LUND UNIVERSITY
Faculty of Medicine

Master's Programme in Public Health

Investigating the determinants of self-rated mental health among physically disabled adults: a cross-sectional study using survey data from Bangladesh

June 2022

Author

Sarah Ibrahim

Supervisor

Björn Ekman

Ph.D., Associate Professor of Health Economics Department of Clinical Sciences, Malmö, Lund University, Sweden

Table of Contents

Abstract

Background Disability affects 15% of the world's population, and around 80% of people with disabilities are from low-middle-income countries (LMIC). According to the Bangladesh Final Report on Household Income and Expenditure Survey in 2016, Bangladesh has approximately 11.4 million people living with disabilities. Studies showed that physical disabilities had been associated with poor mental health outcomes, particularly in low socioeconomic conditions.

Aim This study aims to investigate the association between poor self-rated mental health and physical disabilities (hearing, visual, or mobility) in adults in Bangladesh with different socio-demographic, individual, and contextual characteristics.

Methods We used cross-sectional individual and ecological data from the Social Capital and Disability in Bangladesh (SCDB) questionnaire conducted in 2016 in Bangladesh. Data were analyzed using binary logistic regression. Ordered probit and heteroskedastic ordered probit models were fitted to estimate the probability of the reported self-rated mental health attributed to all the potential confounders.

Results Individuals who did not have access to assistive devices had higher percentages of reporting poor mental health. Those who did not receive education and with poor household socioeconomic status had around two times higher chances of reporting poor mental health than those who received higher secondary education. Moreover, bad self-rated physical health and visual or mobility disability increased the probability of reporting very bad mental health by 5%. Unemployment increased the likelihood of reporting bad mental health by 2%.

Conclusions Associations between physical disability (hearing, visual, or mobility) and poor mental health were found in this study. As no research on the mental health of people with these physical disabilities has been conducted in Bangladesh, this study fills a significant knowledge gap. It provides important implications for future research and prevention actions. Further research is required to identify the causal inference of the associations found in this study.

Abbreviations

CDD	= The Center for Disability in Development
WHO	= World Health Organization
CDC	= The Centers for Disease Control and Prevention
LMIC	= Low Middle-Income Countries
NCD	= Non-Communicable Diseases
UNCRPD	= United Nations Convention on the Rights of Persons with Disabilities
DFLE	= Disability Free Life Expectancy
SES	= Socioeconomic status
SCDB	= The Social Capital and Disability in Bangladesh
SRH	= Self-Rated Health
SRMH	= Self-Rated Mental Health
ICF	= International Classification of Functioning
SCI	= Spinal Cord Injury
cOR	= Crude Odds Ratios
OR	= Odds Ratios
OP	= Ordered Probit
HOP	= Heteroskedastic Ordered Probit

1. Introduction

1.1 Background

Disability is becoming an increasingly important public health concern globally, especially among the world's aging populations; it affects 15 percent of the world's population, with approximately one in every seven individuals suffering from some form of disability or another (WHO and World Bank, 2011). Around 80 percent of people living with disabilities are from low-middle income countries (LMIC), according to the 2011 World Health Organization Global Status Report on Noncommunicable Diseases. People with disabilities might be more susceptible to acquiring NCDs due to lack of physical activity, poverty, and vulnerability, limiting their access to healthcare (ibid).

It is essential to note that the United Nations Convention on the Rights of Persons with Disabilities is an international landmark. It recognizes the transformation in perceptions and practices toward people with disabilities over the earlier. It acknowledges that disability comes from the interrelations between people who have impairments and the obstacles (both behavioral and environmental) that prevent them from engaging fully and effectively in the community on an equal footing with others (WHO and World Bank, 2011). The UN Convention on the Rights of Persons with Disabilities reinforces the inclusion of people with disabilities in NCD policies and services. It eliminates barriers to access to NCD prevention and control. It supports access to broader health and social services essential to attain the right of people with disabilities to an optimal level of mental and physical health without discrimination (ibid). Despite the efforts of the international policies to make recommendations for national and global actions on enhancing the health and well-being of people with disabilities, many low-middle income countries still need to provide people with disabilities with appropriate quality healthcare services due to limited resources, lack of awareness, discrimination, and marginalization associated with disability (Ekman et al., 2020).

1.1.2 Disability in Bangladesh

Our study utilizes data on disability from Bangladesh. This South Asian country has made significant progress in decreasing poverty and has accomplished the key United Nations

Millennium Development Goal of half poverty far ahead of the objective (Jahan et el., 2015). In 2014, due to its rapid economic development, Bangladesh was elevated to the lower-middle-income category (ibid). Most of Bangladesh's 150 million people reside in rural regions. As in other Asian countries, Bangladesh's population is aging as birth rates decline and life expectancy rises, resulting in an aging population (Wing, 2003). According to the Bangladesh Final Report on Household Income and Expenditure Survey in 2016, The prevalence of disability in Bangladesh is 6.94 percent, indicating that the nation has approximately 11.4 million people with disabilities (BBS, 2019).

The number of persons with disabilities in Bangladesh is expected to rise as the population ages and chronic diseases like cardiovascular disease and diabetes become more common (Saquib et al., 2012). Although Bangladesh has signed the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), people with disabilities are still affected by negative attitudes, poor knowledge, and misconceptions that might affect their mental health and social well-being (CRDP, 2019). The relationship between socioeconomic status and health is widely discussed in developed nations; persons with better socioeconomic status live longer, enjoy better health, and have reduced disability (Siegrist & Marmot, 2004; Prynn et al., 2019). On average, individuals with a lower socioeconomic status, have a greater risk of illness and death than those with a higher socioeconomic status (Jahan et al., 2015). The scenario worsens for disabled people with poorer education levels, lower employment rates, lower salaries when working, and are more likely to be economically poor than non-disabled individuals (Márton et al., 2013; Bickenbach et al., 1999). These limitations violate fundamental human rights and negatively influence the health and well-being of disabled people (ibid).

1.1.3 Physical Disability and mental health relationship

The World Mental Health Survey, 2009 revealed that depression was the most co-occurring disease of disability, and there is a synergistic joint effect between physical conditions and mental illness (Scott et al., 2009). Moreover, several studies have shown that adults with disabilities are more likely than their peers to suffer from mental health issues since they are more likely to live in poverty and have restrained access to healthcare. Mental distress may increase symptoms associated with physical disabilities and chronic diseases and may improve due to mental health therapy (Callahan et al., 2005). Despite that, healthcare workers who give care to persons with disabilities may be concerned with the underlying disability and overlook

opportunities to diagnose and manage co-occurring psychological issues (Smith and Matson 2010).

The Centers for Disease Control and Prevention (CDC) conducted a study in the United States of America in 2018. It revealed that adults with physical disabilities were approximately five times more likely than adults without disabilities to suffer significant mental illness and also reported that adults with disabilities with lower socioeconomic status were more likely to report mental distress than others with disabilities who had better socioeconomic conditions (Cree et al., 2020). Additionally, a two-year follow-up population study in South Korea suggested a causal relationship between mental illness and physical disability. It indicated that symptoms of mental distress differ according to the type and cause of disability and socioeconomic aspects. (Jung et al., 2021). The relationship between poor mental health and disability is attributed to multidimensional factors. For instance, people with disabilities are often disadvantaged in quality of life, social participation, mental health, and well-being. (Bickenbach et al., 1999; Albrecht and Devlieger 1999; Tough and Siegrist et al., 2017; Márton, et al. 2013). Additionally, several studies addressed those disabled individuals also have poorer education levels, lower employment rates, lower salaries, and are more likely to be economically poor (Kaye et al., 2011; Kruse and Schur, 2003; Norwich et al., 2007).

1.2 Contribution to the evidence base

As discussed previously, various studies were conducted to address the mental health of people with disabilities; however, most of them were in high-income countries. Studies conducted in low-middle-income countries tackled different aspects of disability, and few addressed mental distress as a secondary health condition of disability. Additionally, no research that explicitly focuses on the mental health of individuals with mobility, hearing, or visual disabilities has been undertaken in Bangladesh. Accordingly, we assume this research bridges a substantial knowledge gap by investigating the association between physical disabilities (visual, hearing, or mobility) and poor mental health outcomes.

1.3 Aim of the study

The current study extends the understanding of different aspects discussed in the previous study by Ekman et al., which utilized the same data as our study from the Social Capital and Disability

in Bangladesh (SCDB) questionnaire conducted on individuals with disabilities in Bangladesh in 2016 (Ekman et al., 2020).

This study aims to investigate the association between poor mental health outcomes and physical disabilities (hearing, visual, or mobility) in adults in Bangladesh. The supplementary aim is to examine the impact of different socioeconomic factors on the mental health of physically disabled adults in the nation.

1.3.1 Research questions

1. Is there an association between physical disability and poor mental health among disabled adults in Bangladesh?

2. To what extent do different socio-demographic, individual, and contextual characteristics impact the mental health of disabled adults in Bangladesh?

2. Methods and Analysis

This chapter will describe the study design and data collection, sampling framework, and inclusion criteria of the study participants. After that will explain the analytic approach, the outcome, and independent variables, and the data analysis. Then we will give a brief overviewoft the ethical considerations of our research.

2.1 Study design and data collection

In the present study, we use cross-sectional individual and ecological data from the Social Capital and Disability in Bangladesh (SCDB) study conducted in 2016 in Bangladesh. The Center for Disability in Development (CDD) collaborated with Lund University's Division of Social Medicine and Global Health (SMGH) to conduct this study. The survey includes an extensive data set collected from 1900 respondents living in four different districts in Bangladesh: Chittagong, Nilphamari, Narsingdi, and Dakha. The questionnaire consisted of 97 questions and was classified into six categories: A) Geographical location, B) Identification, Demography, and Family, C) Disability, D) Socioeconomic status (Health, Education, and Employment), E) Social capital, and F) Discrimination.

2.2 Sampling framework

Bangladesh is structured into four divisions and 64 districts. About 500 sub-districts are located in rural regions, urban areas, and municipalities. The last administrative level is the Union, which has roughly 4,451 members, each of which has 9 Wards, the country's most minor organizational level (GoB, 2014). A Ward comprises 600 to 1,200 families, with an average household size of five people, implying that there are between 3,000 and 6,000 people at this administrative level in Bangladesh (ibid). CDD and partner groups work in six Bangladeshi districts where data and information are readily accessible. 9,900 people with disabilities were available to the SCDB research team. Figure 1 shows the distribution of the total sample by district (Chittagong, Nilphamari, Narsingdi, and Dakha) and type of disability (hearing, mobility, and visual), and figure 2 shows the distribution of disability type by gender. Further, in figure 3, we show the frequency of the reported self-rated mental health across both genders, and in figure 4, we present the prevalence of SRMH across age groups.

2.3 Inclusion criteria

Regarding the recruitment of persons, the following participation requirements have been identified: only participants who could reply to questions on their own were included in the study to increase the study's strength and the quality of the household-level data. The study recruited adult participants aged 18 to 55 years with hearing, or mobility disabilities. Each study subject had to be a permanent resident of one of the research locations; and had been able to offer written consent for participation. After applying the inclusion criteria, 9,900 people with disabilities were available for the SCDB study.

2.4 Analytical approach

The research undertakes a quantitative analysis of pertinent correlations while controlling for confounding variables via gathering socio-demographic and contextual survey data as indicated above. The outcome variable of the study is self-rated mental health, which is measured along with other independent parameters. Explanatory variables included disability type, socio-demographic factors (age, gender, area of residence, household characteristics, and socioeconomic status), and other individual and contextual factors (education, employment, physical health, active membership in community associations, and assistive devices).

2.5 Outcome variable: Self-rated mental health

Short-scale measures of people's physical and mental health are becoming more common in epidemiologic surveys. They make it easier for people to fill out the survey and for researchers to efficiently gather public health indicators (Rohrer et al., 2005). A growing number of health studies, such as population health surveys, rely on one-item measures of self-rated mental health (SRMH), and on a scale of one to five, respondents were asked to score their mental health (Fleishman et al., 2007). Previous studies showed that adults with disabilities reported having worse mental health outcomes and poorer than their non-disabled counterparts, more serious medical problems, and chronic conditions (Lollar et al., 2002; Kinne et al., 2004; Mitra et al., 2002). In the present study, we measured self-reported mental health (SRMH) by respondents' mental health scores on a five-point score; *very good, good, neither good nor bad, bad* and *very bad*. The responses were grouped into two main categories: *Good* for those who responded "good and very good" versus *Poor* for those who answered, ", neither good nor bad, bad and very bad." The dichotomization of SRMH was used to attain a binary outcome in the Chi-2 tests to examine the distribution of study variables by self-rated mental health and in the binary logistic regression to calculate crude odds ratios (Manor et al., 2000; Cullati et al., 2020). We used the original five-point scale of self-rated mental health in the fitted ordered probit to estimate the probability of all responses (from very good to very bad) attributed to all potential confounders to achieve statistically accurate outcome associations (Lall et al., 2002).

2.6 Control variables

2.6.1 Disability

Our study classified disability into three categories: Visual, Hearing, and Mobility. The questionnaire used a modified version of the International Classification of Functioning (ICF) instrument to assess disability among the research subjects (Jette et al., 2006). It is a validated evaluation method used for individuals with visual, hearing, or physical disabilities to determine their kind of disability and how long it has been since their onset (ibid).

2.6.2 Control variables: Socio-demographic factors

Age

We categorized age into four groups: 18-28 years (reference age group), 29-34 years, 35-44 years, and 45-55 years. The age category 18-28 years was selected as the reference group since the literature suggested that most mental health problems related to disabilities occur with advancing age (Bombardier et al., 2010; Jensen et al., 2014).

Gender

Gender was divided into two categories: female and male. We did not stratify our analysis by gender because there was no statistically significant difference between men and women reporting the outcome variable (self-rated mental health) in our sample.

Residential areas and districts

The areas of residence were divided into two categories: urban and rural. Districts were divided into Chittagong, Nilphamari, Narsingdi, and Dakha. We included geographic variables in our analysis due to their influence on the accessibility of healthcare services and assistive technology for people with disabilities (Goins et al., 2005; Borg et al., 2011).

Household size and socioeconomic status

Our analysis captures the socioeconomic status of disabled individuals due to its influence on disability and mental distress (Brems et al., 2006). Household socioeconomic status was classified into average, poor, and very poor households. The household size was dichotomized into two groups: big and not big.

3.6.3 Control Variables: Individual and Contextual Factors

Individual and Contextual variables included employment, education, membership or active participation in community associations or groups, physical health, and access to assistive devices.

Employment and Education

The literature highlighted that disability and physical impairments are strongly associated with lower employment and education; thus, we included them in our statistical analysis. (Mitra et al., 2013; Filmer et al., 2008). Employment status was dichotomized into two categories: employed and unemployed, and the education variable was classified as (no education, primary, secondary, higher Secondary, and Post-Secondary).

Membership in community associations

Active participation in community associations provide a potential understanding of disabled people's needs and enhances their social life and well-being (Milner et al., 2009). Our study dichotomized membership in community associations into a member and not a member.

Physical health and Access to assistive devices

Physical health was measured as a self-assessed variable and classified into (Very Good, Good, Neither Good nor Bad, Bad, and Very Bad). Regarding accessibility to assistive devices, respondents were grouped into used assistive and did not use assistive devices. Both variables in our analysis were crucial for a better understanding of our research objectives. Physical health and disability affect each other differently, as poor physical health can be an outcome or cause of the disability (Cooper et al., 1999). Additionally, previous studies suggested a strong association between poor health outcomes of disabled people and access to assistive technologies (Eide & Øderud, 2009; Borg et al., 2011).

2.7 Data Analysis

Descriptive statistics were used to describe participant characteristics such as age, gender, degree of education, and socioeconomic status. We used chi-square testing to examine different proportions of self-rated mental health by disability type, physical health, and socio-demographic factors such as districts, urban households, employment, and education levels. After that, we performed binary logistic regression to calculate crude odds ratios to examine the effect of independent covariates on reported *poor* self-rated health (from *neither good nor bad to very bad*).

Then we performed an ordered probit (OP) regression model to estimate the probability of the reported self-rated mental health (from *very good to very bad*) attributed to all the potential confounders. We chose the ordered probit regression model over the binary logistic regression model because we found significant differences in the estimated coefficients among both methods. Furthermore, previous studies showed that adopting an ordered probit regression model is more statistically adequate for modeling self-rated health than logistic regression modeling. More precisely, employing the ordered probit regression model may aid in avoiding inconsistent and biased results and their negative impacts on public health research (Lall et al., 2002). Additionally, we fitted a heteroskedastic ordered probit model to avoid inconsistent results, which might be problematic due to heterogeneity in error terms (Greene et al., 2003). All of the statistical analyses in this study were performed using STATA/SE 17 software.

2.7.1 Estimation models

Binary Logistic Regression Model

$Y = \alpha + \beta 1 * x1 + \varepsilon$ *(1)*

Y is a binary outcome of self-rated mental health, which takes on the value of one if self-rated mental health is *poor* and zero if it has been rated as *good*. x1 is a vector of independent variables. ε is an error term that includes all other factors that may also affect Y's outcome variable.

Ordered Probit Regression Model

A single latent variable y* index model

$y^*_i = x'_i \beta + \varepsilon\_i$ *(1)*

$y^*_i = j$ *if* $\alpha_{j-1} < y^*_i \leq \alpha_j$

x is the matrix for independent covariants, β stands for the vector of independent covariates, and index *i* denotes a single individual. The error term ε is assumed to be symmetrically and normally distributed.

The probability that observation *i* will select alternative *j* is:

$p_{ij} = p(y_i = j) = p(\alpha_{j-1} < y^*_i \leq \alpha_j) = F(\alpha_j - x_i'\beta) - F(\alpha_{j-1} - x_i'\beta)$ *(2)*

The ordered probit model with *j* options will have a single group of coefficients with *(j-1)* intercepts and *j* sets of marginal effects, where *F* is the standard normal CDF.

Marginal effects for the ordered logit/probit models

The following formula is the marginal effect of enlarging a regressor x_i on the likelihood of choosing alternative *j*:

$$\delta p_{ij} / \delta x_{ri} = \{F'(\alpha_{j-1} - x_i'\beta) - F'(\alpha_j - x_i'\beta)\}\beta_r \quad (3)$$

The marginal effects of each variable on the various choices equal zero. Interpretation of marginal effects: Each unit increase in the independent variable increases or decreases the likelihood of choosing option *j* by the marginal effect given as a percentage.

2.8 Ethical considerations

The Social Capital and Disability in Bangladesh (SCDB) study was given ethical approval by the Bangladesh Medical Research Council, a government-run organization (approval code is BMRC/NREC/2013-2016/621). Furthermore, the current research is being carried out with the authors' consent of the (SCDB) study. All participants were provided with information about the study's purpose and were asked to obtain informed permission before taking part in the survey questionnaire.

3. Results

This chapter will commence by presenting the sample characteristics and distribution of the sociodemographic indicators to understand the composition and representativeness of the sample population. Further, we will show crude and adjusted odds ratios followed by the sensitivity analysis.

3.1 Sample characteristics

The SCDB questionnaire was sent out to 1900 individuals between 18 and 55 years; the mean age was approximately 35 years. We calculated the response rate for each question used in the present study. Although all participants responded to questions about their health status and disability, not all participants responded to other covariates. For instance, 1871 individuals responded to the question of educational level. Only 1015 individuals responded to the question of economic status. Additionally, 1888 research participants did not fully complete a question regarding their employment status, as 12 response data were missing, and most were unemployed at the time of the survey's implementation. Further, we calculated Cronbach's alpha coefficient to test for the internal consistency and reliability of the health and disability questionnaire sections; the results showed that the health subscale consisted of 4 items (α = 0.55), and the disability subscale of 10 items (α = 0.65).

3.2 Frequency and Distribution of Sociodemographic indicators

Table 1 shows the frequency of responses and their categories, together with the total, and provides missing data for each answer. Results showed that, of the 1900 participants, 51.89 % were aged 18 –35 years, 48.11% were between 36 and 55 years of age, 57.68% were female, 63.71 % had a physical disability, 16.46 with hearing disability, 19.83% with a visual

disability. Regarding the response to self-rated mental health, 3.37% reported very good, 39.95% answered neither good nor bad, and 16.68 reported very bad mental health. Furthermore, 57.89% had no education, 60.42% were unemployed, 82.95% lived in rural areas, 48.05% reported having poor economic conditions, 98.26% were not members of community associations, 67.47% had no access to disability benefits, and 61.23% reported they do not feel safe at home.

Table 2 presents the socio-demographic characteristics of the study population, and it showed that, for the total sample, the prevalence of *bad* self-rated mental health was 48.58 % among females, 28.43% for those aged 45 to 55 years, 63.03% for people wh a physical disability, 66.88% for those without education, 64.35% among unemployed, 69.40% for people who do not use assistive devices, and 44.16% for those with poor socioeconomic status.

3.3 Crude and adjusted odds ratios

Crude odds ratios were estimated using bivariate logistic regression and fully adjusted models using multivariate logistic regression. Table 3 presents the crude odds ratios calculated using bivariate logistic regression analysis for the association between the explanatory variables and the self-rated mental health outcome measures. Results showed no significant difference between genders for reporting *poor* self-rated mental health. However, there was a significant association between *poor* self-rated mental health and older age (cOR 1.48, 95% CI 1.22-1.79). Those who did not receive education had around two times higher odds of reporting *poor* mental health than those who received higher secondary education (cOR 2.17, 95% CI 1.242-3.80). The odds of reporting *poor* mental health for unemployed participants were (cOR 1.47, 95% CI 1.21-1.78) and those with no access to assistive devices (cOR 1.25, 95% CI 1.01-1.57). The odds of having *poor* mental health for those with poor household economics were twice as higher compared to others with average household economics (cOR 2.61, 95% CI 1.96-3.48), participants who lived in rural areas had four times higher odds of reporting *poor* mental health compared to those who lived in urban areas (cOR 3.55, 95% CI 12.59-4.87), and individuals who were not a member of associations had two times higher odds to report *poor* mental health compared to others who were members (cOR 1.8, 95% CI 1.63-2.00). On the other hand, those who responded feeling safe at home had lower odds of 82% reporting *poor* mental health than those who did not feel safe at home (cOR 0.18, 95% CI 0.15-0.23).

Results from the adjusted multivariate logistic regression analysis models are shown in the annex. The interaction terms that investigated the combined effect of assistive devices and type of disability on poor self-rated health are shown in (Table 4). Test results showed that those with a visual disability who use assistive devices were 38% less likely to report *poor* mental health odds (OR 0.62, 95% CI 0.40-0.98). The interaction term was statistically significant. Additionally, there was a synergistic effect between having mobility disabilities and not using assistive devices on reporting *poor* mental health with odds (OR 1.06, 95% CI 0.39-0.98); however, this interaction term was not statistically significant.

3.4 Estimates from the Ordered Probit Models

To prevent inconsistency and bias in our ordered probit model due to the cross-sectional data collection, we needed to examine whether error variance is consistent across observations (i.e., check for error variance heterogeneity) (Greene et al., 2003). Therefore, we performed the Breusch–Pagan test to check if the residual or error term variance in our OP model changed considerably (heteroskedasticity). The test result was 3.37 (Prob > F = 0.0000), meaning that the null hypothesis of homoscedasticity is rejected and heteroskedasticity assumed. To combat the issue of heteroskedasticity, we fitted a heteroskedastic ordered probit model (HOP) using robust standard errors that consider heterogeneity and assure the validity and significance of using this model in our research.

Ordered probit regression OP and Heteroskedastic ordered probit model HOP analysis estimated the probability of reporting self-rated mental health (from *very good* to *very bad*) attributed to all the potential confounders (Table 6). Both models showed that reported self-rated mental health was significantly better with a lower prevalence of mobility and visual disability and lower age. Reported self-rated mental health was significantly worse with lower educational levels, employment, household socioeconomic status, and better physical health. The estimated marginal effects of the Heteroskedastic ordered probit model are presented in (Table 7). Results suggest that being female decreased the probability of reporting *very bad* mental health by 2 % and living in rural areas decreased the probability of reporting *good* mental health by 19%. Further, *bad* self-rated physical health and visual or mobility disability increased the probability of reporting very bad mental health by 5%. Additionally, individuals reporting very poor household socioeconomic status had 1% fewer chances to report *very good* self-rated mental health, and unemployment increased the probability of reporting *bad* mental health by 2%.

3.5 Sensitivity Analysis

Before applying the ordered probit model, a Mann-Whitney U test was conducted on 1884 participants to determine if gender leads to a difference in self-rated mental health. Results showed that self-rated mental health was not statistically significantly different between males and females (z = -1.255, p = 0.2096) at a significance level of 0.05 (Table 5). Based on these results, gender did not significantly impact self-rated mental health.

We also measured the variance inflation factor (VIF) to detect multicollinearity by measuring inflation in parameter estimations' variances due to collinearities across predictors. Results showed that the mean value of VIF was equal to 4.47, owing to moderate multicollinearity between the variables involved. Furthermore, we performed goodness of fit tests on the final HOP model; Link-test results indicated that there were no misspecification errors existed and the model specification was correct, and the Hausman specification test also showed that the fixed effect model was appropriate,

4. Discussion

In this study, we conducted a quantitative analysis to examine how socio-demographic, individual, and contextual factors affect self-rated mental health among Bangladesh people with a disability. This chapter will summarize our analysis results; then, we will discuss how they are related to those of other literature and how these results contribute to mental health research on people with disabilities. After that, we will acknowledge the limitations of our study. Lastly, we will argue the implications and recommendations for future research.

4.1 Summary of research findings

Results of the frequency analysis revealed that most of the study participants lived in rural areas (82.95%) with a mean age of 35 years, and men were 57.68% of respondents. Besides, 77.26 % of individuals had no access to assistive devices. Further, the binary logistic regression suggests that older age, poor physical health, poverty-stricken households, unemployment, low level of education, no access to assistive devices, and not being a member of community associations had significantly higher odds of *poor* self-rated mental health.

Findings from the Heteroskedastic ordered probit (HOP) showed that reported self-rated mental health was statistically significantly better with a lower prevalence of mobility and visual disability and lower age and is statistically significantly worse with higher educational levels, employment and household socioeconomic status as well as better physical health. The estimated marginal effects of the HOP model suggested that living in rural areas decreased the probability of reporting *good* mental health by 19%. Further, bad self-rated physical health and visual or mobility disability increased the probability of reporting *very bad* mental health by 5%. Unemployment increased the probability of reporting *bad* mental health by 2%.

4.2 Interpretation and relation to the existing evidence base

A notable strength of this study is that, by analyzing data from the SCBD questionnaire, it identified numerous noteworthy indicators that could potentially affect the mental health of people with physical disabilities. This section will discuss those indicators and compare them with other findings from existing studies.

4.2.1 Age

When we compare the results of this study to those of previous research on the influence of age, it is clear that age has a significant association with poor mental health outcomes. A longitudinal study discovered that persons with physical impairments observed declining family support with advancing age (Jensen et al., 2014). Another study found that middle age may be a time of greater psychological fragility for people with disabilities, which may need a greater need for social assistance (Bombardier et al., 2010). For the reason that disability might compel individuals to face their vulnerabilities earlier than others without disabilities at their age (ibid).

4.2.2 Gender

Our findings contradict those in the literature, which suggested an association between being female with a disability and poor mental health outcomes (Noh et al., 2016; Kavanagh et al., 2015). Moreover, there was evidence that males had significantly better overall self-assessed health than women in another study by Ekman et al. 2020, which utilized data from the SCDB questionnaire (Ekman, Borg, et al., 2020). Our results showed no significant difference in reporting poor self-rated mental health between men and women. The possibility of social desirability bias could explain it as female participants may have under-reported their mental health status for cultural reasons such as fear of affecting their social network image (Mascayano et al., 2015).

4.2.3 Physical health

In our analysis, individuals who reported poor mental health were higher to report having poor physical health. A previous cross-sectional study aimed to assess the relationship between physical activity and mental health among males and females suggested that regular physical activity is related to decreased depression symptomatology and improved emotional well-being (Galper et al., 2006).

4.2.4 Access to assistive devices

According to our findings, most participants did not use assistive equipment; this is consistent with previous literature, which implies that access to assistive devices is inequitable in low- and middle-income countries due to various socioeconomic and geographic characteristics (May-Teerink, 1999; Eide and Øderud 2009). Additionally, a systematic review that provided an overview of existing research on assistive technology for disabled people in low- and lower-middle-income settings highlighted that, given the need for wheelchairs for people with mobility impairments, the difficulties in obtaining them were tremendous. It suggested that inexpensive assistive tools which fulfill the person's safety, physiological and economic conditions were not widely accessible to everyone in need (Borg et al., 2011). Furthermore, we indicate that there is a significant association between poor self-rated mental health and not using assistive devices, which is consistent with the results of another cross-sectional study in Bangladesh, which revealed that those with hearing disabilities who used hearing aids were more likely to report favorable outcomes in terms of standard of living and health compared to others who do not have access to hearing aids (Borg et al., 2012).

4.2.5 Area of Residence

We replicate previous research in that geographical areas (rural or urban) significantly affect the physical and mental health of people living with disabilities; for instance, the challenges in healthcare access in rural areas have been documented in several studies (Goins et al., 2005; Brems et al., 2006). Further, A study attempted to predict Disability free life expectancy for persons (DFLE) with disability of all ages residing in Bangladesh's urban and rural regions and found significant inequalities in DFLE across rural and urban areas in Bangladesh attributed to the barriers to access to general health care services in the rural areas compared to urban ones (Islam et al., 2017).

4.2.6 Household socioeconomic status

Our results reveal that most of the study participants suffered from poor household economics, which indicates that disability in Bangladesh is highly related to greater multidimensional poverty. Furthermore, our ordered probit regression (OP) results showed that the reported self-rated mental health was statistically significantly worse with lower socioeconomic status. The relationship between socioeconomic status and health is widely discussed in developed nations, with persons with more excellent status living longer, enjoying better health, and having

reduced disability, and individuals with a lower socioeconomic status, on average, have a greater risk of illness and death than those with a higher socioeconomic status (Siegrist et al., 2004). A randomized control trial in Bangladesh looked at work-related family incomes before and after Spinal Cord Injuries (SCI) to determine economic insecurity among persons with SCI and their households. Results indicated that individuals and their families faced severe financial consequences since most of those injured were young individuals from poor socioeconomic areas who were the primary breadwinners for their families (Hossain, Harvey, et al. 2020). A,dditionally, compared to non-disabled individuals, disabled individuals have poorer education levels, lower employment rates, lower salaries when working, and are more likely to be economically poor (Braveman et al., 2005).

4.2.7 Education and Employment

Our data analysis reveals that most study participants had low education attainment, were unemployed, and had significantly higher chances of reporting poor mental health. These findings consistently line with several studies. For instance, a study by Mitra et al., 2013, utilized data from 15 developing countries that suggested that for people with disabilities, three aspects that led most to multidimensional poverty dramatically affect well-being.; education, health costs, and employment (Mitra et al., 2013). Additionally, results from a World Bank study used data from household surveys of 14 developing countries, showing that countries with a higher stigma towards individuals with disabilities or less effort to ensure their school access had higher schooling deficits (Filmer et al., 2008). Further, Ekman et al., 2020 showed that 40% of the SCDB participants reported having encountered some discrimination. Findings like these may explain the low education attainment among disabled participants in our study, although our analysis aims not to draw causal inferences between different variables.

4.3 Limitations

The findings in this study are subject to some limitations that we should consider. First, in our research, we utilized cross-sectional data; thus, we cannot infer the causality of poor self-rated health of people among disability, socio-demographic and contextual variables. Second, we focused on disabled adults and did not consider children with disabilities. Also, we focused on three types of disabilities (visual, physical, and hearing) and excluded other cognitive

disabilities; thus, findings from our study could not be generalized to a broader scale. Third, our results might be subject to self-report biases due to relying on a single measurement score of self-rated health; however, it has been widely used in health surveys and it is not specific for people with disabilities. In other worself-reported health ratingsalth by individuals with disabilities might differ considerably from external observers (Albrecht et al., 1999). Moreover, people with and without disabilities might have wide variations in norms for self-rating health or the underlying mechanism of assessing self-rated health. Finally, another methodological problem stems from the dichotomization of the research variables (ibid). A significant drawback of dichotomizing is that it reduces the statistical ability to examine relationships between independent variables and outcomes (MacCallum et al., 2002).

4.4 Implications and Recommendations

For people with disabilities, our findings may be beneficial as a baseline for interventions and policy implications for closing the health outcomes gap. Initially, it may be necessary to screen disabled individuals for mental distress to ensure that they get prescribed clinical therapy and referral, even if the mental health problems are unrelated to the primary diagnosis for which individuals are being investigated. Future research on mental suffering in individuals with disabilities might target disease prevention and health promotion interventions. Moreover, our findings imply that individuals with disabilities should be explicitly included in poverty-related policies and research agendas in developing economies. Further, Policies aimed at enhancing the socioeconomic conditions of people with disabilities cannot be one size fits all and must consider the different aspects of inequality experienced, such as employment, income, and education (Braveman et al., 2005).

Lastly, to address the general necessity for investment in preventative, rehabilitative, and accessible services, it is vital to have more extensive and more profound knowledge of the experiences of people with disabilities and the prevalence of disability across and within nations. A deeper understanding of the challenges faced by persons with disabilities in their day-to-day activities, such as employment, accessing medical services, and attending school, would help policymakers devise more effective strategies and interventions (Mitra et al., 2013; Ekman et al. 2,020).

5. Conclusions

This study is the first to examine mental distress as a secondary outcome of physical disabilities in Bangladesh. Our findings show significant associations between poorer self-rated mental health and physical disability (hearing, visual, and mobility). Additionally, results from this study suggest significant associations between various socio-demographic, individual, and contextual characteristics and the self-rated mental health of disabled adults. Low socioeconomic status, unemployment, lack of access to assistive devices, and poor physical health significantly negatively impacted mental health status. To address disparities in mental anguish, public health professionals, policymakers, and health care providers can recommend practices to enhance social solidarity, encourage civic engagement, and improve access to adequate mental health screening and support, along with promoting health and wellness recommendations and participation in evidence-based programs. Further, more research is needed better to understand the mental health of people with physical disabilities and identify the causal effects of environmental and social barriers on poor mental health outcomes.

6. References

Albrecht, G. L., & Devlieger, P. J. (1999). The disability paradox: high quality of life against all odds. *Social Science & medicine (1982)*, *48*(8), 977–988. https://doi.org/10.1016/s0277-9536(98)00411-0

Bangladesh Bureau of Statistics - BBS (2019). Disability in Bangladesh: Prevalence and pattern. Retrieved from: http://203.112.218.65:8008/WebTestApplication/userfiles/Image/PopMonographs/disabiityFinal.pdf

Bickenbach, J. E., Chatterji, S., Badley, E. M., & Ustün, T. B. (1999). Models of disablement, universalism, and the international classification of impairments, disabilities and handicaps. *Social science & medicine (1982)*, *48*(9), 1173–1187. https://doi.org/10.1016/s0277-9536(98)00441-9

Bombardier, C. H., Ehde, D. M., Stoelb, B., & Molton, I. R. (2010). The relationship of age-related factors to psychological functioning among people with disabilities. *Physical medicine and rehabilitation clinics of North America*, *21*(2), 281–297. https://doi.org/10.1016/j.pmr.2009.12.005

Borg, J., Larsson, S., Östergren, P. O., Rahman, A. S. M., Bari, N., & Khan, A. H. M. (2012). Assistive technology use and human rights enjoyment: a cross-sectional study in Bangladesh. *BMC international health and human rights*, *12*(1), 1-11.

Borg, J., Lindström, A., & Larsson, S. (2011). Assistive technology in developing countries: a review from the perspective of the Convention on the Rights of Persons with Disabilities. *Prosthetics and orthotics international*, *35*(1), 20–29. https://doi.org/10.1177/0309364610389351

Braveman, P. A., Cubbin, C., Egerter, S., Chideya, S., Marchi, K. S., Metzler, M., & Posner, S. (2005). Socioeconomic status in health research: one size does not fit all. *JAMA*, *294*(22), 2879–2888. https://doi.org/10.1001/jama.294.22.2879

Brems, C., Johnson, M. E., Warner, T. D., & Roberts, L. W. (2006). Barriers to healthcare as reported by rural and urban interprofessional providers. *Journal of interprofessional care*, *20*(2), 105–118. https://doi.org/10.1080/13561820600622208

Callahan, C. M., Kroenke, K., Counsell, S. R., Hendrie, H. C., Perkins, A. J., Katon, W., Noel, P. H., Harpole, L., Hunkeler, E. M., Unützer, J., & IMPACT Investigators (2005). Treatment of depression improves physical functioning in older adults. *Journal of the American Geriatrics Society*, *53*(3), 367–373. https://doi.org/10.1111/j.1532-5415.2005.53151.x

Cooper, R. A., Quatrano, L. A., Axelson, P. W., Harlan, W., Stineman, M., Franklin, B., Krause, J. S., Bach, J., Chambers, H., Chao, E. Y., Alexander, M., & Painter, P. (1999). Research on physical activity and health among people with disabilities: a consensus statement. *Journal of rehabilitation research and development*, *36*(2), 142–154.

Cree RA, Okoro CA, Zack MM, Carbone E. Frequent mental distress among adults, by disability status, disability type, and selected characteristics—United States, 2018. MMWR Morb Mortal Wkly Rep 2020;69:1238–43. PMID:32914770 https://doi.org/10.15585/mmwr.mm6936a2

CRPD Alternative Report Platform Bangladesh (2019). Alternative Report on the Status of Implementation of the Convention on the Rights of Persons with Disabilities in Bangladesh. Retrieved from: https://www.blast.org.bd/content/report/Alternative-ReportNGDO-2019.pdf

Cullati, S., Bochatay, N., Rossier, C., Guessous, I., Burton-Jeangros, C., & Courvoisier, D. S. (2020). Does the single-item self-rated health measure the same thing across different wordings? Construct validity study. *Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation*, *29*(9), 2593–2604. https://doi.org/10.1007/s11136-020-02533-2

Eide AH, Øderud T. Assistive Technology in low-Income Countries. In: Disability & International Development. New York: Springer US; 2009. p. 149–60. https://doi.org/10.1007/978-0-387-93840-0_10.x

Ekman, B., Borg, J., Khan, A. H. M. N., Bari, N., Tanbir, M., & Emmelin, M. (2020). Disability, Sociodemographics, and Discrimination: A Descriptive Analysis of Household Survey Data from Bangladesh. *Disability, CBR & Inclusive Development*, *31*(3), 6-22. https://doi.org/10.47985/dcidj.424

Filmer, Deon. (2008). Disability, Poverty, and Schooling in Developing Countries: Results from 14 Household Surveys. World Bank Economic Review. 22. 141-163. 10.1093/wber/lhm021.

Fleishman, J. A., & Zuvekas, S. H. (2007). Global self-rated mental health: associations with other mental health measures and with role functioning. *Medical care*, *45*(7), 602–609. https://doi.org/10.1097/MLR.0b013e31803bb4b0

Galper, D. I., Trivedi, M. H., Barlow, C. E., Dunn, A. L., & Kampert, J. B. (2006). Inverse association between physical inactivity and mental health in men and women. *Medicine and science in sports and exercise*, *38*(1), 173–178. https://doi.org/10.1249/01.mss.0000180883.32116.28

Greene, W. H. (2003). *Econometric analysis*. Pearson Education India.

GoB. Government of Bangladesh. Secondary Government of Bangladesh 2014. http://www .bangladesh.gov .bd/?q=en.

Goins, R. T., Williams, K. A., Carter, M. W., Spencer, M., & Solovieva, T. (2005). Perceived barriers to health care access among rural older adults: a qualitative study. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*, *21*(3), 206–213. https://doi.org/10.1111/j.1748-0361.2005.tb00084

Hossain, M. S., Harvey, L. A., Islam, M. S., Rahman, M. A., Liu, H., Herbert, R. D., & CIVIC Trial Collaboration (2020). Loss of work-related income impoverishes people with SCI and their families in Bangladesh. *Spinal cord*, *58*(4), 423–429. https://doi.org/10.1038/s41393-019-0382-1

Islam, M. S., Tareque, M. I., Mondal, M., Fazle Rabbi, A. M., Khan, H., & Begum, S. (2017). Urban-rural differences in disability-free life expectancy in Bangladesh using the 2010 HIES data. *PloS one*, *12*(7), e0179987. https://doi.org/10.1371/journal.pone.0179987

Jahan, S., Jespersen, E., Mukherjee, S., Kovacevic, M., Bonini, A., Calderon, C., & Lucic, S. (2015). Human development report 2015: Work for human development. New York, NY, USA: UNDP.

Jensen, M. P., Smith, A. E., Bombardier, C. H., Yorkston, K. M., Miró, J., & Molton, I. R. (2014). Social support, depression, and physical disability: age and diagnostic group effects. *Disability and health journal*, *7*(2), 164–172. https://doi.org/10.1016/j.dhjo.2013.11.001

Jette A. M. (2006). Toward a common language for function, disability, and health. *Physical therapy*, *86*(5), 726–734.

Jung, S.W., Yoon, JH. & Lee, W. Predictors for depressive symptoms by four types of disability. *Sci Rep* **11,** 19371 (2021). https://doi.org/10.1038/s41598-021-98765-4

Kavanagh, A. M., Krnjacki, L., Aitken, Z., LaMontagne, A. D., Beer, A., Baker, E., & Bentley, R. (2015). Intersections between disability, type of impairment, gender and socioeconomic disadvantage in a nationally representative sample of 33,101 working-aged Australians. *Disability and health journal*, *8*(2), 191–199. https://doi.org/10.1016/j.dhjo.2014.08.008

Kaye, H.S., Jans, L.H. & Jones, E.C. Why Don't Employers Hire and Retain Workers with Disabilities?. J Occup Rehabil 21, 526–536 (2011). https://doi.org/10.1007/s10926-011-9302-8

Kinne, S., Patrick, D. L., & Doyle, D. L. (2004). Prevalence of secondary conditions among people with disabilities. *American journal of public health*, *94*(3), 443–445. https://doi.org/10.2105/ajph.94.3.443

Kruse, Douglas & Schur, Lisa. (2003). Employment of People with Disabilities Following the ADA. Industrial Relations: A Journal of Economy and Society. 42. 31 - 66. 10.1111/1468-232X.00275.

Lall, R., Campbell, M. J., Walters, S. J., & Morgan, K. (2002). A review of ordinal regression models applied on health-related quality of life assessments. *Statistical methods in medical research*, *11*(1), 49–67. https://doi.org/10.1191/0962280202sm271ra

Lollar D. J. (2002). Public health and disability: emerging opportunities. *Public health reports (Washington, D.C. : 1974)*, *117*(2), 131–136. https://doi.org/10.1093/phr/117.2.131

MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological methods*, *7*(1), 19–40. https://doi.org/10.1037/1082-989x.7.1.19

Manor, O., Matthews, S., & Power, C. (2000). Dichotomous or categorical response? Analysing self-rated health and lifetime social class. *International journal of epidemiology*, *29*(1), 149–157. https://doi.org/10.1093/ije/29.1.149

Márton, S. M., Polk, G., & Fiala, D. R. C. (2013). Convention on the Rights of Persons with Disabilities. *USA: United Nations*.

Mascayano, Franco & Armijo, Julio & Yang, Lawrence. (2015). Addressing Stigma Relating to Mental Illness in Low- and Middle-Income Countries. Frontiers in Psychiatry. 6. 1-4. 10.3389/fpsyt.2015.00038.

May-Teerink T. (1999). A survey of rehabilitative services and people coping with physical disabilities in Uganda, East Africa. *International Journal of rehabilitation research. Internationale Zeitschrift fur Rehabilitationsforschung. Revue internationale de recherches de readaptation*, *22*(4), 311–316. https://doi.org/10.1097/00004356-199912000-00008

Mitra, Sophie & Posarac, Aleksandra & Vick, Brandon. (2013). Disability and Poverty in Developing Countries: A Multidimensional Study. World Development. 41. 1–18. 10.1016/j.worlddev.2012.05.024.

Noh, J. W., Kwon, Y. D., Park, J., Oh, I. H., & Kim, J. (2016). Relationship between Physical Disability and Depression by Gender: A Panel Regression Model. *PloS one*, *11*(11), e0166238. https://doi.org/10.1371/journal.pone.0166238

Norwich, Brahm. (2008). Dilemmas of Difference, Inclusion and Disability: international perspectives. European Journal of Special Needs Education. 23. 287-304. 10.1080/08856250802387166..

Rohrer, J. E., Pierce, J. R., Jr, & Blackburn, C. (2005). Lifestyle and mental health. *Preventive medicine*, *40*(4), 438–443. https://doi.org/10.1016/j.ypmed.2004.07.003 https://doi.org/10.1016/j.ypmed.2004.07.003.

Scott, K. M., Von Korff, M., Alonso, J., Angermeyer, M. C., Bromet, E., Fayyad, J., de Girolamo, G., Demyttenaere, K., Gasquet, I., Gureje, O., Haro, J. M., He, Y., Kessler, R. C., Levinson, D., Medina Mora, M. E., Oakley Browne, M., Ormel, J., Posada-Villa, J., Watanabe, M., & Williams, D. (2009). Mental-physical co-morbidity and its relationship with disability: results from the World Mental Health Surveys. *Psychological medicine*, *39*(1), 33–43. https://doi.org/10.1017/S0033291708003188

Siegrist, J., & Marmot, M. (2004). Health inequalities and the psychosocial environment-two scientific challenges. *Social science & medicine (1982)*, *58*(8), 1463–1473. https://doi.org/10.1016/S0277-9536(03)00349-6

Smith, K. R., & Matson, J. L. (2010). Psychopathology: differences among adults with intellectually disabled, comorbid autism spectrum disorders and epilepsy. *Research in developmental disabilities*, *31*(3), 743–749. https://doi.org/10.1016/j.ridd.2010.01.016

Tough, H., Siegrist, J., & Fekete, C. (2017). Social relationships, mental health and well-being in physical disability: a systematic review. *BMC public health*, *17*(1), 414. https://doi.org/10.1186/s12889-017-4308-6

Wilber, N., Mitra, M., Walker, D. K., Allen, D., Meyers, A. R., & Tupper, P. (2002). Disability as a public health issue: findings and reflections from the Massachusetts survey of secondary conditions. *The Milbank Quarterly*, *80*(2), 393–421. https://doi.org/10.1111/1468-0009.00009

Wing P. (2003). "Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh." Conceptual Framework for Health, Nutrition and Population Sector Programme (HNPSP).

World Health Organisation and World Bank (2011). World report on disability. Geneva. Available at: https://www.who.int/disabilities/world_report/2011/report.pdf

7. Figures and Tables

Table.1 Frequency Table for the total population size of 1900 adults from The SCBD questionnaire, 2016

Variable	Total	Category	Frequency	%
Gender	1.9	Male	1,096	57.68
		Female	804	42.32
		Missing	0	
Age	1.888	18-28 years	541	28.65
		29-34 years	401	21.24
		35-44	497	26.32
		45-55	449	23.78
		Missing	12	
District	1.892	Chittagong	342	18.00
		Dhaka	402	21.16
		Narshingdi	521	27.42
		Nilphamari	627	33.00
		Missing	8	
Disability type	1,896	Hearing	312	16.46
		Mobility	1.208	63.71
		Visual	376	19.83
		Missing	*4*	
Self-rated mental health	1.884	Very good	64	3.37
		Good	611	32.16
		Neither good nor bad	759	39.95
		Bad	317	16.68
		Very bad	133	7
		Missing	16	
Physical Health	1.898	Very good	33	1.74
		Good	721	37.95
		Neither good nor bad	544	28.63
		Bad	461	24.26
		Very bad	1.144	60.21
		Missing	2	
Education	1.871	No Education	1.1	57.89
		Primary	379	19.95
		Secondary	293	15.42
		Higher Secondary	52	2.74
		Post Secondary	47	2.47
		Missing	29	

Continue table 1.

Variable	Total	Category	Frequency	%
		Yes	740	38.95
Employment	1.888	No	1,148	60.42
		Missing	12	
		Urban	324	17.05
Urban	1.9	Rural	1,576	82.95
		Missing	0	
		Yes	428	22.53
Use of assistive devices	1.896	No	1,468	77.26
		Missing	4	
		Big	777	59.11
Size of household	1.9	Not big	1.123	40.89
		Missing	0	
		Not member	1.867	98.26
Membership at associations	1.9	Member	33	1.74
		Missing/do not know	0	
		Very poor	665	35.00
Household economics	1.894	Poor	913	48.05
		Average/Rich	311	16.37
		Missing	5	0.26
		Yes	618	32.53
Disability benefits	1.9	No	1.282	67.47
		Missing	0	
		Yes	697	38.77
Feeling safe at home	1.798	No	1.101	61.23
		Missing	102	

Tabel 2. Socio-demographic Characteristics according to the self-rated mental health of the study sample N=1900

Variable	Category	Total	Very good		Good		Neither good nor bad		Bad		Very bad		Chi-squared P-value
			n	%	n	%	n	%	n	%	N	%	
	Male	1.096	48	75	354	257	448	59.03	163	51.42	73	54.89	<0.05
	Female	804	16	25	57.94	42.06	311	40.97	154	48.58	60	45.11	
Gender	*Missing*	*16*											
	18-28 years	541	24	37.50	195	32.02	197	26.16	82	26.20	38	28.57	<0.05
	29-34 years	401	20	31.25	138	22.66	166	22.05	52	16.61	21	15.79	
	35-44	497	15	23.44	155	25.45	195	25.90	90	28.75	38	28.57	
	45-55	449	5	7.81	121	19.87	195	25.90	89	28.43	36	27.07	
Age	*Missing*	*16*											
	Chittagong	342	5	7.81	124	20.29	133	17.52	42	13.25	37	27.82	<0.01
	Dhaka	402	34	53.12	107	17.51	156	20.55	94	29.65	11	8.27	
	Narshingdi	521	14	21.88	196	32.08	207	27.27	66	20.82	34	25.56	
	Nilphamari	627	11	17.19	182	29.79	257	33.86	115	36.28	51	38.35	
District	*Missing*	*16*											
Disability type	Hearing	312	4	6.25	96	15.71	132	17.39	50	15.77	18	13.53	<0.01
	Mobility	1.208	41	64.06	401	65.63	455	59.95	217	68.45	90	67.67	
	Visual	376	19	29.69	114	18.66	169	22.27	49	15.46	25	18.80	
	Missing	*16*											
Physical health	Very good	33	16	25.00	10	1.64	6	0.79	0	0.00	1	0.75	<0.01
	Good	721	35	54.69	421	68.90	222	29.25	33	10.41	5	3.76	
	Neither good nor bad	544	7	10.94	99	16.20	315	41.50	98	30.91	24	18.05	
	Bad	461	4	6.25	64	10.47	186	24.51	155	48.90	45	33.83	
	Very bad	139	2	3.12	17	2.78	29	3.82	31	9.78	58	43.61	
	Missing	*2*											
	No Education	1100	26	40.62	317	51.88	441	58.10	212	66.88	92	69.17	<0.025
	Primary	379	12	18.75	136	22.26	154	20.29	52	16.40	23	17.29	
	Secondary	293	20	31.25	101	16.53	120	15.81	37	11.67	13	9.77	
	Higher Secondary	52	1	1.56	25	4.09	16	2.11	8	2.52	2	1.50	
	Post Secondary	47	5	7.81	20	3.27	15	1.98	5	1.58	2	1.50	
Education	*Missing*	*29*											
Employment	Yes	740	42	65.62	260	42.55	299	39.39	112	35.33	22	16.54	<0.01
	No	1.148	22	34.38	344	56.30	456	60.08	204	64.35	111	83.46	

Continue table 2.

Variable	Category	Total	Very good		Good		Neither good nor bad		Bad		very bad		Chi-squared P-value
			n	%	n	%	n	%	n	%	n	%	
	Missing	*12*											
Urban/Rural	Urban	324	3	4.69	48	7.86	168	22.13	69	21.77	35	26.32	<0.01
	Rural	1.576	61	95.31	563	92.14	591	77.87	248	78.23	98	73.68	
	Missing	*11*											
Use of assistive devices	Yes	428	28	43.75	143	23.40	139	18.31	88	27.76	29	21.80	<0.01
	No	1.468	36	56.25	468	76.60	619	81.55	227	71.61	103	77.44	
	Missing	*4*											
Size of household	Big	777	28	43.75	275	45.01	282	37.15	114	35.96	66	49.62	<0.01
	Not big	1.123	36	56.25	336	54.99	477	62.85	203	64.04	67	50.38	
	Missing	*0*											
	Not member	1.313	37	57.81	416	68.09	521	68.64	222	70.03	102	76.69	<0.05
	Member	587	27	42.19	195	31.91	238	31.36	95	29.97	31	3.31	
Membership at associations	*Missing*	*0*											
	Very poor	665	20	31.25	136	22.26	305	40.18	141	44.48	58	43.61	<0.01
	Poor	913	29	45.31	347	56.79	334	44.01	140	44.16	55	41.35	
	Average	316	15	23.44	125	20.46	117	15.42	36	11.36	20	15.04	
Household socioeconomic status	*Missing*	*6*											
Disability benefits	Yes	618	30	46.88	189	30.93	236	31.09	103	32.49	51	38.35	<0.05
	No	1.282	34	53.12	422	69.07	523	68.91	214	67.51	82	61.65	
	Missing	*0*											
	Yes	697	44	68.75	371	60.72	193	25.43	66	20.82	11	8.27	<0.01
Feeling safe at home	No	1.101	18	28.12	225	36.82	525	69.17	220	69.40	110	82.71	
	Missing	*102*											

Table.3 Crude odds ratios for poor self-rated health of the study participants (N= 1900).

Variables	Category	OR	95% CI
Gender	Male	Ref	(0.93-1.36)
	Female	1.14	
Age	18-28 years	Ref	(0.80-1.36)
	29-34 years	1.04	(1.02-1.69)
	35-44 years	1.31	(1.22-1.72)
	44-55 years	1.75*	
District	Chittagong	Ref	(0.83-1.52)
	Dhaka	1.12	(0.67-1.18)
	Narshingdi	0.89	(1.01-1.76)
	Nilphamari	1.33	
Disability type	Hearing	Ref	(0.66-1.12)
	Mobility	0.86	(0.66-1.25)
	Visual	0.91	
Physical- Health	Very Good	Ref	
	Good	2.12	(0.91-4.95)
	Neither good nor bad	15.31*	(6.47-36.22)
	Bad	21.08*	(8.80-50.50)
	Very bad	23.06*	(8.78-60.55)
Education	Higher Secondary	Ref	(1.242-3.80)
	No Education	2.17*	0.86-1.93)
	Primary	1.55	(0.78-2.54)
	Secondary	1.40	(0.40-1.94)
	Post Secondary	0.88	
Employment	Yes	Ref	
	No	1.47*	(1.21-1.78)
Urban/Rural	Urban	Ref	
	Rural	3.55*	(2.59-4.87)
Use of assistive devices	Yes	Ref	(1.01-1.57)
	No	1.25***	
Size of household	Not big	Ref	(0.63-0.92)
	Big	0.76*	
Membership at associations	Not member	Ref	(1.63-2.00)
	Member	1.80*	
Household SES	Average/Rich	Ref	(0.88-1.47)
	Poor	1.14	(1.96-3.48)
	Very poor	2.61*	
Disability benefits	No	Ref	(0.81-1.21)
	Yes	0.99	
Feeling safe at home	No	Ref	(0.15-0.23)
	Yes	0.85*	

Boldface indicates statistical significance (*p <0.05, **p<0.01, ***p<0.001 two-tailed tests)

Table.4 Test for interaction to investigate the joint effect of the use assistive devices and type of disability (visual, mobility and hearing) on poor self-rated health presented as Odds Ratios with 95% Confidence Intervals

Interaction term	**OR**	**CI 95%**	**P-value**
Visual/Yes the use of assistive Device	0.62	(0.40-0.98)	0.04
Mobility/No the use of assistive Device	1.06	(0.81-1.39)	0.66
Visual/No the use of assistive Device	1.41	(1.00-2.00)	0.05
Mobility/Yes the use of assistive Devices (ref)			

Table.5 Two-sample Wilcoxon rank-sum (Mann-Whitney) test of difference in Self Rated Mental Health (SRMH) by Gender

Group	N	Rank Sum	Expected
Female	798	764274	752115
Male	1086	1011396	1023555
Combined	1884	1775670	1775670

H0: SRMH female = SRMH male; z=-1.255, Prob>|z|=0.2096

Table.6 Final estimation results based on ordered probit and heteroscedastic ordered probit model

Independent variables	OP Estimated Coefficient	Std. err.	HOP Estimated Coefficient	Robust std. err.
Disability				
Mobility	-0.2199*	0.0727	-0.1012*	0.0370
Visual	-0.27330*	0.0853	-0.1134*	0.0433
Gender (female)	-0.0500	0.0574	-0.0159	0.0222
Age				
29-34 yrs	-0.0226	0.0737	-0.0188	0.0287
35-44 yrs	0.0423	0.0694	0.0127	0.0267
45-55 yrs	-0.0003	0.0726	-0.0271*	0.0278
Education				
No education	0.0589	0.1665	0.0152	0.0649
Postsecondary	-0.0990	0.2258	-0.0072	0.0994
Primary	-0.0253	0.1701	-0.0182	0.0660
Secondary	-0.1026	0.1716	-0.0206	0.0665
Employment (No)	0.2486*	0.0592	0.0557***	0.0263
Household SES				
Poor	0.1418	0.0738	0.0460	0.0313
Very poor	0.2476	0.0798	0.0624	0.0358
Urban/Rural				
Rural	0.005*	0.1501	0.1813 *	0.0615
Physical health				
Good	1.0567*	0.2129	0.5454*	0.1699
Neither good nor bad	2.0065*	0.2167	0.9115*	0.2248
Bad	0.3918*	0.2192	1.0681*	0.2548
Very Bad	2.8885*	0.2340	1.5496*	0.9477
The use of assistive Devices				
(No)	0.0803	0.0621	0.0153	0.0247

Boldface indicates statistical significance (*p <0.05, **p<0.01, ***p<0.001 two-tailed tests)

Table 7. Marginal effects of the independent variables on SRMH outcomes of the HOP model

Independent Variable	Very good	Good	Neither good nor bad	Bad	Very Bad
Disability					
Mobility	-0.0026	0.0642*	0.0498	-0.0551*	-0.0504*
Visual	0.0011	0.0781*	0.0315	-0.0573*	-0.0478**
Gender (female)	-0.0090*	0.0007	0.0512*	-0.0202	-0.0220*
Age					
29-34 yrs	-0.0012	0.0127	0.0106	-0.0114	-0.0097
35-44 yrs	-0.0075	-0.0206	0.0408	-0.0001	-0.0111
45-55 yrs	-0.0066	0.0128	0.0431	-0.0246	-0.0228
Education					
No education	-0.0024	-0.0154	0.0113	0.0061	0.0004
Postsecondary	0.0161	0.0141	-0.0621	0.0057	0.0224
Primary	0.0007	0.0151	-0.0001	-0.0101	-0.0052
Secondary	0.0060	0.0209	-0.0241	-0.0059	0.0026
Employment					
Employment (No)	-0.0081	-0.0523**	0.0310	0.0240***	0.0055
Household SES					
Poor	-0.0130	-0.04349	0.0467***	0.0140	-0.0033
Very poor	-0.0155***	-0.0605**	0.0589***	0.0208	-0.0028
Urban/Rural					
Rural	-0.0143*	-0.1917*	0.0089*	0.0993*	0.0177*
Physical health					
Good	-0.4206*	0.2025*	0.2119*	0.0152	-0.0072
Neither good nor bad	-0.4733*	-0.1354*	0.4049*	0.1720*	0.0327**
Bad	-0.4732*	-0.2098*	0.3020*	0.2473*	0.1234*
Very bad	-0.4717*	-0.2539*	0.1639*	0.2355*	0.2428*
Use of assistive devices					
(No)	-0.0368	-0.0163	0.0178	0.0046	-0.0018

Boldface indicates statistical significance (*p <0.05, **p<0.01, ***p<0.001 two-tailed tests)

Fig.1 Distribution of disability types by districts

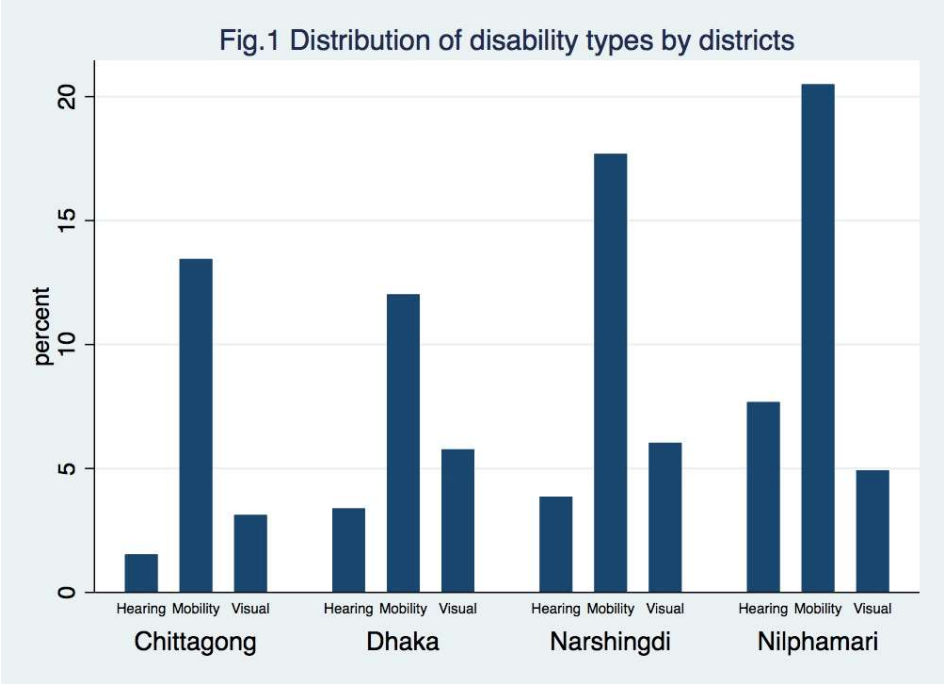


Fig.2 Distribution of disability types by gender

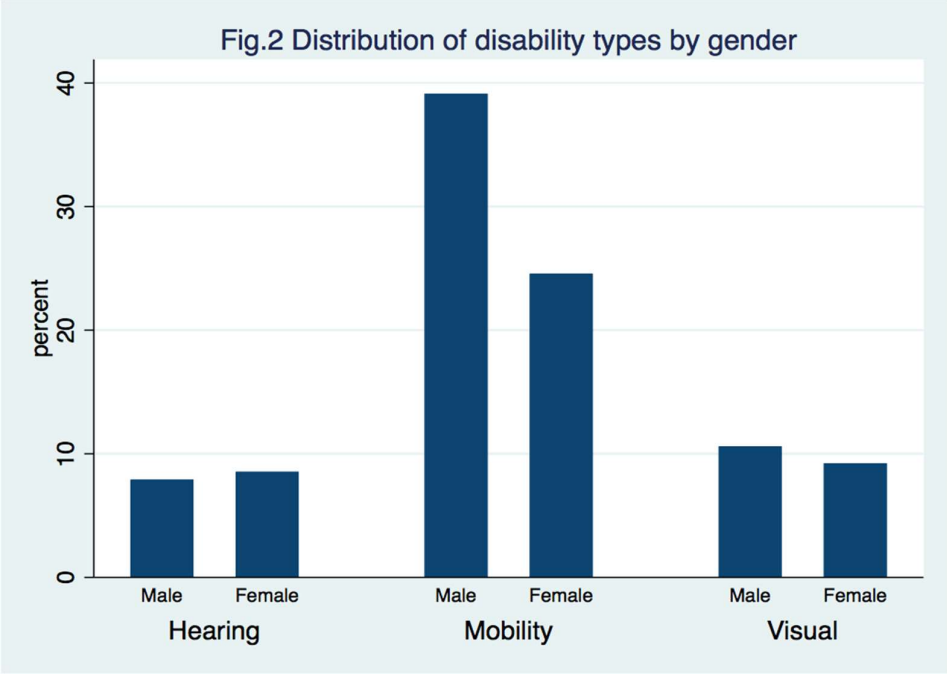


Fig.3 Distribution of reported self-rated mental health by gender

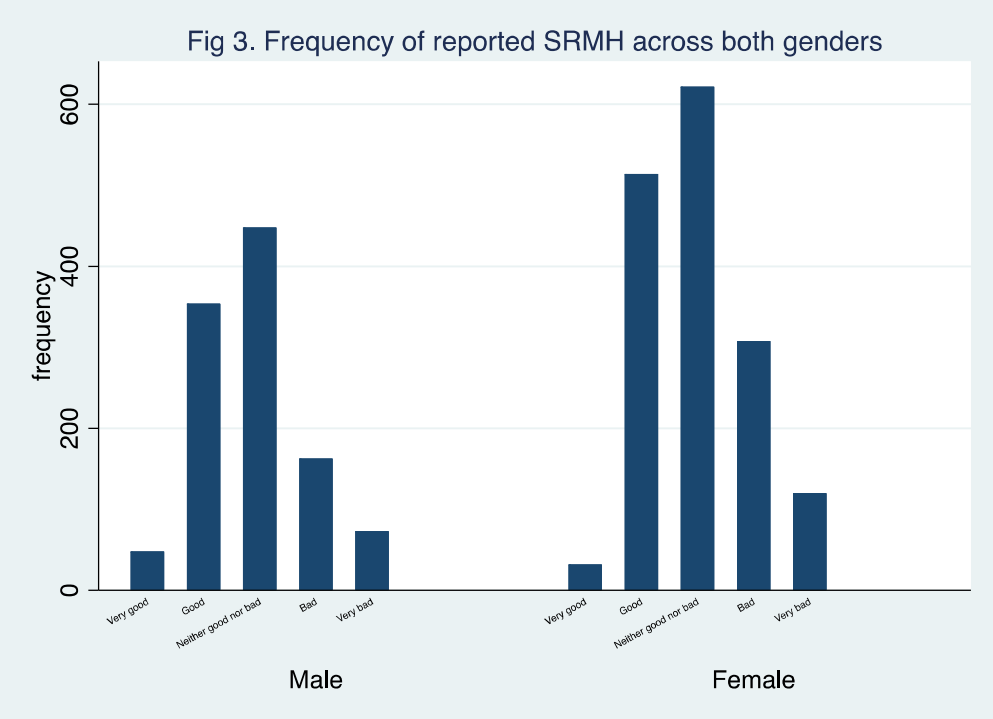
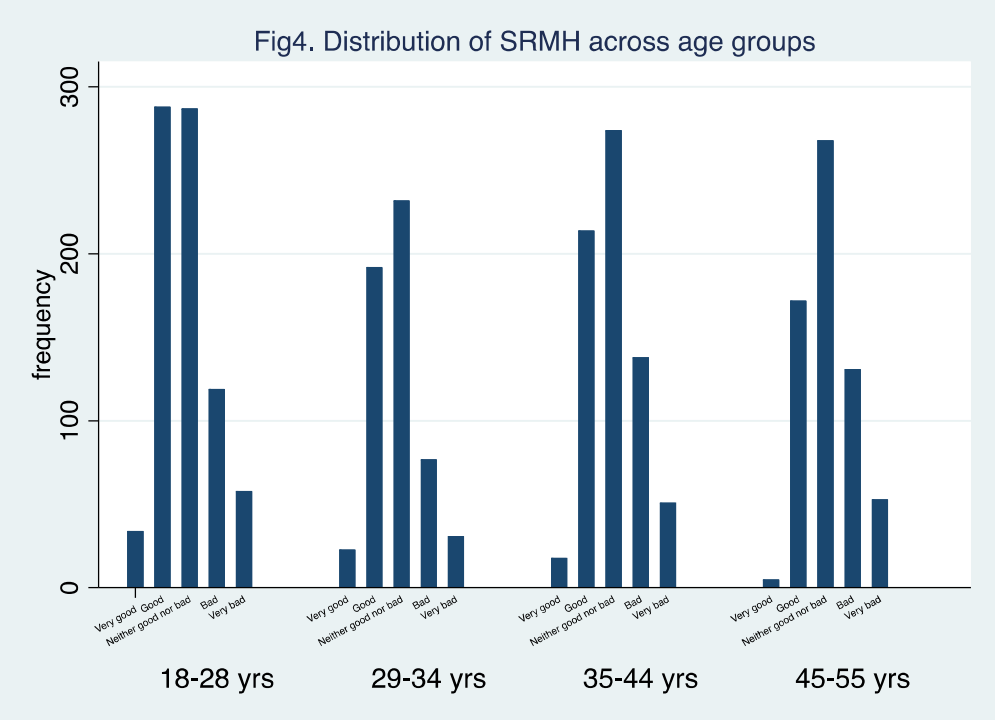


Fig.4 Distribution of reported self-rated mental health by age



8. Annex

Table 8. Multivariable logistic regression analyses for poor self-rated health adjusted for potential confounders.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Disability type							
Mobility	0.87(0.67-1.14)	0.84(0.64-1.10)	0.91(0.69-1.21)	0.91(0.69-1.21)	0.91(0.68-1.21)	0.61(0.44-0.85)*	0.62(0.45-0.87)*
Visual	0.92(0.67-1.27)	0.88(0.64-1.21)	0.90(0.65-1.24)	0.91(0.65-1.27)	0.89(0.64-1.24)	0.75(0.51-1.10)	0.78(0.55-1.15)
Gender (Female)	1.12(0.92-1.36)	1.13(0.93-1.34)	1.09(0.89-1.32)	0.91(0.74-1.14)	0.89(0.71-1.11)	0.90(0.70-1.16)	0.86(0.67-1.11)
Age		1.06(0.81-1.38)	1.00(0.77-1.31)	1.09(0.83-1.44)	1.15(0.87-1.53)	1.11(0.81-1.53)	1.12(0.82-1.55)
(29-34 years)		1.31(1.02-1.70)	1.22(0.94-1.60)	1.29(0.99-1.68)	1.32(0.88-1.73)	1.08(0.80-1.43)	1.11(0.82-1.51)
(35-44 years)		1.80(1.36-2.35)*	1.58(1.19-2.01)*	1.57(1.19-2.08)**	1.66(1.25-2.21)*	1.06(0.76-1.47)	1.10(0.80-1.53)
(44-55 years)							
Education (No education)			1.94(1.10-3.41)**	1.80(1.00-3.23)**	1.36(0.75-2.50)*	1.23(0.61-2.48)	1.19(0.60-2.40)
Employment (Unemployed)				1.46(1.71-1.81)**	1.50(1.20-1.90)*	1.30(1.00-2.58)***	1.32(1.02-1.71)***
Household SES (Very poor)					2.5(1.83-3.41)*	2.32(1.63-3.30)*	2.36(1.66-3.35)*
Physical health Good						2.19(0.87-5.50)	2.13(0.85-5.36)
Neither good nor bad						16.58(6.52-42.19)*	16.32(6.41-41.57)*
Bad						21.78(8.43-56.25)*	21.24(8.21-54.09)*
Very bad						20.43(7.23-57.67)*	19.67(6.96-55.61)*
Use of assistive devices (No use of assistive devices)							1.30(1.00-1.71)***

Boldface indicates statistical significance (*p <0.05, **p<0.01, ***p<0.001 two-tailed tests)

Popular Science Summary

Because of chronic diseases and ageing populations, the number of people with disabilities is growing. Previous studies showed that people with disabilities were more likely to report frequent mental illness associated with chronic diseases, poor health conditions, and obstacles in daily life than other people without disabilities.

In this study we utilize data on disability from Bangladesh and examine various socioeconomic indicators that could affect the mental health of people living with a disability. Our findings suggest significant differences in the prevalence of poor self-rated mental distress by disability type, use of assistive devices, socioeconomic conditions, and physical health. Individuals with physical disabilities and those with no access to assistive devices had higher percentages of poor mental health. Further, results showed that older age, poor physical health, poverty-stricken households, unemployment, low level of education, no access to assistive devices, and not being a member of community associations had significantly higher odds of poor self-rated mental health. We assume this research bridges a substantial knowledge gap because no research that explicitly focuses on the mental health of individuals with mobility, hearing, or visual disabilities has been undertaken in Bangladesh. Further, findings from this study may be beneficial as a baseline for interventions and policy implications for closing the health outcomes gap.