

Menstruation-related participation difficulty and symptoms of depression and anxiety among adolescents and young women in Nepal

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Abstract

Background

Contemporary definitions of menstrual health include the capacity to participate in work, education and social life; however, nationally representative evidence examining the association between menstruation-related functional difficulty and mental-health symptoms is lacking in Nepal.

Methods

Cross-sectional analysis of the Nepal Multiple Indicator Cluster Survey 2024–25. Participants were women aged 15–24 years who had menstruated in the preceding 12 months ($n = 3,845$ for prevalence; $n = 3,772$ analytic sample). The exposure was any menstruation-related difficulty participating in work, education/training, or social activities during the last menstrual period. The outcome was NMICS-defined depression and/or anxiety symptoms during the preceding two weeks, using survey-specific thresholds for depression (≥ 14) and anxiety (≥ 12). Survey-weighted logistic regression with marginal standardization estimated adjusted prevalence differences (aPD), controlling for age, residence, province, wealth, education, and current marital/union status.

Results

Weighted prevalence of any participation difficulty was 45.3% (95% CI 43.2–47.4); domain-specific prevalence was 41.7% for work, 31.8% for education/training, and 34.7% for social activities. Standardized prevalence of depression and/or anxiety symptoms was 7.7% (6.1–9.3) without difficulty and 16.8% (14.4–19.3) with difficulty, an aPD of 9.07 percentage points (6.34–11.81). Estimates were similar for depression (7.99; 5.59–10.39) and anxiety (8.34; 5.72–10.96), and in a post hoc analysis restricted to participants whose most recent menstrual period began within 14 days before interview (aPD 8.58 percentage points, 95% CI 5.02–12.14).

Conclusions

Nearly half of menstruating adolescents and young women aged 15–24 years in Nepal reported menstruation-related participation difficulty, and participation difficulty was associated with a higher prevalence of depression and/or anxiety symptoms.

Background

The consensus definition developed by the Global Menstrual Collective frames menstrual health as complete physical, mental and social wellbeing in relation to the menstrual cycle, and includes the capacity to participate in work, education and social life without menstruation-related restriction (1). This

repositions participation from an incidental consequence of menstruation to a constitutive component of menstrual health, and situates it within targets spanning education, gender equality and psychosocial wellbeing (2).

Evidence that menstruation constrains participation is substantial. A qualitative metasynthesis of 76 studies across 35 low- and middle-income countries described convergent pathways through which stigma, resource limitations and restrictive social norms generate shame, distress and withdrawal from school, work and social engagement (3). In India, pooled estimates indicate that approximately a quarter of adolescent girls miss school during menstruation (4). Reflecting these consequences, the priority indicator shortlist for national and global monitoring designates menstrual health impacts, including participation, as a distinct measurement domain (5).

Although adverse menstrual experiences, including menstrual symptoms and activity limitations, have been associated with poorer mental health among adolescent girls (6, 7), such studies are typically small, school-based and geographically confined, limiting generalisability and precluding population-level estimation. Evidence specifically examining the relationship between menstruation-related participation difficulty and mental health remains limited in low- and middle-income countries.

Nepal is a salient setting for these questions. Menstrual restrictions remain widespread: a nationally representative analysis of the 2022 Nepal Demographic and Health Survey found that 84.8% of menstruating women aged 15–49 years reported at least one menstrual restriction, while 6.2% reported *chhaupadi*, with marked geographical variation across the country (8). Mixed-methods work in mid-western Nepal identified pain management and mental health as central to menstrual dignity (9). Nationally, anxiety and depressive symptoms are common among Nepalese women and care-seeking is low (10), and because most mental disorders emerge before age 25 (11), adolescence and young adulthood represent a critical window. Nationally representative evidence linking menstruation-related functional difficulty to mental health in Nepal nonetheless remains absent.

We therefore examined the association between any menstruation-related participation difficulty and symptoms of depression and/or anxiety among Nepalese women aged 15–24 years using nationally representative data. Secondary objectives were to examine depression and anxiety separately, characterise associations across the work, education/training, and social participation domains, assess modification by age group, and examine menstrual-material sufficiency and pain management as supplementary menstrual-health exposures.

Methods

Study design and data source

We conducted a cross-sectional analysis of the Nepal Multiple Indicator Cluster Survey (NMICS) 2024–25, a nationally representative household survey conducted by the National Statistics Office in partnership with UNICEF between December 2024 and May 2025. NMICS used a stratified, multistage

cluster sampling design based on the 2021 National Population and Housing Census. Enumeration areas were selected with probability proportional to size within 15 sampling strata, followed by systematic selection of households. Overall, 540 enumeration areas were sampled.

The present study included female respondents aged 15–24 years who reported menstruating during the preceding 12 months and had sufficient information to classify menstruation-related participation difficulty. Respondents reporting no applicable activity in all three participation domains were excluded from the primary exposure definition. The primary complete-case analytic sample comprised 3,772 participants (Supplementary Table S1).

All items analysed were drawn from the standard MICS7 survey instruments administered by the survey implementers. The Questionnaire for Women Age 15–49 Years and the Household Questionnaire, as administered in NMICS 2024–25, are provided as Additional files 1 and 2 and are reproduced in Appendix E of the official survey report (12); the MICS7 model questionnaires are publicly available from the UNICEF MICS programme (13). Questionnaires were interviewer-administered face-to-face by female interviewers. The mental health module required assured privacy before administration; interviewers were instructed not to begin, and to reschedule, where privacy could not be maintained (item MH1).

Exposure measures

The primary exposure was any recent menstruation-related difficulty participating in usual activities. NMICS assessed menstruation-related participation difficulty using UN16, which asked: “During your last menstrual period, did you have trouble participating in the following activities due to your period?” The three domains were work (UN16A), education and training (UN16B), and social activities outside school or work (UN16C). Response options were yes, no, no such activity, and don't know/not sure. For each domain-specific analysis, responses of yes and no defined the applicable population, with yes indicating participation difficulty; “no such activity” was treated as not applicable, while uncertain or missing responses were treated as unclassifiable. Participants with at least one applicable domain, no reported difficulty, and no uncertain or missing response for an otherwise assessable domain were classified as having no participation difficulty. Participants with no positive response but an uncertain or missing response that prevented definitive classification were treated as unclassifiable. Those reporting “no such activity” for all three domains were not eligible for the composite exposure. Because the composite was defined as difficulty in any applicable domain, participants with more applicable domains had more opportunities to meet the exposure definition. The number of applicable domains (one, two, or three) was therefore described in Table 1.

The work item was labelled simply “work” in NMICS and did not distinguish paid, formal, domestic, or other forms of work. Supplementary menstrual-health exposures were insufficient menstrual materials and inability to reduce menstruation-related pain when pain reduction was needed. Insufficient menstrual materials was derived from UN18, which asked whether respondents had enough menstrual materials to change them as often as they wanted throughout their last menstrual period. “No, not enough” was classified as insufficient and “yes, enough” as sufficient; don't-know/don't-remember and missing

responses were treated as unclassifiable. Inability to reduce pain was derived from UN19. Respondents reporting that they did not need to reduce pain were excluded from the pain analysis. Among respondents who needed pain reduction, “no” was classified as unable and “yes” as able to reduce pain; missing responses were unclassifiable.

Outcomes

The primary outcome was the NMICS-defined classification of depression and/or anxiety symptoms during the two weeks preceding interview, corresponding to MICS indicator TM.701. Symptoms were assessed using the Measurement of Mental Health Among Adolescents and Young People at the Population Level (MMAPP) module incorporated into MICS7 (14). The module uses a two-stage administration design developed for population surveys: all respondents are asked four core depression-symptom items (MH3–MH6) and six core anxiety-symptom items (MH7–MH12), each scored from 0 (never) to 3 (always).

The thresholds applied here follow the NMICS analytic definitions (12). They are intended for population-level estimation of symptom prevalence rather than for individual clinical diagnosis, and are lower than the cut-offs printed in the field questionnaire, which governed participant-support and referral procedures rather than analysis.

Depression and anxiety were classified using the survey’s gated scoring algorithm. For each component, respondents with no core item scored ≥ 2 (“often” or “always”) were classified below the corresponding symptom threshold; the expanded items were skipped by design and were not assigned zero values. Respondents with at least one core item scored ≥ 2 were administered the corresponding expanded items. Among these respondents, depression was classified from the 15 required items (MH3–MH6 and MH15–MH25; possible score 0–45) using a threshold of ≥ 14 , and anxiety from the 13 required items (MH7–MH12, MH23–MH25, and MH27–MH30; possible score 0–39) using a threshold of ≥ 12 . Items MH23–MH25 contribute to both scales and were administered if either screen was positive. A component was coded missing if the core items were incomplete or, following a positive screen, any required expanded item was missing. The combined outcome was classified as positive if either component met its threshold, including when the other component was unclassifiable; it was classified as negative only when both components were classifiable and negative, and otherwise was coded missing.

Covariates

Sociodemographic variables included for adjustment were continuous age, residence, province, household wealth quintile, education, and current marital/union status. These variables were selected on substantive grounds to account for measured sociodemographic differences between exposure groups; they were not considered a sufficient causal adjustment set.

Statistical analysis

Analyses were conducted in R using the survey package. All analyses accounted for the NMICS complex sampling design using the individual women's sampling weight (wmweight), primary sampling unit (PSU), and sampling stratum (stratum). The survey-design object was constructed among all interviewed women with positive sampling weights before study eligibility restrictions were applied; analytic populations were subsequently defined as survey subpopulations using subset() rather than by reconstructing separate survey designs after exclusions. Adjusted standardized prevalences were estimated by predictive margins using svypredmeans() in the R survey package. For each outcome we fitted a survey-weighted logistic model (quasibinomial logit link) containing the standardization covariates only: centred age, residence, province, household wealth quintile, education and current marital/union status, and supplied participation difficulty as the grouping factor. This yields the weighted mean predicted probability of the outcome across the whole analytic domain under each exposure level, holding observed covariate values. The adjusted prevalence difference (aPD) was $p_1 - p_0$. Its variance was obtained from the joint covariance matrix V of the two margins (vcov()) as $V_{00} + V_{11} - 2V_{01}$, and the 95% CI as $aPD \pm t_{0.975, df} \times \sqrt{\text{Var}(aPD)}$, with the survey-design degrees of freedom from degf() ($df = 525$). Estimates are reported in percentage points. All variances used Taylor linearization incorporating the survey weights, strata and primary sampling units.

Effect modification by age was examined using a participation-difficulty $\times$ age-group interaction (15–19 versus 20–24 years) retaining continuous age and the remaining covariates. Continuous age was retained to account for within-group age variation, whereas age group defined the effect-modification contrast. Age-specific standardized prevalences and aPDs were estimated, and heterogeneity was evaluated using the between-group difference in aPD and its design-based interaction test.

Of 3,845 respondents with a classifiable primary exposure, 3,772 (98.1%) had complete information for the primary outcome and adjustment variables and were included in the primary model. Each outcome was analysed using its own complete cases. Because the combined outcome was coded missing whenever neither component met its threshold and at least one component was unclassifiable, a component outcome could be classifiable when the combined outcome was not; the depression and anxiety samples therefore exceed the combined-outcome sample. No values were imputed. Supplementary analyses of menstrual-material sufficiency and inability to reduce menstrual pain used the same survey-weighted modelling and predictive-margin approach, with each supplementary menstrual-health exposure substituted for participation difficulty and using exposure-specific complete-case samples. Two post hoc sensitivity analyses were conducted. First, we restricted the analysis to participants whose most recent menstrual period began within 14 days before interview to more closely align the reference period of the menstrual exposure with the two-week reference period of the mental-health outcomes. Second, to assess whether the any-domain exposure definition was sensitive to differences in the number of applicable activity domains, we restricted the analysis to participants for whom all three domains: work, education/training, and social activities were applicable, thereby giving all participants the same number of opportunities to meet the composite exposure definition.

Results

Participant characteristics and participation difficulty

Of 14,080 women in the source file, 13,762 were interviewed with positive sampling weights, including 4,108 aged 15–24 years. Among 4,108 respondents, 3,856 reported menstruating during the preceding 12 months and 3,845 had a classifiable any-domain participation-difficulty exposure. These 3,845 respondents were used to estimate exposure prevalence. For Table 1 and the primary association model, 71 respondents without a classifiable combined mental-health outcome and two with missing education data were excluded, yielding a complete-case analytic sample of 3,772. (Supplementary Table S1). Among these participants, 441 had depression and/or anxiety symptoms.

In the primary analytic sample of 3,772 participants, 51.9% were aged 15–19 years and 68.0% lived in urban areas. Approximately three-fifths had secondary education (60.5%), while 21.2% had basic and 13.6% higher education. Nearly two-thirds were not currently in a marital union (65.3%). Participants were distributed across household wealth quintiles, with 20.9% in the poorest and 16.5% in the richest quintile. More than two-thirds (68.3%) had all three participation domains - work, education/training, and social activities applicable to them (Table 1).

The distribution of several characteristics differed descriptively according to menstruation-related participation difficulty. Compared with participants reporting no difficulty, those reporting difficulty were more frequently aged 15–19 years (56.0% vs 48.6%), had secondary education (64.1% vs 57.6%), and were not currently in a marital union (69.3% vs 62.0%). They were less frequently in the poorest wealth quintile (17.6% vs 23.6%) and more frequently in the fourth (24.6% vs 21.0%) or richest (18.1% vs 15.3%) quintiles. Geographic variation was also apparent, although these descriptive differences were not formally tested.

Among the 3,845 participants with a classifiable participation exposure, the weighted prevalence of any menstruation-related participation difficulty was 45.26% (95% CI 43.15–47.37) (Fig. 1). Domain-specific prevalence was 41.66% (39.63–43.70) for work, 31.84% (29.31–34.36) for education/training, and 34.74% (32.22–37.27) for social activities. Participation difficulty was consistently more prevalent among those aged 15–19 than among those aged 20–24: 48.83% versus 41.40% for any domain, 44.18% versus 38.96% for work, 36.07% versus 25.79% for education/training, and 36.88% versus 32.16% for social activities. The largest absolute age-group difference was observed for education/training.

Table 1

Characteristics of the primary analytic sample according to menstruation-related participation difficulty

Characteristic	Category	Overall n (%)	No difficulty n (%)	Difficulty n (%)
Total		3,772 (100)	2,098 (100)	1,674 (100)
Age group	15–19	1,800 (51.90)	942 (48.55)	858 (55.96)
	20–24	1,972 (48.10)	1,156 (51.45)	816 (44.04)
Residence	Urban	2,123 (68.02)	1,133 (66.30)	990 (70.11)
	Rural	1,649 (31.98)	965 (33.70)	684 (29.89)
Province	Koshi	473 (15.09)	300 (16.68)	173 (13.16)
	Madhesh	694 (22.24)	365 (21.84)	329 (22.73)
	Bagmati	610 (18.65)	324 (17.38)	286 (20.19)
	Gandaki	359 (7.79)	155 (6.02)	204 (9.94)
	Lumbini	583 (18.14)	296 (17.44)	287 (18.98)
	Karnali	541 (7.64)	328 (8.47)	213 (6.63)
	Sudurpashchim	512 (10.45)	330 (12.17)	182 (8.37)
Wealth quintile	Poorest	989 (20.85)	627 (23.55)	362 (17.57)
	Second	775 (20.37)	447 (21.09)	328 (19.49)
	Middle	775 (19.60)	413 (19.06)	362 (20.25)
	Fourth	747 (22.66)	371 (21.04)	376 (24.63)
	Richest	486 (16.52)	240 (15.26)	246 (18.05)
Education	None/ECED	176 (4.71)	118 (5.58)	58 (3.66)
	Basic	863 (21.20)	521 (23.57)	342 (18.33)
	Secondary	2,316 (60.52)	1,240 (57.55)	1,076 (64.11)
	Higher	417 (13.58)	219 (13.30)	198 (13.91)
Current marital/union status	Not currently in union	2,129 (65.33)	1,101 (62.02)	1,028 (69.33)
	Currently in union	1,643 (34.67)	997 (37.98)	646 (30.67)

Characteristic	Category	Overall n (%)	No difficulty n (%)	Difficulty n (%)
Applicable activity domains	1	736 (15.54)	453 (17.46)	283 (13.23)
	2	613 (16.12)	314 (14.74)	299 (17.79)
	3	2,423 (68.34)	1,331 (67.80)	1,092 (68.99)

Values are unweighted *n* and survey-weighted percentages. Percentages may not sum to 100 because of rounding. No hypothesis tests were conducted for descriptive characteristics.

Participation difficulty and mental-health symptoms

The crude prevalence of depression and/or anxiety symptoms was 7.82% (95% CI 6.23–9.42) among participants without participation difficulty and 16.60% (14.10–19.10) among those reporting difficulty. After sociodemographic adjustment and standardization, the corresponding prevalences were 7.73% (6.14–9.33) and 16.81% (14.36–19.26), yielding an aPD of 9.07 percentage points (95% CI 6.34–11.81) (Table 2). For the secondary outcomes, the aPD was 7.99 percentage points (5.59–10.39) for depression symptoms and 8.34 percentage points (5.72–10.96) for anxiety symptoms. Outcome-specific analytic samples were 3,782 for depression and 3,779 for anxiety.

Table 2
Association between menstruation-related participation difficulty and symptoms of depression and anxiety

Outcome	N (events)	Crude prevalence, no difficulty % (95% CI)	Crude prevalence, difficulty % (95% CI)	Standardized prevalence, no difficulty % (95% CI)	Standardized prevalence, difficulty % (95% CI)	aPD, percentage points (95% CI)
Depression and/or anxiety	3,772 (441)	7.82 (6.23–9.42)	16.60 (14.10–19.10)	7.73 (6.14–9.33)	16.81 (14.36–19.26)	9.07 (6.34–11.81)
Depression	3,782 (315)	4.96 (3.79–6.13)	12.44 (10.08–14.81)	4.83 (3.70–5.96)	12.82 (10.51–15.12)	7.99 (5.59–10.39)
Anxiety	3,779 (376)	6.59 (5.12–8.07)	14.82 (12.40–17.23)	6.56 (5.06–8.05)	14.90 (12.54–17.26)	8.34 (5.72–10.96)

aPD, adjusted standardized prevalence difference. Models adjusted for continuous age centred at 20 years, residence, province, household wealth quintile, education, and current marital status and accounted for the survey design. *N* and event counts are unweighted; prevalences, standardized estimates, and confidence intervals account for the survey design.

Domain-specific analysis and age modification

Adjusted prevalence differences were positive across each participation domain. Adjusted prevalence differences were 9.38 percentage points (95% CI 6.49–12.28) for work, 9.66 (6.12–13.20) for education/training, and 7.50 (3.95–11.05) for social activities (Table 3). Because the eligible populations differed across domains, these estimates were not interpreted as formal between-domain comparisons.

The aPD was 10.40 percentage points (6.39–14.40) among participants aged 15–19 years and 7.58 (3.83–11.32) among those aged 20–24 years. The between-group difference in aPD (20–24 minus 15–19 years) was – 2.82 percentage points (95% CI -8.35 to 2.71; interaction P = 0.317), providing no clear evidence of effect modification by age.

Table 3

Domain-specific and age-specific associations between menstruation-related participation difficulty and depression and/or anxiety symptoms

Panel A. Domain-specific participation difficulty				
Participation domain	N	Standardized no-difficulty % (95% CI)	Standardized difficulty % (95% CI)	aPD, percentage points (95% CI)
Work	3,766	7.94 (6.39–9.49)	17.32 (14.66–19.99)	9.38 (6.49–12.28)
Education/training	2,676	8.32 (6.57–10.08)	17.98 (14.65–21.31)	9.66 (6.12–13.20)
Social activities	2,791	8.41 (6.64–10.18)	15.91 (12.80–19.02)	7.50 (3.95–11.05)
Panel B. Association of participation difficulty by age group				
Age group	N	Standardized no-difficulty % (95% CI)	Standardized difficulty % (95% CI)	aPD, percentage points (95% CI)
15–19 years	1,800	7.76 (5.49–10.02)	18.15 (14.53–21.78)	10.40 (6.39–14.40)
20–24 years	1,972	7.67 (5.60–9.73)	15.24 (12.05–18.43)	7.58 (3.83–11.32)
Difference in aPD (20–24 minus 15–19)	-	-		-2.82 (-8.35 to 2.71)

Domain-specific analyses were restricted to respondents for whom the respective activity was applicable and participation status was classifiable; consequently, denominators differ across domains. Estimates across domains should not be interpreted as formal between-domain comparisons. N are unweighted; prevalences, standardized estimates, and confidence intervals account for the survey design. Difference in aPD (20–24 minus 15–19 years): -2.82 percentage points (95% CI -8.35 to 2.71); design-based interaction P = 0.317.

Sensitivity analyses

In a post hoc sensitivity analysis restricted to participants whose most recent menstrual period began within 14 days before interview (N = 2,102; 244 events), standardized prevalence of depression and/or anxiety symptoms was 7.70% among participants without participation difficulty and 16.28% among those with difficulty (Supplementary Table S2). The adjusted prevalence difference was 8.58 percentage points (95% CI 5.02–12.14), similar to the primary estimate of 9.07 percentage points (95% CI 6.34–11.81).

In a second post hoc sensitivity analysis restricted to participants for whom all three participation domains were applicable (N = 2,423; 260 events), standardized prevalence of depression and/or anxiety symptoms was 7.13% (95% CI 5.25–9.02) among participants without participation difficulty and 15.69% (12.91–18.46) among those with difficulty. The adjusted prevalence difference was 8.56 percentage points (95% CI 5.33–11.78), similar in magnitude to the primary estimate of 9.07 percentage points (95% CI 6.34–11.81).

In supplementary analyses, insufficient menstrual materials was associated with an aPD of -3.00 percentage points (95% CI -6.47 to 0.47; N = 3,775; 443 events), while inability to reduce menstrual pain among participants who needed pain reduction was associated with an aPD of 2.21 percentage points (95% CI -1.09 to 5.51; N = 2,949; 346 events) (Supplementary Table S3). Neither estimate was precisely estimated and both confidence intervals included the null.

Discussion

In this nationally representative sample of menstruating women aged 15–24 years in Nepal, nearly one in two reported menstruation-related difficulty participating in work, education or training, or social activities. After adjustment and standardisation, the prevalence of depression and/or anxiety symptoms was 7.73% among participants without participation difficulty and 16.81% among those with difficulty, an absolute difference of 9.07 percentage points (95% CI 6.34 to 11.81). Estimates were closely comparable when depression and anxiety were examined separately, and were consistent across all three participation domains. Participation difficulty was more common among adolescents aged 15–19 years than among women aged 20–24 years, yet there was no clear evidence of age modification of its association with mental-health symptoms. The association was also similar when analysis was restricted to participants whose most recent menstrual period began within the preceding 14 days (aPD 8.58 percentage points, 95% CI 5.02–12.14), reducing concern that the primary finding was driven by substantial separation of the exposure and outcome reference periods. However, temporal ordering remains unresolved even within this subgroup because participation difficulty and psychological symptoms may have occurred contemporaneously or bidirectionally.

By characterising whether menstruation interferes with ordinary participation in life, rather than relying on conventional menstrual-hygiene indicators alone, this study examines a functional dimension emphasised in contemporary definitions of menstrual health (1). At the population level, menstruation-

related participation difficulty therefore co-occurred with a higher prevalence of depression and anxiety symptoms, but the measures were not interchangeable: most participants reporting participation difficulty did not meet either mental-health symptom threshold, while symptoms were also present among some participants reporting no participation difficulty.

Participation difficulty was reported across all three assessed domains. Among respondents for whom each domain was applicable, prevalence was 41.7% for work, 34.7% for social activities, and 31.8% for education/training and was consistently more common among participants aged 15–19 years, with the widest absolute age gap in education or training (36.1% versus 25.8%). The higher prevalence of participation difficulty among adolescents aged 15–19 years may reflect age-related differences in menstrual-management experience, knowledge, autonomy, or confidence (15). Menstrual-health literacy and self-efficacy have been associated with greater confidence in managing menstruation and lower menstruation-related stress among adolescents, although these mechanisms were not measured in the present study. In a nationally representative survey of 3,495 adolescent girls aged 10–19 years, menstrual restrictions were reported in relation to social activities (46.1%), household activities (51.9%), and religious activities (79.1%), while 26.7% reported missing school because of menstruation-related problems (16). A systematic review of menstrual health research in Nepal similarly identified culturally restrictive practices, inadequate menstrual-management environments, and menstrual symptoms as barriers to participation in daily and community activities and to school attendance (17). The NMICS measure is broader in a different respect: it captures self-reported participation difficulty, which could reflect pain or fatigue, fear of leakage, inadequate facilities, stigma, social exclusion, externally imposed restriction, or combinations of these factors; the causes of difficulty were not measured.

Our findings extend a small but converging Nepalese and international literature. In a relevant comparable Nepalese study, Niroula and colleagues surveyed 270 school-going adolescent girls in Rangeli Municipality and found that moderate-to-severe dysmenorrhoea and low perceived support from family and friends during menstruation were each associated with higher odds of depression, anxiety, and stress (7). That study provides valuable contextual corroboration but was modest in size, geographically confined, and restricted to girls attending school. The broader evidence base is consistent. Meta-analytic evidence from 44 observational studies likewise shows that greater dysmenorrhoea severity is positively associated with depressive symptoms, anxiety symptoms, and global psychological distress (18). Among 892 working women in Kathmandu and Nairobi, better-met menstrual practice needs in the workplace were associated with more favourable psychological well-being and with not missing work during the last menstrual period, although that study's adult working population and continuous scale measurement differ from ours (19). The present analysis extends this literature by providing nationally representative estimates across work, education/training, and social participation and by reporting absolute standardized differences in depression and anxiety symptom prevalence.

Several explanations for the observed association are possible, and the cross-sectional data cannot distinguish among them. First, reverse directionality is plausible. Depressive and anxiety symptoms are

associated with impaired everyday functioning, including school, social, and other role-related activities (20, 21). These symptoms could therefore contribute to participation difficulties independently of menstruation and may also influence the subjective perception or reporting of participation difficulties (22). Second, shared determinants could contribute to both participation difficulty and mental-health symptoms. Menstrual pain severity and low social support, for example, have been associated with psychological distress among adolescent girls (7), while menstrual stigma, gender norms, resource constraints, shame, teasing and culturally imposed restrictions can affect both everyday participation and psychosocial well-being (23, 24). Third, physical and environmental conditions such as menstrual pain, fatigue, heavy bleeding, inadequate privacy, limited access to toilets or water, and fear of leakage may simultaneously impede participation and generate worry, embarrassment, or distress (17, 25). The integrated model of menstrual experience similarly situates material resources, physical environments, knowledge, stigma, menstrual practices, confidence, shame, and participation within an interconnected system rather than a single linear pathway (3). This systemic framing is consistent with contemporary definitions of menstrual health, which encompass both participation in valued activities and freedom from menstruation-related stigma and psychological distress (1). Accordingly, the adjusted prevalence difference should be interpreted as a covariate-standardized association rather than as an estimate of the effect of participation difficulty on mental health.

Our analyses warrant caution on several points. First, although domain-specific aPDs were similar in magnitude, the analyses involved different eligible populations; the estimates should therefore not be interpreted as direct between-domain comparisons. Second, exposure prevalence and effect modification must be kept distinct. Participation difficulty was more common among adolescents aged 15–19 years than among women aged 20–24 years, particularly for education or training. However, the age-specific associations were similar (aPD 10.40 versus 7.58 percentage points), and the between-group difference was imprecisely estimated (-2.82 percentage points, 95% CI -8.35 to 2.71; interaction $P = 0.317$). There was no clear evidence of effect modification by age, although the confidence interval around the between-group difference was compatible with some heterogeneity in either direction.

These findings do not support inferences about intervention effects. They do, however, indicate that menstruation-related participation difficulty and depression or anxiety symptoms are associated but non-equivalent measures: most participants reporting participation difficulty did not meet either symptom threshold, while symptoms were also present among some participants reporting no difficulty. Intervention evidence suggests that improvements in proximal menstrual-health outcomes do not necessarily translate into improvements in broader functional or psychosocial outcomes. Systematic reviews have found relatively consistent improvements in menstrual knowledge and management practices following educational interventions, while evidence for educational, functional, and psychosocial outcomes has been more limited and heterogeneous, with substantial variation in intervention content, outcome measurement, and study quality (26–28). More directly, the MENISCUS cluster-randomised trial in Ugandan secondary schools improved menstrual-health outcomes including pain management, menstrual self-efficacy, and attitudes, but found no evidence of improvement in mental-health problems or educational performance over one year (29). Evidence beyond school settings

is particularly limited: a recent systematic review identified only eight evaluable interventions addressing menstrual, sexual, reproductive, or mental health among out-of-school girls, and none was directed specifically at mental health (30). Future evaluations in Nepal should therefore prespecify participation and mental-health outcomes separately and use an explicit theory of change to examine whether, and through which pathways, menstrual-health interventions influence each outcome.

This study has several strengths. It uses recent, nationally representative data on menstruating adolescents and young women aged 15–24 years and accounts for the NMICS multistage sampling design throughout the analyses. The use of marginal standardisation provides absolute prevalence differences that are readily interpretable at the population level, while separate analyses of depression, anxiety, and the three participation domains characterise the association beyond the primary composite outcome. The estimate was also similar when analysis was restricted to participants for whom all three domains were applicable (aPD 8.56 percentage points), reducing concern that the primary association was explained by differences in the number of opportunities to report participation difficulty.

Several limitations warrant emphasis. First, the cross-sectional design precludes temporal or causal inference. Although a post hoc analysis restricting to participants whose most recent menstrual period began within 14 days yielded a similar estimate (aPD 8.58 percentage points, 95% CI 5.02–12.14), temporal ordering remains uncertain and reverse or bidirectional relationships are possible. Second, residual confounding is likely, as factors such as menstrual pain, heavy bleeding, illness, violence, social support, and stress may influence both participation difficulty and mental health; the estimate therefore reflects a covariate-standardised association rather than an independent effect (31). Third, the participation measure is heterogeneous, capturing only whether difficulty occurred and not its type, severity, or cause, and the “work” item is not further defined, limiting interpretability. Fourth, self-reported exposure and outcomes collected in the same interview may be affected by recall and shared reporting bias. Fifth, depression and anxiety were defined using the survey-specific MMAPP thresholds adopted for NMICS 2024–25. These measures were developed for population-level estimation of symptom prevalence rather than individual clinical diagnosis, and respondents classified above the thresholds should therefore not be interpreted as having clinically confirmed depressive or anxiety disorders. Although MMAPP was developed through cross-cultural adaptation and multicountry validation, misclassification remains possible when symptom-based survey measures are used in place of diagnostic interviews (32). Finally, domain-specific analyses are not directly comparable due to differing eligibility, and generalisability is limited to menstruating respondents with at least one applicable activity domain.

Conclusion

Menstruation-related participation difficulty was common among menstruating adolescents and young women in Nepal and was associated with a higher prevalence of depression and/or anxiety symptoms. These findings identify an important overlap between menstrual participation and mental-health symptom burden but do not establish temporal or causal direction. Longitudinal studies are needed to

clarify temporal relationships and common determinants, and intervention studies should assess participation and mental health outcomes separately.

Abbreviations

aPD	
adjusted standardized prevalence difference	
CI	
confidence interval	
ECED	
early childhood education and development	
MICS	
Multiple Indicator Cluster Survey	
MMAPP	
Measurement of Mental Health Among Adolescents and Young People at the Population Level	
NMICS	
Nepal Multiple Indicator Cluster Survey	
NSO	
National Statistics Office	
PSU	
primary sampling unit	
UNICEF	
United Nations Children's Fund.	

Declarations

Ethics approval and consent to participate

This study is a secondary analysis of anonymised, publicly available microdata; no ethics committee approval was sought or required for the present analysis, which involved no contact with participants and no access to personally identifiable information.

The NMICS 2024–25 survey protocol was approved by the National Statistics Office pursuant to National Statistics Act, 2079 (2022) and was implemented under the government ethics protocol; according to the official survey report (12), this process did not involve an institutional review board. Informed consent was obtained from every respondent before interview, with assurance that participation was voluntary, that responses would remain confidential and anonymous, and that any question could be declined or the interview stopped at any time. For respondents aged 15–17 years, which includes all participants younger than 16 years, permission was additionally obtained from an adult household member aged 18 years or older and verified before the interview could commence (items HH33 and WM7); adolescents for

whom no mother or primary caregiver was identified in the household were recorded as emancipated and consented for themselves (item HL20, code 90). The instruments are provided as Additional files 1 and 2.

Consent for publication

Not applicable. This manuscript does not contain any individual person's data in any form, including individual details, images or videos.

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Author Contribution

DU conceived the study and designed the analysis. BN contributed to the literature search, review and synthesis of existing evidence. DU conducted the statistical analysis, which KM, JD and NP independently checked. BA and KM contributed to interpretation of the findings and critically reviewed and edited the Discussion. DU, BN and NP drafted the manuscript. All authors read and approved the final manuscript.

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Data Availability

The datasets analysed during the current study are available from the UNICEF Multiple Indicator Cluster Surveys repository, <https://mics.unicef.org/surveys> where the Nepal MICS 2024–25 microdata may be downloaded following free registration and approval of a data-use request.

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Figures

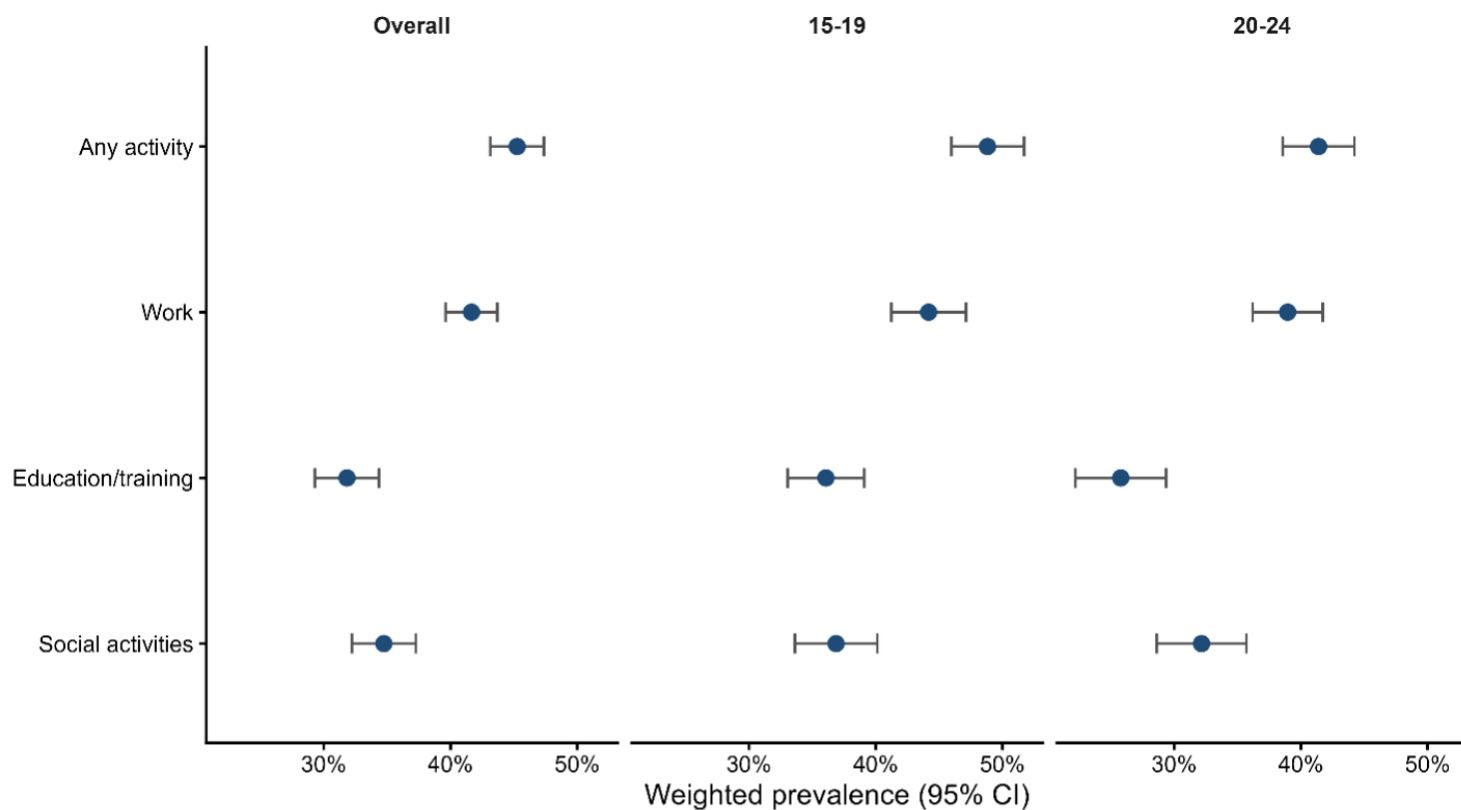


Figure 1

Survey-weighted prevalence of menstruation-related participation difficulty, overall and by age group, among menstruating adolescents and young women aged 15–24 years in Nepal. Points represent weighted prevalence estimates and horizontal bars represent 95% confidence intervals.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [QuestionnaireforWomenAge1549Years.pdf](#)
- [HouseholdQuestionnaire.pdf](#)
- [Supplementarytables.docx](#)