summed across the household/caregiving, occupational, transport and sports/exercise domains) and exercise/leisure-time (LTPA) adherence (sports/exercise domain only). The outcome was the rate of GWG (kg/week). Prevalence was compared using McNemar's test and agreement with Cohen's kappa. Hierarchical linear regression examined the association of each PA measure with GWG rate, with models repeated using GWG amount (kg) as the outcome.

Results. All-domain adherence was 79.1% (95% CI 74.4–83.1) versus 29.0% (95% CI 24.4–34.0) under the LTPA criterion (difference 50.1 percentage points; $p < 0.001$); classification agreement was only 48.7% ($\kappa = 0.175$), and 170 of the 265 all-domain adherents (64.2%) reached the threshold entirely through non-leisure activity. Non-leisure domains accounted for 96.9% of total activity, whereas sports/exercise contributed only 3.1%. Neither criterion was associated with the rate of GWG (adjusted $\beta = -0.001$, $p = 0.983$ for all-domain; adjusted $\beta = -0.024$, $p = 0.537$ for LTPA); continuous, domain-specific and sedentary measures were likewise not associated, and results were unchanged with GWG amount as the outcome. Parity was the only consistent correlate (adjusted $\beta = 0.093$ kg/week, $p = 0.046$).

Conclusions. The domain-inclusion criterion substantially affects prevalence estimates of guideline adherence during pregnancy but did not alter the (null) association with GWG. Studies using domain-structured questionnaires should state and, where possible, compare domain-inclusion criteria; objective measurement may be needed to clarify the PA–GWG relationship.

Background

Regular moderate-intensity physical activity (PA) during pregnancy is associated with a lower risk of gestational diabetes, hypertensive disorders of pregnancy and excessive gestational weight gain (GWG) [1–3]. Accordingly, the World Health Organization (WHO) 2020 guidelines recommend that pregnant women without contraindications accumulate at least 150 minutes of moderate-intensity activity per week[4], and national guidelines in Canada, the United States and elsewhere convey the same message[5, 6]. Importantly, these recommendations do not restrict qualifying activity to any single domain: activity performed for household, occupational and transport purposes contributes to the recommended total on the same footing as leisure-time exercise[4–6].

How this domain-neutral recommendation is operationalised, however, varies across studies. The Pregnancy Physical Activity Questionnaire (PPAQ), the most widely used instrument for assessing PA in pregnancy, queries activity across four domains (household/caregiving, occupational, sports/exercise and transport), with items also classified by intensity (sedentary, light, moderate and vigorous)[7] and has been translated into Chinese and validated in Chinese pregnant women[8]. Studies using domain-structured instruments consistently show that pregnancy activity is largely non-leisure: household and occupational activities dominate total energy expenditure, whereas sports/exercise constitutes only a small fraction. In a large United States cohort, for example, household and occupational activity together accounted for about 70% of total activity while sports/exercise contributed around 5%[9]. This compositional profile has an important but underappreciated methodological consequence: the same woman can be classified as sufficiently active or insufficiently active depending on which domains are counted toward the guideline threshold, yet the domains counted are rarely stated explicitly in prevalence reports[10].

Reported adherence to PA guidelines during pregnancy varies widely across studies[10], and the measurement properties of pregnancy PA questionnaires differ substantially[11]. Evidence is emerging that including or excluding non-leisure domains changes both who is classified as active and the magnitude of prevalence estimates[12]. However, few studies have compared domain-inclusion criteria head-to-head within the same sample, and evidence from Chinese populations—where household and caregiving activity is culturally prominent—remains limited[13].

The outcome side of this question is equally relevant. GWG is a modifiable determinant of maternal and neonatal outcomes[14], and the Institute of Medicine (IOM) recommends monitoring weight gain against ranges defined by pre-pregnancy body mass index[15]. The association between GWG and adverse outcomes depends strongly on pre-pregnancy body mass index and on the timing of gain[16]. In China, excessive GWG is common and its determinants are well documented[17]; cultural beliefs may downplay the importance of gestational weight management[18]. Recognising that international recommendations might not transfer directly, researchers have derived optimal GWG ranges specific to Chinese body mass index categories[19, 20]. Whether PA—and which operational definition of PA—is associated with GWG in this context is therefore of practical interest[21].

Against this background, we conducted a cross-sectional study of 335 pregnant women from three provinces of China to (1) quantify adherence and classification agreement under an all-domain versus an exercise/leisure-time (LTPA) criterion, (2) describe the domain and intensity composition of PA, and (3) examine whether either criterion was associated with the rate of GWG.

Methods

Study design and setting

This multicentre cross-sectional survey was conducted from 27 January to 21 February 2024 in three provinces of China chosen to capture geographical and climatic diversity: Guangdong (southern, subtropical), Zhejiang (eastern, temperate) and Shaanxi (northern, continental). Data were collected at one tertiary hospital in each province (Zhongshan Hospital of Traditional Chinese Medicine, Guangdong; The First Affiliated Hospital of Ningbo University, Zhejiang; and Xi'an Fourth Hospital, Shaanxi). All eligible pregnant women attending routine antenatal visits during the recruitment period were invited to complete an electronic questionnaire administered through the Wenjuanxing ("Questionnaire Star", www.wjx.cn) platform. Of the 356 women who accessed the questionnaire, 21 were excluded because they did not meet the inclusion criteria, leaving 335 for analysis. The study was reported in accordance with the STROBE statement for cross-sectional studies[22].

Participants

Eligible participants were women aged 20 to 45 with a singleton pregnancy, no history of habitual abortion or preterm birth, and no premature rupture of membranes, persistent vaginal bleeding, placenta previa, severe anemia, systemic diseases, mental illness, or cognitive impairment. A total of 335 women with complete PA and weight data were included in the analysis. The sample size ($n = 335$) was determined a priori to estimate the prevalence of guideline adherence: assuming an expected adherence of 22.1% (from our 2017 Guangdong preliminary study[23]), a 95% confidence level and a 5% margin of error, the minimum required sample was 265.

Relationship to companion publications. The quantitative dataset analysed here ($n = 335$) is shared with two companion publications from the same cohort: a convergent mixed-methods study examining whether the Exercise Benefits/Barriers Scale and the Pregnancy Exercise Self-Efficacy Scale capture the lived exercise experiences of Chinese pregnant women[24], and a cross-sectional study identifying factors associated with PA guideline adherence, in which adherence was defined using the sports/exercise (LTPA) criterion examined here[25]. Neither companion study compared domain-inclusion criteria, quantified classification agreement, or examined gestational weight gain; the present manuscript addresses these distinct research questions.

Measures

Physical activity. PA was assessed with the Chinese version of the PPAQ, which queries the frequency and duration of activities across four domains (household/caregiving, occupational, sports/exercise and transport) and yields MET-hours per week (MET-h/week) for each domain and for total activity[7, 8]. Items were classified by intensity (sedentary, light, moderate, vigorous).

Adherence criteria. Two criteria were derived from moderate-intensity activity, both anchored to the recommendation of at least 150 minutes of moderate-intensity activity per week[4]:

All-domain adherence: at least 7.5 MET-h/week of moderate-intensity activity summed across the household/caregiving, occupational, transport and sports/exercise domains (equivalent to 150 minutes per week at 3 METs)[26];

Exercise/leisure-time (LTPA) adherence: at least 7.5 MET-h/week of moderate-intensity activity within the sports/exercise domain[26].

Gestational weight gain. Self-reported pre-pregnancy weight and current weight were used to calculate the rate of GWG as (current weight – pre-pregnancy weight) / (gestational weeks – 12), expressed in kg/week. The 12-week subtraction was applied so that the rate corresponds to the second and third trimesters, the period over which the IOM recommends monitoring weekly gain; this assumes that first-trimester gain is small (approximately 0.5–2 kg) relative to later gain[27].

Covariates. Covariates were selected a priori and grouped into demographic (age; education dichotomised as college/undergraduate or above versus high school or below; employment status; residence; living arrangement; annual income), regional (province), obstetric (pre-pregnancy body mass index, gestational weeks and parity) and psychosocial factors. Psychosocial factors were measured with the Exercise Benefits/Barriers Scale (EBBS)[28] and the Chinese version of the Pregnancy Exercise Self-Efficacy Scale (P-ESES)[29].

Statistical analysis

Descriptive statistics (mean $\pm$ SD or n, %) were used to summarise participant characteristics. Adherence prevalence was reported with 95% confidence intervals (Wilson method). The two criteria were compared using McNemar's test for paired proportions, and agreement was assessed with Cohen's kappa, interpreted using the conventional benchmarks of Landis and Koch[30]. A 2 $\times$ 2 cross-tabulation was constructed, and the number of women meeting the all-domain but not the LTPA criterion was quantified.

The association of each PA measure with the rate of GWG was examined using hierarchical linear regression, with variables entered in four blocks: (1) the PA exposure; (2) demographic and regional factors; (3) obstetric factors; and (4) psychosocial factors. Models were repeated using GWG amount (kg) as the outcome and using continuous PA measures (moderate-intensity activity and sports/exercise activity, MET-h/week), including domain-specific and sedentary measures. Multicollinearity was assessed using variance inflation factors (VIF). A two-sided p-value < 0.05 was considered statistically significant. Analyses were performed in IBM SPSS Statistics version 26.0.

Ethics

The Ethics Committee of the Philippine Women's University (ERB2024_007) served as the single reviewing institutional review board and approved the multicentre protocol for all three data collection sites; The First Affiliated Hospital of Ningbo University, which contributed the largest sample, additionally

granted local ethics approval (2024 035A-1). All participants provided electronic written informed consent before completing the questionnaire.

Results

Participant characteristics

A total of 335 pregnant women with complete PA and weight data were included. The mean age was 30.6 ± 3.5 years and the mean gestational age was 34.3 ± 4.9 weeks; 94.6% of the women were in the third trimester. Because recruitment took place predominantly in late pregnancy, the activity and weight data reported here chiefly reflect behaviour and weight accumulation across the second and third trimesters, which is consistent with the derivation of the outcome: the 12-week subtraction aligns the rate of GWG with the same window. Most women had a college or undergraduate education (77.3%) and were employed (67.8%), a pattern relevant to the domain composition described below because employment is a primary determinant of occupational activity; 72.8% were nulliparous. The mean rate of GWG was 0.52 ± 0.31 kg/week. Characteristics are shown in Table 1. The overrepresentation of women with tertiary education and paid employment should be borne in mind when generalising, because domestic and job-related activity patterns may differ in women with less education or outside the labour force.

Table 1
Characteristics of participants (n = 335)

Characteristic	Value
Age, years, mean $\pm$ SD	30.6 $\pm$ 3.5
Height, cm, mean $\pm$ SD	161.2 $\pm$ 5.5
Pre-pregnancy weight, kg, mean $\pm$ SD	55.1 $\pm$ 8.1
Current weight, kg, mean $\pm$ SD	66.6 $\pm$ 8.9
Gestational age, weeks, mean $\pm$ SD	34.3 $\pm$ 4.9
Rate of GWG, kg/week, mean $\pm$ SD	0.52 $\pm$ 0.31
Level of education, n (%)	
Junior high and below	14 (4.2)
High school / technical secondary	34 (10.1)
College / undergraduate	259 (77.3)
Graduate	28 (8.4)
Employment status, n (%)	
Employed	227 (67.8)
Unemployed	108 (32.2)
Parity, n (%)	
Nulliparous	244 (72.8)
Parous	91 (27.2)
Trimester, n (%)	
First	6 (1.8)
Second	12 (3.6)
Third	317 (94.6)
Pre-pregnancy BMI, kg/m ² , mean $\pm$ SD	21.2 $\pm$ 2.9
Residence (urban), n (%)	294 (87.8)
Province, n (%)	Guangdong 109 (32.5); Zhejiang 149 (44.5); Shaanxi 77 (23.0)
Living arrangement, n (%)	
Co-residence with parents/in-laws	144 (43.0)

Characteristic	Value
Living separately from parents/in-laws	191 (57.0)
Annual household income (RMB), n (%)	
< 100,000	72 (21.5)
100,000–300,000	201 (60.0)
> 300,000	62 (18.5)

Adherence under the two criteria

Applying the two domain-inclusion criteria to the same 335 women produced markedly divergent prevalence estimates (Table 2, Fig. 1). Under the all-domain criterion, 79.1% (265/335; 95% CI 74.4–83.1) of women met the threshold, whereas under the exercise/LTPA criterion only 29.0% (97/335; 95% CI 24.4–34.0) did. The absolute difference of 50.1 percentage points was statistically reliable (McNemar’s test, $p < 0.001$). Overall classification agreement was 48.7%, and Cohen’s kappa was 0.175 (95% CI 0.122–0.228), which falls within the range conventionally interpreted as slight agreement beyond chance[30]. Thus, for about half of the sample the two criteria yielded different labels, and the observed agreement was only slightly higher than would be expected were the classifications independent.

Table 2
Adherence and classification agreement under the two criteria

Indicator	Value
All-domain adherence, % (n/N)	79.1 (265/335)
Exercise/LTPA adherence, % (n/N)	29.0 (97/335)
Difference, percentage points	50.1
McNemar's test, p	< 0.001
Overall agreement, %	48.7
Kappa (κ , 95% CI)	0.175 (0.122–0.228)
Discordant classification, n (%)	172 (51.3)
All-domain adherents not meeting LTPA, n (%)	170 (64.2)
Meeting LTPA but not all-domain, n (%)	2 (0.6)
2×2 cross-tabulation	
Meeting both criteria, n	95
Meeting all-domain only, n	170
Meeting LTPA only, n	2
Meeting neither criterion, n	68

The cross-tabulation clarifies the source of this divergence. Of the 265 women who met the all-domain criterion, 170 (64.2%) reached the threshold entirely through household, occupational and transport activity; only 2 women (0.6%) met the LTPA criterion without also meeting the all-domain criterion (Table 2). The LTPA criterion is therefore almost entirely nested within the all-domain criterion: a leisure-time-only definition labels as inactive a large group of women who nonetheless accumulate the volume of moderate-intensity activity specified by the domain-agnostic recommendation.

Domain composition of physical activity

Total activity averaged 183.6 ± 87.0 MET-h/week, an amount reflecting the summed contribution of all five PPAQ domains rather than exercise alone. Partitioning this total by domain revealed a markedly unequal distribution: household/caregiving activity accounted for the largest share (59.8%), followed by occupational (27.3%) and transport (9.8%) activity, whereas sports/exercise contributed only 3.1%; collectively, the three non-leisure domains represented 96.9% of all reported activity (Table 3). The distribution by intensity provides a complementary view: sedentary behaviour accounted for 54.5% of total activity, light activity for 27.1%, and moderate-to-vigorous activity for 18.4% (moderate 18.0%, vigorous 0.4%). Two observations follow. First, most reported energy expenditure occurred at intensities

below the threshold relevant to the guideline, so the volume qualifying as moderate intensity was much smaller than the total. Second, vigorous activity was virtually absent (0.4%). Reading the domain and intensity distributions together clarifies the structure of the exposure: the moderate-intensity volume that determines adherence was accrued disproportionately through household and work-related tasks rather than organised exercise. This is precisely the mechanism that produces criterion-dependent prevalence estimates—a criterion that excludes non-leisure domains removes the principal source of qualifying activity—and it also limits what either criterion can detect in the association analyses that follow, because the leisure-time exposure has little variance while the all-domain measure aggregates heterogeneous behaviours.

Table 3
Domain and intensity composition of physical activity (n = 335)

Group	Variable	Mean $\pm$ SD (MET-h/week)	Median (P25–P75)	Percent of total (%)
Total	Total activity	183.6 $\pm$ 87.0	173.7 (129.7–224.6)	100
By intensity	Sedentary	100.1 $\pm$ 44.7	100.5 (60.7–135.5)	54.5
	Light	49.8 $\pm$ 38.6	39.0 (20.7–69.1)	27.1
	Moderate	33.1 $\pm$ 43.1	18.9 (8.5–40.2)	18.0
	Vigorous	0.6 $\pm$ 2.2	0.0 (0.0–0.0)	0.4
By domain	Household/caregiving	109.9 $\pm$ 58.9	96.6 (70.5–131.6)	59.8
	Occupational	50.1 $\pm$ 47.5	59.9 (0.0–76.8)	27.3
	Transport	18.0 $\pm$ 19.1	12.3 (7.0–21.0)	9.8
	Sports/exercise (LTPA)	5.6 $\pm$ 6.6	3.4 (0.8–8.3)	3.1

Association with gestational weight gain

In hierarchical linear regression models, neither the all-domain criterion (crude β = 0.010, 95% CI – 0.071 to 0.091, p = 0.810; fully adjusted β = –0.001, 95% CI – 0.084 to 0.083, p = 0.983) nor the LTPA criterion (crude β = –0.023, 95% CI – 0.096 to 0.049, p = 0.528; fully adjusted β = –0.024, 95% CI – 0.099 to 0.052, p = 0.537) was associated with the rate of GWG. Continuous measures (moderate-intensity activity, β = –0.00004, p = 0.932; sports/exercise activity, β = –0.002, p = 0.447), domain-specific measures (household, β = –0.0001, p = 0.858; occupational, β = 0.000, p = 0.613; transport, β = –0.001, p = 0.267) and sedentary behaviour (β = 0.000, p = 0.430) were likewise not associated with GWG rate. Across all eight exposure specifications, coefficients were uniformly small, indicating that the null findings reflect genuinely negligible associations rather than imprecise estimation. The only consistent correlate was parity: parous women gained weight approximately 0.09 kg/week faster than nulliparous women (fully adjusted β = 0.093, 95% CI 0.002 to 0.184, p = 0.046). The fully adjusted models explained approximately

4–5% of the variance in GWG rate. Variance inflation factors remained within acceptable bounds in all models, indicating that multicollinearity was not a concern (Table 4).

Table 4
Association between physical activity and the rate of gestational weight gain (kg/week)

Exposure	Model	β (95% CI)	p	VIF
All-domain adherence (yes vs no)	Crude	0.010 (– 0.071, 0.091)	0.810	1.000
All-domain adherence (yes vs no)	Fully adjusted	–0.001 (– 0.084, 0.083)	0.983	1.058
LTPA adherence (yes vs no)	Crude	–0.023 (– 0.096, 0.049)	0.528	1.000
LTPA adherence (yes vs no)	Fully adjusted	–0.024 (– 0.099, 0.052)	0.537	1.081
Moderate-intensity activity (MET-h/week)	Fully adjusted	–0.00004 (– 0.001, 0.001)	0.932	1.120
Sports/exercise activity (MET-h/week)	Fully adjusted	–0.002 (– 0.007, 0.003)	0.447	1.099
Household activity (MET-h/week)	Fully adjusted	–0.0001 (– 0.001, 0.001)	0.858	1.154
Occupational activity (MET-h/week)	Fully adjusted	0.000 (– 0.001, 0.001)	0.613	1.533
Transport activity (MET-h/week)	Fully adjusted	–0.001 (– 0.003, 0.001)	0.267	1.083
Sedentary behaviour (MET-h/week)	Fully adjusted	0.000 (– 0.001, 0.001)	0.430	1.500
Parity (parous vs nulliparous)	Fully adjusted	0.093 (0.002, 0.184)	0.046	1.506
Note. Fully adjusted models included age, education, employment, residence, living arrangement, income, province, pre-pregnancy BMI, gestational weeks, parity and psychosocial factors (exercise benefits, exercise barriers and exercise self-efficacy). Each row represents a separate regression model with the listed exposure as the primary independent variable. The parity estimate is taken from the model with all-domain adherence as the exposure. VIF, variance inflation factor; VIF values refer to the exposure (or parity) variable in the corresponding model, and VIF = 1.000 in crude models containing a single predictor. All VIF values were below 2, indicating no concerning multicollinearity.				

Sensitivity analyses

To assess whether the null associations were robust to the definition of the outcome, the models were re-estimated with GWG amount (kg) as the dependent variable. Results were unchanged: no PA measure was associated with GWG amount, and the direction and magnitude of the (null) associations were consistent across models. Because the rate and the amount of gain capture related but non-identical facets of weight accrual—the former indexing the tempo of gain across the second and third trimesters

and the latter the cumulative total—the concordance between the two sets of estimates suggests that the absence of an association with PA was not an artefact of a single analytic choice.

Discussion

Main findings

In a multi-province sample of Chinese pregnant women, the estimated prevalence of meeting PA guidelines differed more than twofold according to whether non-leisure domains were included (79.1% versus 29.0%), and the two criteria classified almost half of the women differently (agreement 48.7%, $\kappa = 0.175$). The near-complete nesting of the LTPA criterion within the all-domain criterion—170 of 265 all-domain adherents qualified through non-leisure activity alone, while only two women qualified through leisure activity alone—shows that the two definitions are not interchangeable alternatives. However, neither criterion, nor any continuous, domain-specific or sedentary measure, was associated with the rate of GWG.

Why the prevalence diverges

Pregnancy PA is largely non-leisure. In our sample, household, occupational and transport activity together accounted for 96.9% of total activity, whereas sports/exercise contributed only 3.1%. This profile closely mirrors international observations: in a large United States cohort, household and occupational activity contributed about 42% and 28% of total activity, respectively, while sports/exercise contributed about 5%[9]; and in an Italian study, 51% of women met an all-domain criterion versus only 7.8% when exercise alone was counted[31]. The French ELFE cohort provides the most direct parallel: only 28.0% of women met guidelines through leisure-time activity, whereas adding transport, household/caregiving and occupational activity raised the estimate to as high as 85.6%[32]. Chinese data point in the same direction, with household and caregiving activities dominating pregnant women's activity profiles[21]. Leisure-only measures therefore omit most of the exposure and yield markedly lower adherence, whereas all-domain measures capture the total volume described in the WHO recommendation[4]. This is primarily a measurement issue rather than a biological one. It also explains why adherence to different guidelines can classify the same women differently, as demonstrated in Portuguese women whose apparent activity level depended on which guideline was applied[12]. For surveillance and cross-study comparison, the implication is direct: two reports drawing on comparable populations could arrive at adherence estimates differing by a factor of nearly three solely by virtue of the domains counted toward the threshold, and estimates that do not state their domain-inclusion criterion may be systematically incomparable.

Null association with gestational weight gain

The absence of an association across all exposure specifications is notable and warrants careful interpretation. Several explanations are plausible. First, self-reported PA is subject to recall and social-desirability bias, and the PPAQ has been shown to overestimate moderate-to-vigorous activity relative to

accelerometry[33]; such non-differential measurement error would attenuate any true association toward the null, and studies using objectively recorded PA confirm that questionnaire-based estimates can diverge substantially from device-based ones[34, 35]. Indeed, the measurement properties of pregnancy PA questionnaires are variable even under favourable conditions[11, 36]. Second, the compositional structure of activity constrains statistical power: because sports/exercise contributed only 3.1% of total activity, the leisure-time exposure had limited variance, whereas the all-domain measure aggregates behaviours—household, occupational and transport activity—whose separate associations with weight gain may differ in direction and size and thus cancel out. Third, energy intake, which we did not measure, is a major determinant of GWG[37] and may confound or outweigh any contribution of activity at the levels observed here.

Our findings are consistent with prospective studies that found little or no association between self-reported PA and GWG, including a cohort of Hispanic women in the United States[38] and a large cohort linking mid-pregnancy behaviour to excessive gain[39]. At the same time, randomised trial evidence indicates that structured exercise or combined diet-and-activity interventions produce modest but reliable reductions in GWG[1, 3], and interventions can increase device-measured PA in pregnancy, albeit modestly[40]. The contrast between trial effects and observational null results such as ours likely reflects the difference between a supervised, adequately dosed exercise exposure and the habitual, predominantly non-leisure activity captured by questionnaires, rather than a true absence of any causal effect of activity on weight gain. This distinction matters: our null findings should not be read as evidence against promoting PA in pregnancy, for which the benefits are well established[2, 3, 5], but as evidence that questionnaire-classified guideline adherence—under either domain-inclusion criterion—is a weak proxy for the exposure that modifies GWG.

Implications for measurement, surveillance and practice

Our results carry three implications. First, for research reporting, studies using domain-structured questionnaires such as the PPAQ should state explicitly which domains are counted toward the adherence threshold and, where possible, report prevalence under more than one criterion, because the near-complete nesting we observed indicates that the two labels cannot be used interchangeably[12]. Second, for surveillance, the wide divergence between criteria (79.1% versus 29.0%) cautions against comparing adherence estimates across studies that apply different domain-inclusion rules, and may partly explain the heterogeneity in reported prevalence[10]. Third, for practice, the dominance of household and caregiving activity suggests that counselling which recognises these culturally prominent activities—rather than exhorting leisure-time exercise alone—may resonate better with Chinese pregnant women, whose beliefs about exercise during pregnancy differ from those of women in Western settings[18]. At the same time, because moderate-intensity volume was accrued mainly through domestic and work-related tasks of uncertain health value, guidance should continue to encourage safe, structured exercise alongside daily activity[41, 42].

Strengths and limitations

The main strength of this study is the direct, within-sample comparison of two scoring criteria, which quantifies a measurement problem previously acknowledged only qualitatively and avoids confounding by population or instrument differences. The study thereby separates the effect of the measurement decision on prevalence from its effect on exposure–outcome associations, by testing whether the choice of criterion affects the association with GWG. Additional strengths include the use of a validated, pregnancy-specific instrument[35, 43], prespecified covariate blocks including psychosocial factors, robustness checks using an alternative outcome definition, and the multi-province Chinese setting, where context-specific evidence remains scarce.

Several limitations should be noted. The cross-sectional design precludes causal inference and is vulnerable to reverse causality, because women who gain more weight may reduce their activity; longitudinal designs are therefore needed to establish temporal ordering. PA and body weight were self-reported, with recall and social-desirability bias: the PPAQ tends to overestimate moderate-to-vigorous activity[33], and the GWG rate was derived from self-reported weights, so future studies should incorporate device-based measurement and objective weight records. No pregnancy or neonatal outcomes were collected, so we could not determine which criterion better predicts clinical outcomes; this comparison should therefore be a priority in future research. The sample was highly educated, predominantly employed, and clustered in the third trimester, and was recruited by convenience sampling from three provinces, which limits generalisability to the wider Chinese pregnant population, particularly women with less education or outside the labour force; future studies should deliberately oversample these underrepresented groups. The fully adjusted models explained only 4–5% of the variance in GWG rate, indicating that important determinants—most notably dietary intake[17]—were not measured, and the study may have been underpowered to detect very small associations. Multiple exposures and covariates were examined without formal adjustment for multiplicity, so the borderline association of parity ($p = 0.046$) should be interpreted cautiously as hypothesis-generating. Part of this cohort has been reported in two companion publications[24, 25], although the present research questions—the comparison of domain-inclusion criteria and their association with GWG—are distinct.

Future research

Future studies should measure PA across all trimesters using device-based methods integrated with domain-specific questionnaires, building on recent updates that combine accelerometry with wearable cameras to improve the PPAQ's performance[34, 35], and should test whether the domain-inclusion criterion affects associations with outcomes such as gestational diabetes and preterm birth, where the physiological mechanisms may differ from those governing weight gain. Qualitative work on how pregnant women conceptualise “exercise” versus everyday “activity” would help refine both instruments and counselling messages, and intervention studies should establish whether increasing structured, leisure-time exercise modifies GWG even when habitual non-leisure activity is already high[40].

Conclusions

In Chinese pregnant women, the domain-inclusion criterion strongly affects the estimated prevalence of meeting PA guidelines—79.1% under an all-domain criterion versus 29.0% under a leisure-time criterion, with only slight agreement between the two—but did not change the (null) association with gestational weight gain. Because the LTPA criterion is almost entirely nested within the all-domain criterion, the two definitions are not interchangeable. Studies using domain-structured questionnaires should state and, where possible, compare domain-inclusion criteria, surveillance should interpret prevalence estimates in light of the domains counted, and objective-measurement studies are warranted to clarify the relationship between PA and gestational weight gain.

Abbreviations

PA	physical activity
GWG	gestational weight gain
IOM	Institute of Medicine
MET	metabolic equivalent of task
TEE	total energy expenditure
SED	sedentary behavior
LPA	light-intensity physical activity
MPA	moderate-intensity physical activity
VPA	vigorous-intensity physical activity
DPA	domestic physical activity
TPA	transportation physical activity
OPA	occupational physical activity
LTPA	leisure-time physical activity (mainly exercise)
PPAQ	Pregnancy Physical Activity Questionnaire
EBBS	

Exercise Benefits/Barriers Scale
P-ESES
Pregnancy Exercise Self-Efficacy Scale.PA,physical activity
GWG
gestational weight gain
IOM
Institute of Medicine
MET
metabolic equivalent of task
WHO
World Health Organization
LTPA
leisure-time physical activity (mainly exercise)
PPAQ
Pregnancy Physical Activity Questionnaire
EBBS
Exercise Benefits/Barriers Scale
P-ESES
Pregnancy Exercise Self-Efficacy Scale
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
VIF
variance inflation factor
CI
confidence interval.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of the Philippine Women's University (ERB2024_007), which provided institutional oversight for the doctoral project across all data collection sites. Additional local ethics approval was obtained from The First Affiliated Hospital of Ningbo University (Approval No. 2024 035A-1), the site contributing the largest participant sample. For the remaining two hospitals, data collection was conducted with institutional permission, and all participants provided electronic written informed consent, in compliance with the Declaration of Helsinki.

Consent for publication

Not applicable. This manuscript does not contain any individual person's data in any form (e.g., personal identifiers, images, or recordings). All data were anonymized prior to analysis, and participants

consented to the use of their anonymized data for research and publication during the informed consent process.

Availability of data and materials

The data analysed in this study were originally collected for the first author's doctoral dissertation (Philippine Women's University, 2024; printed archive, unpublished) and derive from a single cohort of 335 pregnant women recruited from three Chinese provinces. The dataset overlaps with those used in two companion publications from the same cohort: a cross-sectional paper examining predictors of physical activity guideline adherence[25] (preprint: <https://www.researchsquare.com/article/rs-9418228/v1>) and a convergent mixed-methods paper triangulating self-report scales with qualitative interview data[24] (accepted by BMC Pregnancy and Childbirth, in press). Overlap with these companion papers is limited to participant characteristics, PPAQ-derived physical activity estimates, and EBBS and P-ESES scale scores; the gestational weight gain outcome, the comparison of domain-inclusion scoring criteria, and all association analyses presented herein are original and have not been published previously. The datasets generated and analysed during the current study are not publicly available in order to protect participant confidentiality, but are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JL conceptualised the study, collected data and drafted the manuscript; YW, XL and HL collected data and contributed to recruitment at the three study sites; JL and JTS performed the statistical analysis; JTS supervised the study and critically revised the manuscript. All authors read and approved the final manuscript.

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Clinical Trial Number

Not applicable.

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Figures

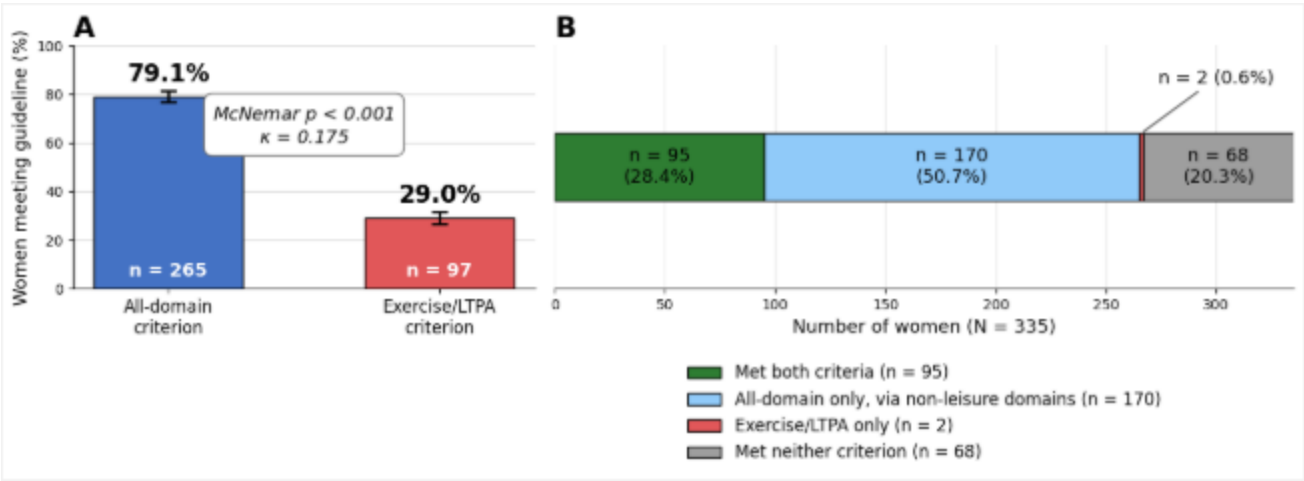


Figure 1

Adherence to the physical activity guideline under the all-domain and exercise/leisure-time (LTPA) criteria and cross-classification of participants (N = 335).