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Household-related stress, intimate partner violence and mental health: exploring the syndemic in urban slum women in Bangladesh during Covid-19 pandemic

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Abstract

Introduction Mental health conditions are emerging concerns that were worsened by Covid-19, especially in developing countries. The pandemic instigated an increase in household stress particularly among migrant women living in urban slums due to overcrowding, increased caregiving burden, and intimate partner violence, resulting in deteriorating mental health. This study assessed the prevalence of mental health conditions and intimate partner violence during Covid-19 and also explored the pathways between pandemic-related household stress and mental health outcomes with the mediating role of crowding and intimate partner violence in the Bangladeshi urban slums.

Method The cross-sectional survey was conducted among internal migrant women from five slums of Urban Health and Demographic Surveillance Systems operated by International Centre for Diarrhoeal Disease Research, Bangladesh. Face-to-face interviews were conducted from August to October 2022 using a semi-structured questionnaire that had three validated screening tools to measure depression, anxiety and intimate partner violence. A path analysis using structural equation modelling with maximum likelihood methods was performed to understand the objectives.

Result Among the total 405 participants, the majority of women (68.40%) were housewives and their husbands (46.43%), were engaged as daily wagers. A large portion of the women (38.77%) had only primary education and one-third of the surveyed women (36.5%) reported increased household stress due to Covid-19. About 71% of women experienced an event of intimate partner violence with reports of emotional (57.3%), physical (49.4%), and sexual violence (39.0%). The prevalence of anxiety and depression were 73.8% and 65.2%, respectively. The structural equation modelling path analysis revealed that household stress increased the likelihood of anxiety and depression. Moreover, household stress has a direct effect on anxiety, while it has an indirect effect on both anxiety and depression with these effects mediated by intimate partner violence.

Conclusion These novel baseline findings may support the relevant stakeholders to design further research and programmes to strengthen emergency preparedness for the women living in informal settlements of Urban

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Bangladesh. A rights-based approach, as has been shown effective elsewhere, may offer a strategy to enhance the overall well-being.

Keywords Mental health, Covid-19, Household stress, Overcrowding, Intimate partner violence

Introduction

Mental health (MH) and well-being are now a global concern as they enable people to cope with the stresses of life, realise their abilities, and work in harmony to make positive contributions to their community and society. The recent Covid-19 pandemic has not only made it challenging to sustain mental well-being but also deteriorated the overall MH status of all population [1, 2]. Previous studies have already attested to the rise in common MH diseases like anxiety and depression as consequences of the pandemic [3–5]. The declaration of the Covid-19 pandemic as a global public health emergency and the associated lockdowns with restrictions on mobility confined people to their homes, increasing social isolation [6, 7]. Moreover, sudden closures of businesses had a catastrophic impact on national and household economies, adversely affecting livelihoods and incomes and contributing to increased household stress (HHS) [6–9].

HHS is variously defined in the literature but mostly concerns disturbance in family dynamics as a result of external factors like socio-economic deprivation, repercussion of war and humanitarian disasters, as well as intrinsic factors like emotional connections [7, 10, 11]. Various studies report indicators of household stress such as income loss, food insecurity, unmet health needs during Covid-19 disproportionately affected women and the overall population [7, 12, 13].In the context of pandemic-induced school shutdowns, women, who predominantly serve as primary caregivers in most households, faced the dual burden of increased domestic responsibilities and child-rearing chores. This amplified workload has made them more vulnerable to mental health conditions. Prior studies from high to low income countries suggest a direct correlation between HHS and psychological well-being [7, 14, 15].

In LMICs like Bangladesh, the financial insecurity resulting in inability to access healthcare services, food insecurity, and household violence increases the likelihood of adverse MH outcomes such as anxiety and depression [7, 12, 13]. Poor socio-economic status, compounded with patriarchal practiceslike dowry harassment, adverse childhood experiences and inaccessibility to basic support services, increase the vulnerability of women to IPV [16, 17]. Moreover, during the pandemic, income loss intensified the stress and violence within couples, impacting the children's wellbeing as well [7].

The onset of Covid-19 was also linked to increased incidences of gender-based violence (GBV) [18–23]. In Low and Middle-Income Countries (LMICs), around 46% of women were estimated to be exposed to IPV during the Covid-19 timeframe [24, 25]. This is consistent with evidence in previous epidemics in West Africa where researchers reported a 4.5% increase in Intimate Partner Violence (IPV) during the pandemic [26]. A plethora of studies report both HHS and IPV negatively affected physical as well as mental health, leading to anxiety and depression among women [27–29]. One of these studies reported that a third of the participating women had injuries due to IPV and among them at least 1 out of 6 women suffered from major depressive episodes [30]. Another study conducted among women in the low-income quantile found a positive association between adverse mental health outcome, relationship termination and bidirectional violence [28].

Social distancing leading to extended periods of proximity, less personal space, and uncertainty of livelihood led to increased discord among spouses, which in turn aggravated tension within the household [31]. Such concerns trigger intimate partner violence (IPV) and parenting stress overburdening the family relationship [7, 12, 13]. IPV is one of the major psychological stressors threatening the overall well-being of women with intimate partners [30]. Older women with a higher number of children were found to have heightened anxiety due to increased caregiving responsibilities [12]. Moreover, maternal depression was reported due to HHS, which emerged as both a risk factor andconsequenceofIPV [13].

Although HHS is widely prevalent, women from urban slums face distinct barriers because of the different individual, familial, economic and social precarities which also increase their risks to violence from partners [16, 17, 32–35]. Additionally, urban slum households are characterised by overcrowding, with single rooms shared by four or more people which in turn contributes to deteriorated mental health, especially depressive symptoms [36, 37]. During the pandemic, overcrowded living spaces heightened the likelihood of accumulated aggression between couples, leading to increased familial stress and impaired mental well-being [38, 39].

Few studies have examined household stress during the Covid-19 pandemic, as the crisis exacerbated existing socioeconomic vulnerabilities and introduced new challenges for households worldwide [40–42]. However, studies tend to focus narrowly on physical health outcomes or economic impacts rather than providing holistic assessments of household stress involving fear of contraction, increased responsibilities, financial strain, conflicts, healthcare access issues, and lockdown isolation, leaving

gaps in understanding the full scope of stressors faced by slum residents [40–42]. The extent to which household stress has been studied in specific contexts, especially in developing countries like Bangladesh, remains uneven, with some populations such as individuals living in urban slums or resettlement areas, receiving less attention than others.

While previous studies have investigated the prevalence and risk factors of poor mental health among the slum populations in Bangladesh [27, 43], none have examined the relationship between IPV and mental health, nor the impact of household stress on both issues. This gap is particularly relevant during and after the Covid-19 pandemic. Moreover, most studies conducted in Bangladesh involving women living in precarious situations followed a cross-sectional study design, and were highly localised [27, 43]. No prior studies have examined MH and IPV during the pandemic among migrants in Bangladesh, who were found to be most disproportionately affected by lockdown and Covid-19 [44].

In this context, this study aims to:

(i) examine the prevalence of mental health (MH) conditions specifically anxiety and depression, and intimate partner violence (IPV) during the Covid-19 pandemic.

(ii) identify the pathways between household stress (HHS) and mental health outcomes with the mediating roles of IPV and the crowding score index (CSI) in exacerbating these issues among married migrant women living in urban slums of Bangladesh.

A greater understanding of these relationships may assist in devising appropriate interventions to reduce the risk of mental health conditions and IPV through the identification of potentially modifiable factors, particularly for women at greater risk during future public health crises.

Methods

Study design and setting

This cross-sectional survey was conducted among the slum dwellers in the capital of Bangladesh. The sample for the study was drawn from Urban Health and Demographic Surveillance Systems (Urban HDSS), which is operated by the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr, b) since 2015. Urban HDSS is a continuous monitoring and evaluation system of the population living in the 13 slums of five selected areas of Dhaka North (Mirpur and Korail), South (Dhalpur and Shaympur), and Gazipur (Tongi) City Corporations. Currently, it is continuing monitoring on approximately 160,000 people living in 40,000 households. More details of the slum population and study sites are published elsewhere [45].

Participants and sampling process

Participants of the study were selected from the sample frame of slum women from the Urban HDSS on the following criteria: (a) age: 18–60 years; (b) must be ever married at the time of the survey; (c) must have lived with her husband for at least 1 year throughout the Covid-19 pandemic period (2020–2022) and (d) must be rural to urban migrants living in the selected slum for more than two years preceding the survey. Women who were severely ill or pregnant at the time of the survey were not included in the study. This was mainly because they were likely to be psychologically vulnerable and prone to pre or antenatal depressive symptoms, and likely to be affected by the questions related to IPV.

The Urban HDSS sample frame provided the lists of women that met the first two inclusion criteria. The remaining two criteria were verified before the interview. The required sample size was determined to be ($n = 369$) using a single proportion formula (Eq. 1), based on a 40% prevalence of depression among urban female garment workers, many of whom reside in informal settlements and have prior experience withIPV [46].

$$n = \frac{z^2 p(1-p)}{d^2} \tag{1}$$

where n = number of samples; z = 1.96 (95% confidence level); $p = 40\%$ or 0.4; and d = precision limit or proportion of sampling error 0.05. However, due to the limited accessibility of the slum women, the total sample was adjusted with a 10% non-response rate and later re-estimated. A larger sample size of 405 was considered for this study.

A probability proportional to size (PPS) method was applied to select the sample women. Each of the areas were divided into multiple slum areas based on their geographic locations, where there were unequal numbers of households. In the first stage, specific areas were randomly selected from each of the slums, and the lists of women in those slums were filtered from the Urban HDSS sampling lists. Later, based on the size of the slum area and the number of eligible women, were selected using proportional intervals.

Data collection tools

A semi-structured questionnaire including both open-ended and closed-ended questions was applied to obtain data. The questionnaire includes (i) socio-demographic variables (ii) household situation in Covid-19; (iii) individual stressor related to pandemic (e.g., fear of Covid-19 contraction, healthcare access, increased household burdens, conflicts, lockdown isolation, financial strain); (iv) factors assessing gender-power relations (i.e. women's decision making, workforce participation, experience

of violence or abuse). It also included individual health status; health care utilisation, incidence of IPV utilising World Health Organization's standardised study questionnaire [47]; and screened for mental health status using Generalised Anxiety Disorder-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9). The English version of the questionnaire was translated into Bengali, the official language. The questionnaire was pre-tested on 50 females from the adjacent slums not selected for the study, and necessary changes were incorporated.

Variable of interest for mediation analysis

The data collection tool measured a range of components. Since this study was not solely focused on determining the prevalence of IPV or MH and associated factors, it employed Structural Equation Modeling (SEM) to identify and analyse the pathways between household stress (HHS) and mental health outcomes, specifically depression and anxiety with the mediating role of crowding and IPV. The variables used for the SEM analysis included. The variables used for the SEM analysis are following:

Crowding score index (CSI)

The household CSI was generated dividing the number of rooms available in the house with the number of household members sharing the same roof [48]. Higher the score, more is the crowing index, i.e., more household members are sharing the same room.

Household stress due to Covid-19

The household stress (HHS) is a composite variable which includes fifteen items/ variables from the household situation and other factors related to Covid-19 (loss of income, family dynamics etc.) The responses were dichotomously recoded as (yes, no). The items included: (i) self-perceived stress due to susceptibility of contracting Covid-19 infection; (ii) husband exhibiting stress due to fear of contracting Covid-19 infection; (iii) increase in household chores; (iv) closure of children's school; (v) unavailability of food in market; (vi) reduced family income; (vii) increased argument with husband; (viii) increased argument with family members; and (ix) increased argument with neighbours; (x) participant contracted Covid-19 infection; (xi) family members contracted Covid-19; (xii) difficulties in seeking healthcare; (xiii) lockdown induced isolation for a period of two months; (xiv) lack of support/relief from government or non-government organisations; and (xv) lack of access to/ involvement in a microcredit programme. All the items were summarised to generate household stress (ranging from 0 to 15), as the increased scores indicated proportional increases in household stress.

Intimate partner violence

WHO standardised questionnaire was used to capture IPV. This has been previously used and validated in Bangladesh [49, 50]. The participants were asked about their experience and the frequency of physical, sexual and psychological violence by an intimate partner in the past year. To minimise the recall bias a 5-point Likert scale (once, a few times, monthly, weekly, daily) was used to incorporate those who responded "yes" for all the items [51].

Patient health questionnaire (PHQ-9)

To assess symptoms of depression, PHQ-9, a previously validated screening tool for Bangladesh was applied which have been used in several studies for similar outcomes [52], consists of nine symptoms of depression. The total score ranges from 0 to 27; a higher score means a higher level of depression. The symptom severity scores for PHQ-9 were <5 = minimal depression, 5–9 = mild depression, 10–14 = moderate depression, 15–19 = moderately severe depression, and 20–27 = severe depression. The reliability test reported Cronbach's alpha score (0.93), indicating excellent reliability.

Generalised anxiety disorder (GAD-7)

To measure anxiety, GAD-7 consists of seven items, was used which was previously validated and many studies used this tool to assess similar outcomes in the past in Bangladesh [53]. The cumulative score for GAD-7 ranges from 0 to 21; the higher score indicates a higher level of anxiety. The categories for GAD-7 are <5 = minimal anxiety, 5–9 = mild anxiety, 10–14 = moderate anxiety, and >15 = severe anxiety. The scale showed a reliable result with a score of 0.87 in Cronbach's alpha.

Data collection procedure and measures

Five female research assistants were rigorously trained to collect sensitive information related to violence and mental health. The slum communities in the study areas were already sensitised to Urban HDSS with the ongoing surveillance. The interviews for this study were conducted alongside the routine Urban HDSS activities from August to October 2022. Lists of participants' identifications, such as their household number (generated by the Urban HDSS), name, detailed address (*bari wala* or household head), and contact number, were given to the interviewers. They tracked down the households of the study participants, approached them with detailed information on research objectives, ensuring their anonymity in the process. Once participants consented, the interview was scheduled at a place and time convenient to the participants to maintain their privacy. Researcher's ensured family members/ spouse were not present at the time of the interview to avoid potential harms and influence. In

some cases, when the husbands were home, the women chose to be interviewed in the neighboring house. The co-investigators verified the quality of the data collection by using frequent field visits on multiple occasions. The open-ended questions were coded after the data collection.

Statistical analysis

Study sample was defined using frequency distribution, and descriptive statistics was used for continuous variables. Levels of different types of IPV, anxiety and depression were assessed using percentage distribution and reported with a 95% confidence interval. Detailed frequency distribution and the reliability coefficients of the IPV, anxiety depression and household stress due to Covid-19 were provided in the supplementary file.

The study hypothesis was addressed by a path analysis model using recursive structural equation modelling with maximum likelihood methods. Pearson's correlation coefficients among the study variables were also reported.

For the modelling, continuous exogenous and endogenous variables that suit a non-generalised linear model was used. Prior to the structural equation modelling, the correlation matrix among the representative variables at 5% and 0.1% levels of significance was also observed. In the path model, the exogenous variable was household stress due to Covid-19 (HHS), while the endogenous outcome variables were anxiety and depression. CSI and IPV were used as the mediator endogenous variables of outcome variables. Due to the high collinearity between anxiety and depression, it was assumed that some of the unexplained residuals of anxiety and depression were correlated. Several goodness of fit indices for the path model evaluation: chi-square, likelihood ratio (chi-square/df), comparative fit index (CFI), Tucker-Lewis index (TLI), goodness of fit index (GFI), root mean squared error of approximation (RSMEA), and coefficient of determinants (CD) were applied. The acceptable thresholds for the fit indices were also reported (Hu and Bentler, 1999; Kline, 2010; MacCallum and Hong, 1997; Billah et al., 2022). Furthermore, the statistical significance of the fitted model's direct, indirect, and total effects was examined.

The analysis was conducted in STATA and STATA SEM builders of Windows version 16.0 (Stata Corp. 2019).

Ethical consideration

The study was approved by the Research Review Committee (RRC) and Ethics Review Committee (ERC) of the Institutional Review Board (IRB) of the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr, b) [PR-22001]. The study adhered to the Declaration of Helsinki and the WHO ethical recommendations for researching violence against women, ensuring participants' anonymity and privacy. All participants were assured confidentiality and provided oral or written informed consent as they preferred before the data collection. In few cases, when the participant seemed overwhelmed during the conversation, the interview was stopped immediately and re-scheduled as per the participants' wishes. Women reporting high scores in psychometric assessments were advised or referred to visit the National Mental Health Institute (NIMH) by leveraging previous collaborations. The participants were also requested not to share any information about the interview with anyone, including their husband, family members, and neighbours.

Result

A detailed frequency distribution of the participants in the study is provided in Table 1. Most of the participants (women) were between the ages of 25 and 34 (39.75%), and the mean age of the women was 30.90 years. Majority of the women (46.67%) got married before 15 years of age, followed by 16–18 years of age (39.75%), while only 13.58% of women were married after 18 years of age. More than one-third of women (33.8%) had no formal education, while around 38.77% had primary education, and 27.2% had secondary and higher education. Most women were housewives (68.40%). The remaining (one third) worked in the informal economy as day laborers and domestic workers (12.10%), garment workers (9.14%), whereas 10.37% women were engaged in clerical, administrative jobs in city corporations.

Husbands of one third of the women participants were between the ages of 30–39 years (32.84%), and their mean age was estimated at 37.7 years. The age difference between husband and wife was estimated to be 6.73 years. The proportion of husbands with no formal education and primary education was 42.96% and 44.93% respectively. The majority (46.42%) were working as daily wage labourers (working in occupations such as day labour, domestic help, driver) followed by clerical, administrative jobs (38.77%); while 6.67% were unemployed at the time of the survey. Substance use among husbands was common, reported by 63.95% reporting that their husbands used at least one kind of substances. Of this, 87.26% reported smoking, 51.35% consumed betel leaf, 29.34% consumed *Jorda* (chewing tobacco), and 5.79% used other drug-related substances or alcohol. The husbands were reported as the primary earning member of the family (89.63%).

The settlements were highly dense, with 62.7% of the households reportedly overcrowded [54]. The average numbers of rooms were estimated at 1.6, with 4.5 persons per household. The majority of households (60.49%) had 1–2 children, nearly a third of them had 3 or more, and 6.7% of women reported having no children.

Table 1 Background of the study population ($N=405$)

Variables	*n* (%)	$\bar{x} \pm$ S.E.
Women's age		**30.94 ± 0.404**
< 25 years	104 (25.68)	
25–34 years	161 (39.75)	
35–44 years	110 (27.16)	
45 and above	30 (7.41)	
Age at marriage		
< 15 years	189 (46.67)	
16–18 years	161 (39.75)	
18 + years	55 (13.58)	
Women's education		
No formal education	138 (34.07)	
Primary	157 (38.77)	
Secondary and above	110 (27.16)	
Women's occupation		
Housewife	277 (68.40)	
Clerical, administrative, managerial	42 (10.37)	
Garment worker	37 (9.14)	
Day labour/maid (informal)	49 (12.10)	
Husband's age		**37.69 ± 0.506**
< 30 years	101 (24.94)	
30–39 years	133 (32.84)	
40–49 years	97 (23.95)	
50 and above	74 (18.27)	
Husband's occupation		
Unemployed	27 (6.67)	
Clerical, administrative, managerial	157 (38.77)	
Garment worker	33 (8.15)	
Informal jobs (Driver/day labour/ servant)	188 (46.42)	
Husband's education		
No formal education	174 (42.96)	
Primary	186 (45.93)	
Secondary and above	45 (11.11)	
Substance use by husband		
No	146 (36.05)	
Yes	259 (63.95)	
If Yes, types of substances used		
Smoking	226 (87.26)	
Betel leaf	133 (51.35)	
Jorda	76 (29.34)	
Substances/alcohol	15 (5.79)	
Age difference (husband-wife)		**6.75 ± 0.254**
Main earning member		
Husband	363 (89.63)	
Other than husband	42 (10.37)	
Number of rooms		**1.59 ± 0.043**
1	242 (59.75)	
2	106 (26.17)	
3+	57 (14.08)	
Number of family members		**4.45 ± 0.091**
< 5 person(s)	245 (60.49)	
≥ 5 persons	160 (39.51)	
Number of children		
No child	27 (6.67)	

Table 1 (continued)

Variables	*n* (%)	$\bar{x}$ ± S.E.
1–2 child(ren)	245 (60.49)	
3 and above	133 (32.84)	

Note: $\bar{x}$ indicates sample mean, S.E. indicates the standard error and n indicates frequency

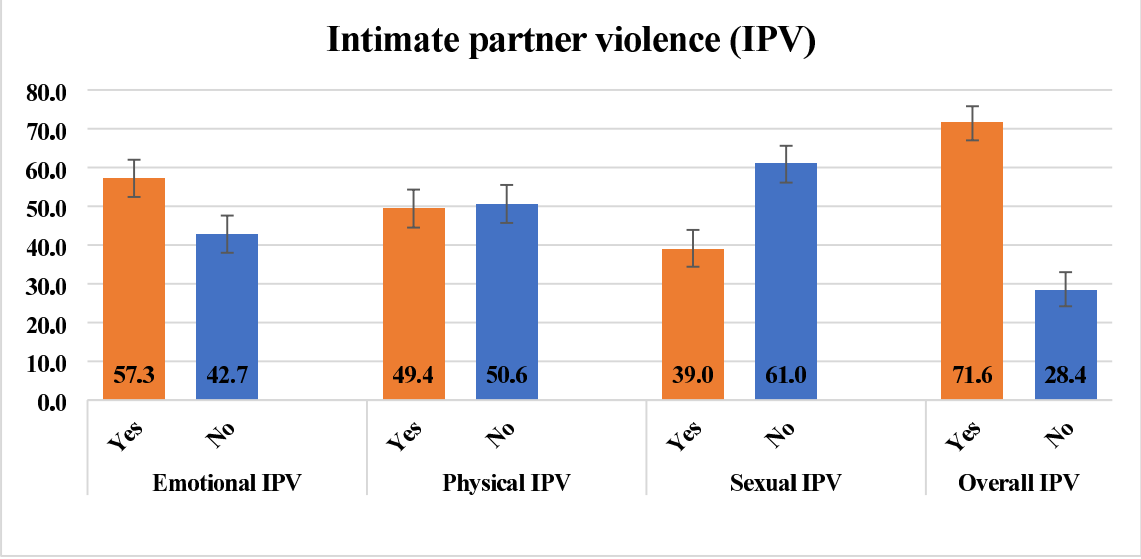

Fig. 1 Prevalence of Intimate partner violence among slum women

Household stress due to Covid-19 was reported by more than one third of the surveyed women (36.5%).

Of the total participants, majority (71%) of women experienced at least one event of IPV in the last one year preceding the survey. All three types of violence were experienced by the participants, with reports of emotional (57.3%, 95% CI: 52.4–62.0) and physical (49.4%, 95% CI: 44.5–54.3) being high but closely followed by sexual violence (39.0%, 95% CI: 34.4–43.9) (Fig. 1).

Likewise, a high prevalence of poor mental health was reported, with anxiety and depression reported by 73.8% and 65.2% women respectively (Fig. 3). Furthermore, nearly 1 out of 10 women reported having severe level of depression (9.9%, 95% CI: 7.3–13.2), while 17.5% had moderate and 37.8% had mild level of depression. On the other hand, nearly 9% women had severe levels of anxiety (8.9%, 95% CI: 6.5–12.1), while 9.1% had moderately severe, 18.8% had moderate and 37.0% had mild levels of anxiety (Fig. 2).

The detailed frequency of these variables and their items are reported in the supplementary file (Additional 1).

Table 2 presents the average correlation scores for IPV (3.12 ± 0.16), for depression (9.01 ± 0.32), for anxiety (7.14 ± 0.25), for CSI (3.13 ± 0.06), and for HHS (7.99 ± 0.09). The interrelations among the independent (exogenous) and dependent (endogenous) variables were minimal but positive, but a strong and positive interrelation was found between depression and anxiety ($r = 0.777$; $p < 0.001$). A lower but positive correlation was observed between the IPV scores and depression ($r = 0.299$; $p < 0.001$), anxiety ($r = 0.281$; $p < 0.001$), and household stress ($r = 0.198$; $p < 0.001$) respectively. Between the level of anxiety and household stress a positive correlation was observed, but not very strong ($r = 0.117$; $p < 0.05$). Household stress was found to be poorly correlated with the CSI ($r = 0.114$; $p < 0.05$) and depression score ($r = 0.117$; $p < 0.05$) of the participants.

A recursive structural equation model (Fig. 3) was used to define the pathway of Covid-19 induced household stress (an exogenous variable) leading to the development of anxiety and depression (endogenous outcome variables). This relationship may occur either directly or through mediation by the CSI and the intimate partner violence score (both endogenous mediator variables). Overall, the model fitting statistics (Table 3) indicated a good fit of the model based on the likelihood ratio (chi-square/df: 1.326), RMSEA (0.0289), CFI (0.999), TLI (0.9393), and GFI (0.997).

Reference values were considered from Hu and Bentler (1999); Kline (2010); MacCallum and Hong (1997); and Billah et al. (2022).

The path analysis indicates that Covid-19 induced HHS affects women's mental health by increasing their

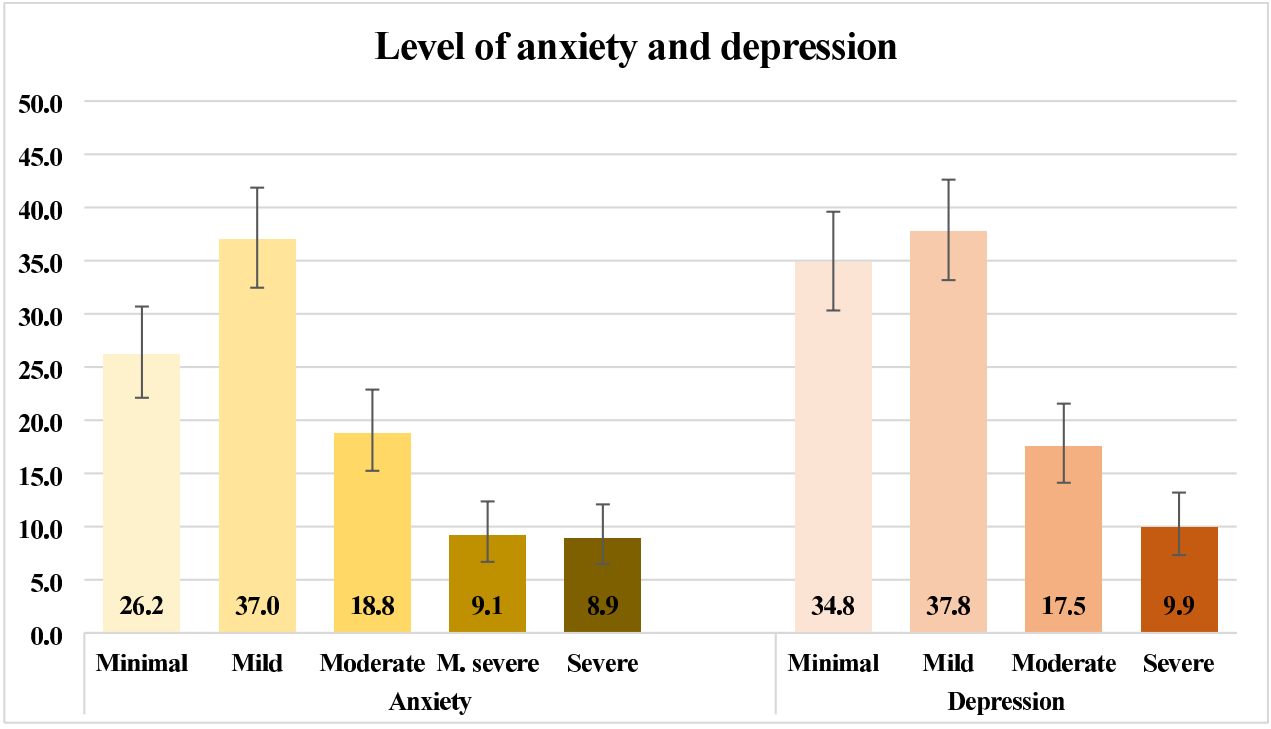

Fig. 2 Prevalence of different levels of anxiety and depression among the slum women

Table 2 Descriptive statistics and interrelationship among intimate partner violence (IPV), depression (DEP), crowding score index (CSI), anxiety (ANX) and household stress due to Covid (HHS-COV)

Components	Yes	No	Mean	SE	IPV	DEP	CSI	ANX	HHS-COV
IPV	71.60	28.40	3.12	0.16	1.000				
DEP	73.83	26.17	9.01	0.32	0.299***	1.000			
CSI	62.72	37.28	3.13	0.06	0.078	0.014	1.000		
ANX	65.19	34.81	7.14	0.25	0.281***	0.777***	0.044	1.000	
HHS-COV	36.54	63.46	7.99	0.09	0.198***	0.117*	0.114*	0.249***	1.000

*, **, and *** indicates 5%, 1% and 0.1% level of significance

likelihood of developing anxiety (Std. Coef.: 0.249, SE: 0.139, $p<0.001$) and depression (Std. Coef.: 0.117, SE: 0.178, $p<0.05$) (Table 4). HHS has a direct effect on anxiety (Std. Coef.: 0.201, SE: 0.138, $p<0.001$), while it has an indirect effect on both anxiety (Std, Coef.: 0.048, SE: 0.046, $p<0.01$) and depression (Std. Coef.: 0.055, SE: 064, $p<0.01$) with these effects mediated by IPV (Fig. 04). Moreover, HHS was found to be correlated with both IPV (Std. Coef.: 0.198, SE: 0.090, $p<0.001$) and CSI (Std. Coef. 0.114, SE: 0.031, $p<0.05$). Additionally, IPV has a direct positive effect on both depression (Std. Coef.: 0.288, SE: 0.094, $p<0.001$) and anxiety (Standard Coef.: 0.241, SE: 0.074, $p<0.001$). However, the CSI showed no direct or significant effect on the mental health.

Discussion

Household stress has emerged as a critical concern in relation to pandemics, or other emergencies, significantly impacting mental well-being, especially among women. It is essential to highlight the heightened vulnerability of women in urban slum environments, as they often face more severe mental health repercussions as compared to their counterparts in non-slum settings. In light of the Covid-19 crises, we found a notable scarcity of research, both globally and specifically in Bangladesh, examining how HHS interacts with urban slum factors like overcrowding, precarious employment and IPV to affect women's mental health status.

Our study steps into this gap by being the first to explore the complex relationship between mental health conditions and household stress, while also considering the mediating roles of IPV and overcrowding among married women living in urban slums of Bangladesh. Our SEM pathway analysis reveals that HHS not only directly worsens mental health conditions but also contributed to IPV. Furthermore, IPV acts as a mediator in the relationship between HHS and mental health outcomes. Interestingly, our results indicate that overcrowding does not

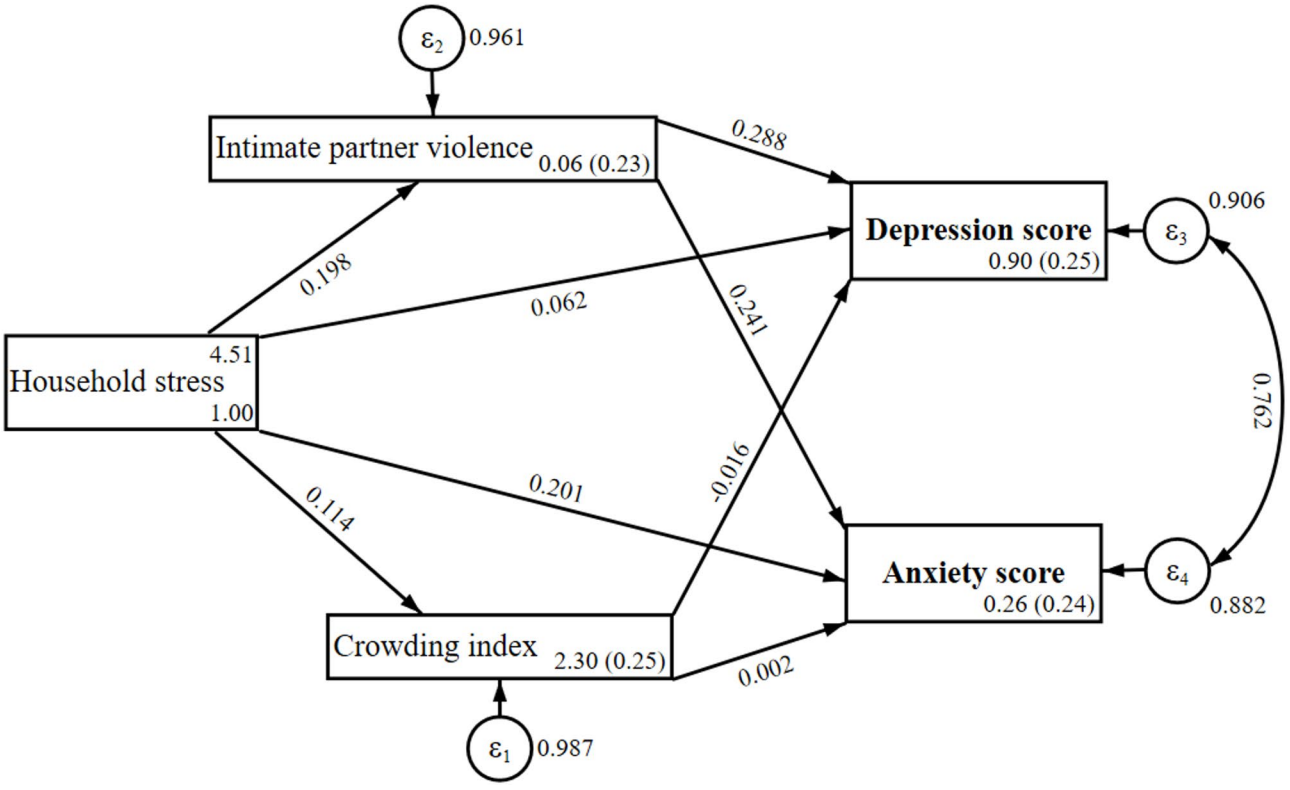

Fig. 3 Path model of intimate partner violence with anxiety and depression with the mediation of crowding score index and household stress due to Covid-19 (Reported standardised estimates)

significantly impact mental health, though it may affect other factors such as food insecurity and care burdens resulting from contracting infection. This was not investigated in the study. These insights contribute to our understanding of the multifaceted challenges urban slum women face and underscore the need for targeted interventions that address these intertwined issues.

Our study's context and population reflect a significant degree of precarity and deprivation [55], which is crucial for interpreting our findings. In examining pathways between HHS and MH conditions, our analysis reveals that an increase in HHS directly raises levels of anxiety. However, when this relationship is mediated by IPV, the impact extends to both depression and anxiety. This suggests that while HHS exerts a direct influence on mental health, it also plays a role indirectly through IPV.

Prior to the Covid-19 pandemic, HHS in slum environments was already prevalent due to limited access to basic necessities like adequate food, education, and healthcare, alongside financial difficulties and housing and sanitation insecurities [56, 57]. The pandemic exacerbated these existing challenges, imposing sudden drastic changes such as social distancing measures that severely affected the livelihoods of slum dwellers [49, 58]. Moreover, low literacy rates, limited reach of public health information campaigns and resulting lack of awareness among these communities heightened their vulnerability to misinformation related to Covid-19, further contributing to stress and anxiety [59, 60]. The strict lockdown measures not only led to economic downturns but also intensified social restrictions, worsening household stress [61]. Many men who worked as street vendors faced significant drops in sales as buyers transitioned to e-commerce [62, 63]. Women in economically disadvantaged settings endured additional hurdles such as unawareness, inaccessibility, and the unaffordability of social support services, all of which further compromised their mental well-being [64].

Evidence from other regions, such as Korea, indicates that higher levels of HHS during the pandemic correlated with increased symptoms of anxiety and despair [65]. In countries like Bangladesh, women disproportionately bear the burden of these adversities due to their social status and societal expectations [66–69]. The findings corroborate from the perspective of family-stress theory by Reuben Hill which underlines that families experience many challenges (e.g., financial, health related, interpersonal) that might affect the balance [70]. Thus, these compounded challenges create stressful family environments, further escalated by incidents of IPV among women [71].

Table 3 Summary and fit statistics of the path model ($n = 405$)

Fit statistic	Value	Reference value
Likelihood ratio		
Chi-square MS (1)	1.326	
p > chi2	0.250	
Chi-square/df	1.326	< 3.0
Chi-square BS (10)	465.132	
p > chi2	0.000	
Population error		
RMSEA	0.028	< 0.06
90% CI, lower bound	0.000	
upper bound	0.139	
pclose	0.458	Probability RMSEA < = 0.05
Information criteria		
AIC	9650.386	
BIC	9718.452	
Baseline comparison		
CFI	0.999	> 0.95
GFI	0.997	
TLI	0.993	> 0.90
Size of residuals		
SRMR	0.015	
CD	0.109	

MS: model vs. saturated; BS: baseline vs. saturated; RMSEA: root mean squared error of approximation; CI: confidence interval; CFI: comparative fit index; TLI: Tucker-Lewis index; GFI: goodness of fit index; CD (coefficient of determination) and SRMR (standardised root-mean-square residuals)

Method: maximum likelihood; Log-likelihood: – 4809.591

Our study revealed a concerningly high prevalence of IPV (71%) among female residents of slum, with reports of emotional, physical and sexual violence. This significant prevalence underscores IPVs dual role as a direct contributor to poor mental health and a mediator between household stress and negative mental health outcomes. In urban slum environments, one in seven women endured violence from their partners during antenatal and postnatal periods [17]. Evidence from similar settings also supports our findings that survivors of domestic violence are at a greater risk of deteriorating mental well-being compared to those who have not experienced such violence [49, 58, 72].

IPV is recognised as a direct cause of poor mental health status among women across various contexts, primarily due to the unequal gender power relations/dynamics that often render women submissive to violations of their human rights [64, 73, 74]. Women enduring IPV frequently find themselves in a vicious cycle of low self-esteem, lack of motivation, and severe mental illnesses [75]. The complex interplay between increased HHS and IPV, along with associated mental health challenges in times of public health emergencies, has been corroborated by a few previous studies [33, 76]. Research conducted in Bangladesh confirmed stressors such as food scarcity and the fear of infection during the pandemic have manifested as feelings of hopelessness and created stressful home environments, ultimately leading to heightened anxiety among slum dwellers [48, 77–79]. Given these findings, it is imperative for the government to tackle the social and structural challenges faced by urban slums through immediate economic relief measures and sustainable initiatives that create income-generating opportunities, improve housing conditions, provide support services and ensure the protection of women during future public health crises.

Interestingly, our mediation analysis indicated that overcrowding had no direct effect on women's MH. This finding contrast with previous evidence that links overcrowding with increased psychological distress. For instance, a study in Chile found that increased levels of household overcrowding were associated with a rise in depressive symptoms, highlighting the detrimental effects of increased household density on mental health [37]. In China, overcrowded living conditions significantly impacted depressive moods, particularly among low-income groups, indicating that socio-economic factors can intensify the psychological impact of overcrowding [80].

Moreover, earlier literature has shown that stress related to crowding can lead to IPV and anxiety among women living in compromised /poor conditions [69, 81]. However, it is important to consider that overcrowding may also function as a protective factor, as evidenced by studies LMICs such as Nigeria and Ghana [82, 83]. In

Table 4 Direct, indirect and total effects of the path model

Path	Direct effect		Indirect effect		Total effect	
	St. Coef (SE)	*p*-value	St. Coef (SE)	*p*-value	St. Coef (SE)	*p*-value
HHS -> CSI	0.114 (0.031)	0.021			0.114 (0.031)	0.021
HHS -> IPV	0.198 (0.09)	0.000			0.198 (0.09)	0.000
CSI -> DEP	-0.016 (0.275)	0.745			-0.016 (0.275)	0.745
IPV -> DEP	0.288 (0.094)	0.000			0.288 (0.094)	0.000
HHS -> DEP	0.062 (0.175)	0.204	0.055 (0.064)	0.002	0.117 (0.178)	0.018
CSI -> ANX	0.002 (0.216)	0.965			0.002 (0.216)	0.965
IPV -> ANX	0.241 (0.074)	0.000			0.241 (0.074)	0.000
HHS -> ANX	0.201 (0.138)	0.000	0.048 (0.046)	0.002	0.249 (0.139)	0.000

these contexts, sharing living spaces and experiencing increased social interactions can have a positive effect on mental health. Crowding presents both challenges and opportunities for social support [82, 83]. By fostering a shared identity and capitalising on the positive aspects of communal living, individuals can enhance their support systems within crowded environments [84]. Understanding these dynamics is crucial for developing strategies that leverage crowding as a source of ongoing support rather than just a stressor.

The findings of our study highlight the need for tailored interventions to address IPV and household stress while considering the unique social dynamics of urban slum communities. Therefore, it is essential to ensure the nation's support infrastructure of social and health care is more aware and prepared to deliver better accessibility for these vulnerable populations of Bangladesh. Tackling these concerns requires a comprehensive approach, comprising economic empowerment, mental health services, and legal protections against IPV. Strengthening social safety nets and ensuring access to mental health care in urban slums should be a priority. Additionally, specific services about IPV awareness to reduce HHS, and also to capacity building of service providers for timely interventions for addressing certain household issues such as IPV and MH is necessary for the improving the well-being of urban slum women.

Strengths and limitations

The present study has some limitations. We could only infer associations between variables because of the cross-sectional nature of the study and our small sample size, which prevented us from establishing causal relationships. Therefore, further longitudinal studies are needed to determine any casual inferences among these prevalent social and health conditions. In addition, this study included only adults but in such informal settings, girls are often married off before 18, therefore, results cannot necessarily be generalised to other age groups of women. Future research could extend the study design to other age populations and compare the differences in burden and its determination across life course. The evaluation of IPV was established on the participant's self-report for all items indicating violence within time frame of one year, which may be subject to recall bias. Due to the social and cultural norms, stigma associated with IPV and mental health, fear of judgment, and repercussions, women might have underreported the incident, resulting in response bias. However, confidentiality and anonymity were maintained to ensure the participant's concern. Moreover, in the context of the migrant population, a language barrier may impose a significant challenge due to the cultural difference in how sensitive terms such as IPV are interpreted, leading to inconsistencies in response. To overcome this concern, we translated the survey tool into the local language and trained the research assistants who were already familiar with the community to collect the data. Another limitation is that we were unable to investigate further intersections of underlying related variables, particularly with socioeconomic conditions, considering this study concentrated on mediation analysis to determine the pathways between HHS and MH with the mediating function of CSI and IPV. Additionally, data were collected from slums of urban areas, which are characterised by particular forms of precarities thus; generalisability at the national level or in other contexts may be limited. Additionally, we were unable to control for several significant confounders, including childhood experiences of violence or exposure to IPV, which are linked to both IPV and mental health problems.

Despite these limitations, the findings of the study will have a significant impact on Bangladesh's present laws and regulations. The results shed light on the intricate interplay between variables affecting HHS and the detrimental effects of intimate partner violence on mental health throughout the Covid-19 pandemic. The complex dynamics revealed in our study demand multi-faceted strategies, including community awareness about managing family dynamics during emergencies, surveillance networks and individualised rights-based programmes for addressing domestic violence integrated psychosocial support services into urban health care for underprivileged women can be introduced.

Methodological implications The data was gathered utilising a surveillance system that tracks the health and demographic trends of the slum population using a scientific methodology. This data set could be valuable for the conceptualisation of large-scale studies, and generate proof of concept studies, and pilot interventions. This study has applied advanced methodology and used validated diagnostic screening measures with tools for IPV and mental health issues.

Policy implications Analysis was conducted considering IPV as a potential mediator of HHS and MH conditions and accounted for a number of critical covariates. This will assist the policymakers in devising further action considering the direction and factors causing the increased burden of these issues in a similar public health crisis. Given the disadvantage household situations and high prevalence of IPV in urban slums of Bangladesh, the study findings will contribute by integrating actions to current system to manage the family stress and reduce IPV with improving overall well-being.

Conclusion

Covid-19 had a radical impact on mental health, particularly among people residing in informal settlements of urban areas. The novel findings reflecting the intersectionality of sociocultural and structural factors for HHS and IPV leading to the compromised wellbeing of marginalised population living in a precarious situation. Given the dearth of similar research in Bangladesh, this baseline evidence may support policy makers, funders and civil society stakeholders to design programmes to strengthen emergency preparedness by explicitly addressing conditions increasing risks of IPV and mental health in urban slums. Questions remain regarding the accessibility of pre-existing services for women living in urban slums, including awareness of their basic human rights in terms of social and health care. A rights-based approach, as has been shown effective elsewhere, may offer a strategy to enhance the overall well-being of these vulnerable women.

Abbreviations

MH	Mental Health
HHS	Household Stress
GBV	Gender Based Violence
LMIC	Low and Middle-income Countries
IPV	Intimate Partner Violence
CSI	Crowding Score Index
UHDSS	Urban Health and Demographic Surveillance System
PPS	Probability Proportional to Size
PHQ-9	Patient Health Questionnaire-9
GAD-7	Generalized Anxiety Disorder-7
SEM	Structural Equation Modeling
CFI	Comparative Fit Index
TLI	Tucker-Lewis Index
GFI	Goodness of Fit Index
RMSEA	Root Mean Squared Error of Approximation
CD	Coefficient of Determinants
GFI	Goodness of Fit Index
HHS-COV	Household Stress due to Covid-19
NIMH	National Mental Health Institute

Supplementary Information

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Supplementary Material 1

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Author contributions

Conceptualisation, K.N.K., S.R.; methodology, K.N.K., S.R., and M.A.B.; validation, K.N.K. and M.A.B.; formal analysis, K.N.K. and M.A.B.; investigation, K.N.K. and M.A.B.; data curation, K.N.K. R.M. and M.A.B.; writing—original draft preparation, K.N.K., R.M. and Z.N.; writing—review and editing, K.N.K., R.M. Z.N., and A.K.; supervision, K.N.K. and A.K.; project administration, K.N.K and SR.; funding acquisition, K.N.K.; All authors have read and agreed to the published version of the manuscript.

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Data availability

The entirety of data from this study is not publicly accessible due to ethical constraints. Furthermore, the icddr,b institutional review board prohibits data sharing in public as it might seriously violate participants' ethical rights. Therefore, M A Salam Khan, the Institutional Review Board (IRB) Coordinator of icddr,b (email: salamk@icddrb.org; IRB Secretariat, Research Administration, icddr,b, Mohakhali,Dhaka-1212) can be contacted with any inquiries about data access.

Declarations

Ethics approval and consent to participate

The study was approved by the Research Review Committee (RRC) and Ethics Review Committee (ERC) of the Institutional Review Board (IRB) of the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr, b) [PR-22001]. The study adhered to the Declaration of Helsinki and the WHO ethical recommendations for researching violence against women, ensuring participants' anonymity and privacy. All participants were assured confidentiality and provided oral or written informed consent as they preferred before the data collection. In few cases, when the participant seemed overwhelmed during the conversation, the interview was stopped immediately and re-scheduled as per the participants' wishes. Women reporting high scores in psychometric assessments were advised or referred to visit the National Mental Health Institute (NIMH) by leveraging previous collaborations. The participants were also requested not to share any information about the interview with anyone, including their husband, family members, and neighbors.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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