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Low Back Pain in the Bangladeshi Adult Population: A Cross-sectional National Survey

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-059192
Article Type:	Original research
Date Submitted by the Author:	10-Nov-2021
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Keywords:	EPIDEMIOLOGY, RHEUMATOLOGY, PUBLIC HEALTH

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1 Low Back Pain in the Bangladeshi Adult Population: A Cross-sectional National Survey

2 3 *Short Running Head: Low Back Pain in Bangladesh*

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43 **Counts:** Number of words (abstract): 248, number of words (body): 2850, number of
44 references: 50, number of figures: 03, number of tables: 03

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52

53 **ABSTRACT**

54 **Objective:**

55 Low back pain (LBP) is a common musculoskeletal disorder. This study aims to determine
56 the residence- and sex-specific prevalence and the risk factors of LBP in Bangladesh.
57

58 **Methods:**

59 The study subjects (ages ≥ 18 years) were identified from 20 primary sampling units of the
60 national census following a cross-sectional multi-stage stratified sampling design. We
61 considered the mechanical type of LBP for this study. A Bangla version of the modified
62 Community Oriented Program for Control of Rheumatic Disorders questionnaire was used. A
63 team of trained field workers, rheumatology residents and rheumatologists collected the data.
64

65 **Results:**

66 Two thousand subjects were approached, but 1843 could be screened. Among them, 561 had
67 musculoskeletal disorders, and 343 were diagnosed with LBP. The age-adjusted prevalence
68 of LBP was 19.4% (95% confidence interval, CI: 14.0–24.8), which was higher in women
69 (27.2%, 19.3–35.1) than men (14.0%, 8.7–19.3). The prevalence persistently increased from
70 age group 18–34 years (12.8%, 8.5–17.2) to ≥ 55 years (23.5%, 16.0–31.0). People with no
71 education had the highest prevalence (35.0%, 25.4–44.6). The prevalences did not differ
72 between urban and rural residential locations. Four factors were significantly associated with
73 LBP: age (adjusted odds ratio: 2.5, 95% CI: 1.8–3.4), female sex (2.4, 1.8–3.2), absence of
74 formal education (1.5, 1.1–1.9), and history of physical trauma (1.9, 1.3–2.8).
75

76 **Conclusion:**

77 LBP is a common problem in Bangladeshi adults. The risk factors are age, female sex, no
78 formal education, and history of physical trauma. These should be addressed adequately to
79 prevent and treat LBP.
80

81 **Keywords:** Low back pain, risk factors, Bangladesh, prevalence, cross-sectional survey
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3 834
5 84 **KEY MESSAGES:**6
7 85 **What is already known?**

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- 9 86
- Low back pain—a common musculoskeletal disorder—is an important cause of
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- 11 87 disability and work loss globally particularly for the lower middle income countries.

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14 89 **What does this study add?**

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- 16 90
- This study was the first national-level study on musculoskeletal disorders using the
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- 18 91 primary sampling units of the Bangladesh Bureau of Statistics

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- 20 92
- We report here the prevalence of low back pain in Bangladesh segregated by
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- 22 93 sociodemographic factors, and risk factors.

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- 24 94
- Four risk factors were identified for LBP: those were age, female sex, absence of
- 25
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- 26 95 formal education, and history of trauma

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29 97 **What is the impact on future clinical practice?**

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- 31 98
- Appropriate clinical services, health education and risk reduction strategies can
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- 33 99 reduce the burden of low back pain.

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113 INTRODUCTION

114 Low back pain (LBP) is one of the most frequent medical problems globally. It is defined as
115 pain, stiffness, or muscle tension localized below the costal margin and above the inferior
116 gluteal folds¹. Up to 84% of adults suffer from LBP at some point in life². The prevalence of
117 chronic LBP is about 23%³. Around 11–12% of the population become disabled due to LBP⁴.
118 It causes substantial personal, social and financial burdens globally⁴. In the USA, LBP is the
119 second most frequent cause for a physician consultation⁵. LBP is ranked globally as the
120 topmost cause of disability as it affects mostly working-age people⁶. It accounted for 60.1
121 million disability-adjusted life-years in 2015. There was a significant increase of LBP by
122 54% since 1990, and the highest escalation took place in the low and middle-income
123 countries (LMICs)⁷. Disability from LBP is a primary concern for the LMICs, where manual
124 labour is common in an unconventional way. The scope for job switching is restricted in
125 resource constraint countries.

126

127 LBP has multi-sectorial health outcomes like a lower quality of life, poorer self-reported
128 health, depression and more workspace absenteeism⁸. As a result, LBP has become an
129 important cause of sick leave and early retirement among the working population⁹. In the
130 USA, approximately 149 million workdays are lost due to LBP, leading to an estimated loss
131 of 100–200 billion US dollars per year¹⁰. Non-specific LBP is the commonest of all causes of
132 LBP. Non-specific LBP is defined as LBP not particularly associated with severe or
133 particular aetiology like malignancy, infection, fracture, inflammatory condition,
134 radiculopathy or cauda equina syndrome³.

135

136 Albeit high in most studies, there is a difference in LBP prevalence in various
137 epidemiological studies. The estimated prevalence was 84% in Canada, 70% in Denmark,
138 59% in the UK, and 29% in Iran¹¹. The estimated prevalence of LBP in India ranged between
139 42 and 83%^{12 13}. A recent cross-sectional, community-based, epidemiological study
140 conducted in Northern India yielded an estimated lifetime prevalence of 47% in man 57% in
141 women¹⁴. A Community Oriented Program for Control of Rheumatic Disorders (COPCORD)
142 survey in Bangladesh published in 2005 showed 6.6%, 9.9%, and 9.2% prevalence of LBP in
143 the rural, urban slum, and affluent urban areas, respectively¹⁵. A cross-sectional national
144 study in Bangladesh in 2015 showed LBP was the top-ranking musculoskeletal disorder
145 (MSD) with a prevalence of 18.6%¹⁶. This communication focuses more deeply on the

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3 146 segregated prevalence, risk factors, disability and work loss due to LBP utilizing data
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5 147 generated by the 2015 study.
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8 149 **METHODS**

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10 150 A detailed description of the methodology is beyond the scope of this article and is described
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12 151 elsewhere¹⁶. Adults aged 18 years or more comprised the study population through a
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14 152 household level multi-stage stratified cross-sectional survey. The sampling frame was based
15
16 153 on the 2001 Bangladesh Census¹⁷. With a design effect of 1.5 and 85% response rate for four
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18 154 reporting domains (man-woman, urban-rural), the calculated sample size was 1,978, which
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20 155 was rounded to 2,000. It was stratified into seven divisions of rural (Mauza) and urban
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22 156 (Mahalla) areas. Twenty (8 urban and 12 rural) primary sampling units (PSUs) were selected.
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24 157 The first 100 households were consecutively included from each PSU, where even numbers
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26 158 were assigned as man and odd numbers as woman households. In each household, the single
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28 159 respondent was identified from a list of eligible household members with the help of a Kish
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30 160 table. (**Figure 1**)
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33 162 A detailed manual was prepared before the training for this survey and was used by all field
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35 163 staff. All investigators and the WHO technical team coordinated and conducted the training.
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37 164 The modified COPCORD questionnaire was the survey tool¹⁸. The English version of the
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39 165 first part of the questionnaire was translated to Bangla, then adapted, validated, and
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41 166 administered by the interviewers. Data were collected for six days from each PSU. There
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43 167 were two recall visits to ensure participation. The research physician interviewed the
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45 168 suspected respondents for MSDs. Opinions were taken from the division level investigator
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47 169 for the doubtful cases. To validate the diagnoses, the investigators made at least one visit to
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49 170 PSUs in their respective divisions.
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52 172 LBP group of disorders were operationally defined as mechanical type back pain that
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54 173 included non-specific LBP and lumbar spondylosis. Considering the limitation of
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56 174 differentiating investigation in the field, we did not classify LBP beyond this. LBP duration
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58 175 was classified into three groups: acute: up to 6 weeks, subacute: 6-12 weeks, and chronic that
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60 176 persists beyond 12 weeks¹⁹. Respondents with pain in the muscles, bones, joints, or any part
177 of the body (musculoskeletal symptom) during the preceding seven days or on pain
178 medication with no pain were considered as positive respondents. The research physicians
179 interviewed and thoroughly examined all 'positive' respondents. Data on physical activity

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3 180 were calculated into metabolic equivalent tasks (MET)-minutes per week using the
4 181 STEPwise Surveillance of noncommunicable disease risk factors (STEPS) protocol and
5 182 divided into quartiles²⁰. The 4th quartile was labelled as strenuous physical activity.
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10 184 The study participants were divided into three subgroups as per age in years: 18-34, 35-54
11 185 and 55-99. We considered ownership of household asset items (electricity, television,
12 186 refrigerator, etc.) for constructing wealth index. In addition, the type of main material used
13 187 for the roof of the main house (cement, tin and katcha such as bamboo/thatched/straw/gunny
14 188 etc.) was also included in the model. A principal component analysis was used to create
15 189 standardized factor scores for each of the items. The total scores for the respondents were
16 190 calculated and categorised those into quartiles for description from one (lowest household
17 191 wealth) to four (highest household wealth)¹⁶.
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25 193 A validated Bangla version of the Bangla Health Assessment Questionnaire - Disability Index
26 194 (HAQ-DI) was used for the disability score. For determining work loss, the recall period was
27 195 12 months²¹. Diabetes was defined as random blood glucose ≥ 11.1 mmol/l or the use of anti-
28 196 diabetic medications. Obesity was defined as a body mass index of ≥ 25 kg/m²²². Abdominal
29 197 obesity was defined if the waist circumference ≥ 90 cm in man, ≥ 80 cm in the woman²³.
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35 199 **Statistical analysis:**

36 200 The survey data were entered in and cleaned using Microsoft Excel. However, statistical
37 201 analysis was done using Epi Info Version 7.1.5.2. Continuous variables were categorised
38 202 before analysis as appropriate. We estimated the prevalence of LBP with 95% confidence
39 203 intervals. The prevalence was segregated by residence (urban/ rural) and sex (man/ woman).
40 204 Nonparametric test (Kruskal-Wallis H test) were used to analyse data that were not normally
41 205 distributed. Whenever we encountered an unweighted respondent size of less than 25, the
42 206 confidence intervals were suppressed. Age adjustment of prevalence estimates was made
43 207 based on the WHO World Population 2000-2025²⁴. Factors were checked for association with
44 208 LBP by comparing LBP with no MSD through 2x2 tables. Univariate logistic regression
45 209 analysis was done to obtain unadjusted odds ratios. All statistically significant relationships
46 210 ($P < 0.05$) were entered into a model for logistic regression analysis. The adjusted odds ratios
47 211 and their 95% confidence limits were calculated to identify the strength of association of LBP
48 212 factors. A detailed description of categorisation and analysis of other variables was described
49 213 elsewhere¹⁶.
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215 Ethics Approval and Consent to Participate:

216 Ethical guidelines, as outlined by the Declaration of Helsinki, were followed throughout the
217 study²⁵. Ethical clearance was obtained from the Institutional Review Board of Bangabandhu
218 Sheikh Mujib Medical University (ID 1100). Consent was obtained from the respondents in
219 Bangla as per Institutional Review Board's guidelines.

220

221 Patient and Public Involvement:

222 Patient or the public were not involved in the design, or conduct, or reporting, or
223 dissemination plans of this study.

224

225 RESULTS**226 Characteristics of respondents:**

227 In this nationally representative study, 2,000 adults 18 years or older were approached, and
228 1,843 (92.2%) agreed to participate¹⁶. The mean age of the participants was 40.5 (standard
229 deviation 14.7) years, and 51.6% were women. A total of 561 (30.4%) had some type of
230 MSDs. LBP was the most common among MSDs (18.6%, unadjusted), followed by knee
231 osteoarthritis (7.3%) and soft-tissue rheumatism (5.2%). Among the inflammatory rheumatic
232 diseases, the common conditions were rheumatoid arthritis (1.6%) and spondyloarthritis
233 (1.3%).

234

235 Characteristics of respondents with LBP:**236 Background characteristics:**

237 Among the LBP respondents (n=343), 63.3% were women, and 65.3% were from rural areas.
238 Mean age in years (standard deviation) was 44.2 (13.8) overall, and 48.8 (13.0) in men and
239 41.6 (13.6) in women. The study participants were divided into three subgroups as per age,
240 and the highest number of LBP was observed in the 35–54 age group (n=168). More than half
241 (52.2%, n=180) were homemakers (all women), while the rest constituted other occupations
242 like laborer, business professional, service holder and others. Almost half of the participants
243 with LBP had no formal education (n=150, 43.7%). Overall, according to the wealth index,
244 30.0% of respondents belonged to the 1st quartile (lowest socioeconomic status). Above one
245 third (36.4%) of the respondents with LBP had additional concomitant MSDs. About one-
246 fourth (23.0%) were overweight and 31.5% had abdominal obesity. (**Table 1**)
247 26.6 (20.1–33.1)

248

249 Prevalence:

250 We report here (**Table 2**) the age-adjusted prevalence of LBP to be 19.4% (95% CI: 14.0–
251 24.8), which is significantly higher in women (23.5%, 16.0–31.0) than men (14.0%, 8.7–
252 19.3). There has been a persistent increase in prevalence from 12.8% (95% CI 8.5–17.1) in
253 18–34 years age group to 23.5% (95% CI 16.0–31.0) in 55–99 years age group. This trend
254 was more prominent in women. The prevalence did not vary significantly among
255 occupational groups. People with no formal education had significantly highest prevalence
256 of LBP (26.6%, 20.1–33.1) compared to other educational groups. Although the highest
257 prevalence (21.6%) was observed in the 1st quartile of the wealth index, it did not vary
258 significantly. LBP was not significantly associated with strenuous physical activity in our
259 sample. We checked LBP prevalence by urban (16.6%, 11.6–21.6) and rural (19.9%, 12.6–
260 27.1) categories, but it did not differ significantly. Among the co-morbidities, the prevalence
261 of LBP was higher among patients of hypertension (23.9%) and obesity (20.6%). The
262 highest prevalence of LBP (81.7%, 74.1–89.3) was seen in 153 respondents who had multiple
263 (two or more) MSDs. (**Figure 2**)

264

265 Disability and work loss:

266 The distribution of Bengali HAQ-DI scores was not normally distributed among the LBP
267 patients. The scores ranged from 0–2.6. The LBP group's median (interquartile range) was
268 0.6 (0.3–0.9). The difference of Bangla HAQ-DI score between LBP (n=343) and no MSD
269 (n=60) is statistically significant ($P<0.0001$) by the Kruskal-Wallis H test, indicating that
270 LBP is associated with a higher disability. The distribution of days lost from work for LBP
271 group had a highly skewed distribution and ranged from 0–365 days. However, the difference
272 of days lost from work (n=1,625) between LBP (n=343) and no MSD (n=1,282) is
273 statistically significant ($P<0.0001$) by the Kruskal-Wallis H test, indicating that LBP is
274 associated with more days lost. (**Figure 3**)

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276 Risk factors:

277 Univariate logistic regression analysis did not observe any significant association of
278 occupation, wealth indices, tobacco use, obesity, and diabetes (**Table 3**). A significant
279 association was observed for age groups 35–54 and 55–99 years, female sex, lack of
280 education, history of physical trauma, and hypertension according to the unadjusted odds
281 ratio and their 95% confidence intervals ($P<0.001$). These significant associations persisted in

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3 282 the multiple logistic regression analysis having all these variables into the model
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5 283 simultaneously ($P<0.001$) except for hypertension.

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11 287 **DISCUSSION**

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13 288 LBP is a common medical problem with very high personal and societal impact, leading to
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15 289 poor quality of life and workability²⁶. This survey was the first national study with a
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17 290 representative sample where we report that one in five adults in Bangladesh suffers from
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19 291 LBP. The prevalence in Bangladesh is similar to Kuwait (22.7%)²⁷ and Qatar (23.3%)²⁸ but
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21 292 lower than northern India (32%)²⁹ and Iran (29.3%)¹¹. Malaysia (11.6%)³⁰ has a lower
22
23 293 prevalence of LBP than we report here. A systematic review of 165 studies from 54 countries
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25 294 revealed the global prevalence of LBP of 12-33%⁴. According to the systematic analysis of
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27 295 the Global Burden of Disease Study 2017, LBP was the leading cause of YLDs (years lived
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29 296 with disability)³¹. In our study, the rural people had a higher prevalence of LBP than the
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31 297 urban people. This difference—though not statistically significant—was probably due to lower
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33 298 doctor concentration in the rural areas, financial limitations, and less education status.
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35 299 However, regional variation was observed in other studies¹¹.

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38 301 Age was a risk factor for LBP in this study. The prevalence of LBP persistently increased
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40 302 with age but this was not statistically significant. However an analysis reported that the risk
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42 303 and prevalence of low back pain increased with age⁵. A systematic review of the global
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44 304 prevalence of LBP revealed the association of age was highest in the 40-49 age group^{4 32}. The
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46 305 overall prevalence rises with age 65, which gradually reduces thereafter³³. Some possible
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48 306 explanations are LBP characteristics in older adults that differ from the middle-aged
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50 307 population (less intense back pain, more leg pain, and more depression)³⁴. Our study showed
51
52 308 a higher prevalence of LBP among women than men, consistent with some other analyses.
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54 309 This could be due to more household or domestic activities among women compared to men.
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56 310 This finding agrees with the results from the national health survey on the Iranian
57
58 311 population¹¹. Some studies and systematic reviews demonstrated a higher incidence of LBP
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60 312 in women than men^{4 32}. Edward *et al.* 2018 found no significant difference in age and sex
313 scores in their study³⁵. Higher women prevalence can be partially explained that they have a
314 lower pain threshold than men³⁶. The sex differences may be implied with gonadal steroid
315 hormones like estradiol and testosterone that modulate sensitivity to pain and analgesia³⁷.

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3 316 Women always experienced a higher frequency of visceral pain (e.g., during menstruation,
4 317 pregnancy) than men³⁸. It seems that in painful conditions, women exhibit a greater
5 318 prevalence than men as women report more pain³⁹.
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9 320 Leboeuf-Yde considered body weight as a possible weak indicator for LBP in his systematic
10 321 literature review due to lack of evidence⁴⁰. The results obtained in our study did not
11 322 demonstrate a statistically significant association between LBP and higher BMI. Some other
12 323 studies found obesity or high BMI associated with increased risk LBP development and
13 324 severity^{11 41}. In our research, we found that the absence of formal education is significantly
14 325 associated with LBP. A cross-sectional study in the United States found that LBP is more
15 326 common in people who have had less than high school education⁴². Other studies in the USA,
16 327 UK, and Iran found lower educational status had an increased association with LBP and
17 328 found higher education inversely associated with LBP^{11 43}. Several proposed mechanisms
18 329 may account for the relationship between low academic status and back pain. The amount of
19 330 formal education contributes to the types of jobs that an individual may involve in, and
20 331 subsequently, the types of jobs influence LBP⁴⁴. Moreover, health education regarding
21 332 posture management, lifestyle changes, physical exercises, stress management poorly reached
22 333 among people with an absence of formal education. We didn't find any significant association
23 334 of LBP with occupation. In a US-based study, LBP was significantly related to occupational
24 335 factors such as truck driving, lifting, carrying, pulling, pushing, twisting, and non-driving
25 336 vibrational exposure⁴⁵. In some European countries, workers involved in heavy weightlifting
26 337 (≥ 25 kg) suffered more from LBP⁴⁶.
27 338
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29 339 Studies reported associations between LBP and lower social class^{11 42} but we did not find any
30 340 significant association of LBP with economic status. In our analysis, we found there was a
31 341 significant positive relation between LBP with trauma. Chronic pain following trauma is
32 342 possible after physical injury. Persistence back pain was more associated with psychological
33 343 factors like stress, low education status, etc., than the physical injury itself⁴⁷. Lack of formal
34 344 education was a significant association in this study which may contribute to this factor. LBP
35 345 may cause inactivity and lack of exercise resulting in weight gain, subsequently creating or
36 346 exaggerating co-morbid conditions like hypertension and diabetes mellitus⁴⁸. We found no
37 347 relationship between hypertension and LBP. In a Korean survey, the lifetime prevalence of
38 348 LBP was 34.4% among the hypertensive respondents, but the adjusted OR of LBP prevalence
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3 349 was significantly lower than the normotensive subjects (fully adjusted 0.79, 95% CI 0.70-
4 350 0.90)⁴⁹. There was no association between diabetes and LBP in this study.

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11 354 **Strengths and Limitations**

12 355 This is the first nationally representative survey on LBP in Bangladesh, and probably, among
13 356 all south Asian nations. The field team included rheumatology residents to make valid
14 357 diagnoses. Most diagnoses were double-checked in the field by the investigators, who are
15 358 experienced rheumatologists themselves¹⁶. Despite the fact that their involvement in the field
16 359 operation, some diagnoses of evolving rheumatological conditions may suffer from sufficient
17 360 validity because of a lack of adequate quality imaging facilities in rural areas. The sample
18 361 size calculation of our study was based on combined MSD prevalence¹⁶. Therefore, a
19 362 cautious interpretation of the results is necessary because of inadequate sample size,
20 363 especially when split into reporting domains.

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23 365 **CONCLUSION**

24 366 This nationally representative study is the first to report the prevalence of LBP by
25 367 sociodemographic background, comorbidities and risk factors in Bangladesh. One in five
26 368 adults suffer from LBP. Education and trauma are modifiable risk factors that warrant
27 369 intervention. These can be addressed through appropriate health education and clinical
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3 **372 Abbreviations and acronyms:**
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5 BMI	Body mass index
6 BSMMU	Bangabandhu Sheikh Mujib Medical University
7 CI	Confidence interval
8 COPCORD	Community oriented program from control of rheumatic diseases
9 HAQ-DI	Health Assessment Questionnaire - Disability Index
10 LBP	Low back pain
11 MSK	Musculoskeletal
12 MSD	Musculoskeletal disorder
13 OR	Odds ratio
14 PPS	Population proportion to size
15 PSU	Primary sampling unit
16 WHO	World health organisation

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27 **373**

28 **374 Acknowledgement:** We gratefully acknowledge the field team, divisional coordinators, civil
29 surgeons, upazila health and family planning officers and health assistants for their support.
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33 **376**

34 **377 Author contribution:**

35 **378** Muhammad Shoaib Momen Majumder (MSMM): Conceptualised the area of work, and
36 prepared the first draft of the manuscript and revised the subsequent drafts.
37
38 **379**

39 **380** Ferdous Hakim (FH): analysed the data, guided preparation of graphs and tables, interpreted
40 the results, revised the draft manuscript, and coordinated the writing exercise.
41
42 **381**

43 **382** Iftexhar Hussain Bandhan (IHB): prepared graphs and tables, revised the draft manuscript.

44 **383** Mohammad Abdur Razzaque (MAR): reviewed the manuscript and with special reference to
45 the literature review.
46
47 **384**

48 **385** Ahmed Zahid-Al-Quadir and Shamim Ahmed: Prepared the training manual, trained the field
49 team, executed the field operation in coordination with the divisional investigators;
50
51 **386**

52 **387** Minhaj R Choudhury, Syed Atiqul Haq and Mohammad Mostafa Zaman: Designed the study,
53 guided the analysis and manuscript writing, critically reviewed the results and manuscript
54 drafts, ensured integrity of data.
55
56 **389**

57 **390** All authors: Approved publication.
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3 391 **Funding:** Preparing this manuscript did not require any funding. However, the base study
4
5 392 was supported by the World Health Organization, Bangladesh (Agreement Reference:
6
7 393 SEBAN140895) back in 2015. As a part of its mandate to strengthen national research
8
9 394 capacity, WHO provided technical guidance in designing, implementing, analysing data, and
10
11 395 writing the report. However, it does not have any influence on the results.
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14 397 **Consent to publish:** All authors contributed to the manuscript and provided consent to
15
16 398 publish.
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18 399
19 400 **Availability of data and materials:** The dataset used for this manuscript is available with
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21 401 the corresponding author upon reasonable request.
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23 402
24 403 **Disclosure of Conflicts of Interest:** None of the authors has any conflict of interest to
25
26 404 disclose. The authors alone are responsible for their views expressed in this article, which do
27
28 405 not necessarily represent the institutions' views, decisions, or policies with which they are
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30 406 affiliated.
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33 408 **Ethical Publication Statement:** We confirm that we have read the Journal's position on
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35 409 issues involved in ethical publication and affirm that this report is consistent with those
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37 410 guidelines.
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412 Tables

Table 1. Socioeconomic characteristics of patients of low back pain in Bangladesh, musculoskeletal disease survey 2015. (n=343)

Sociodemographic characteristics	Total (n=343)*	Man (n=126)	Woman (n=217)
	Number (percent)	Number (percent)	
Age in years, mean (standard deviation)	44.2 (13.8)	48.8 (13.0)	41.6 (13.6)
18-34	91 (26.5)	14 (11.1)	77 (35.5)
35-54	168 (49.0)	70 (55.6)	98 (45.2)
55-99	84 (24.5)	42 (33.3)	42 (19.4)
Occupation			
Homemaker	180 (52.5)	0 (0.0)	180 (82.9)
Laborer†	83 (24.2)	75 (59.5)	8 (3.7)
Business professional	22 (6.4)	22 (17.5)	0 (0.0)
Service holder	11 (3.2)	7 (5.6)	4 (1.8)
Others‡	47 (13.7)	22 (17.5)	25 (11.5)
Education			
No formal education (0)	150 (43.7)	46 (36.5)	104 (47.9)
Any primary education (1-5)	71 (20.7)	33 (26.2)	38 (17.5)
Any secondary education (6-10)	97 (28.3)	38 (30.2)	59 (27.2)
Above secondary (≥11 years)	25 (7.3)	9 (7.1)	16 (7.4)
Married‡	334 (97.4)	123 (97.6)	211 (97.2)
Wealth index quartile§			
1st	103 (30.0)	38 (30.2)	65 (30.0)
2nd	92 (26.8)	34 (27.0)	58 (26.7)
3rd	71 (20.7)	26 (20.6)	45 (20.7)
4th	77 (22.5)	28 (22.2)	49 (22.6)
Rural residence	224 (65.3)	87 (69.0)	137 (63.1)
Duration of low back pain >3 months	253 (76.2)	103 (83.9)	149 (71.6)
Overweight (body mass index ≥25 Kg/m ²)	79 (23.0)	16 (12.7)	63 (29.0)
History of physical trauma	48 (14.0)	23 (18.3)	25 (11.5)
Current tobacco use	172 (50.1)	92 (73.0)	80 (36.9)
Concomitant musculoskeletal disorders ^l	125 (36.4)	41 (32.5)	84 (38.7)
Hypertension [¶]	65 (19.0)	19 (15.1)	46 (21.2)
Diabetes mellitus ^{**}	18 (5.2)	2 (1.6)	16 (7.4)
Strenuous physical activity ^{††}	51 (14.9)	49 (38.9)	2 (0.9)

* All values are number (percent) unless stated otherwise.

† Labourer includes: farmer, daily worker, rickshaw puller, garments worker, field worker and others. Other occupations: retired, weaver and housekeeper etc.

‡ Includes currently married, divorced, separated and widowed.

§ The wealth index was constructed using principal component analysis out of a list of 19 items (see Methods section for details);

^l 125 respondents suffered from low back pain had either additional 1, 2 or 3 musculoskeletal disorders such as, knee osteoarthritis, soft tissue rheumatism, non-inflammatory musculoskeletal disorders, cervical spondylosis etc.

[¶] Hypertension was defined as systolic blood pressure ≥140 or diastolic blood pressure ≥90 or medication for hypertension;

^{**} Diabetes was defined as random capillary glucose level ≥11.1 or medication for diabetes;

^{††} Fourth quartile of the MET-minutes distribution of work-related physical activity. Commutation and leisure time physical activities were not considered because these were negligible contributors

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Table 2. Prevalence of low back pain by sociodemographic characteristics in Bangladesh, musculoskeletal disease survey 2015 (n=1843)

Sociodemographic characteristics	Total (n=1843)		Man (n=892)	Woman (n=951)
	Number	Percent (95% CI)	Percent (95% CI)	
Overall	343	18.6 (13.7–23.5)	14.1 (9.2–19.1)	22.8 (17.1–28.6)
Overall (age adjusted)*	-	19.4 (14.0–24.8)	14.0 (8.7–19.3)	27.2 (19.3–35.1)
Age in years				
18-34	711	12.8 (8.5–17.1)	6.5 (3.6–9.3)	15.6 (10.0–21.1)
35-54	774	21.7 (16.2–27.2)	16.6 (10.3–22.9)	27.8 (21.1–34.6)
55-99	358	23.5 (16.0–31.0)	16.6 (8.3–24.9)	40.0 (27.0–53.0)
Occupation				
Homemaker	749	24.0 (18.1–30.0)	0.0 (–)	24.0 (18.1–30.0)
Laborer†	472	17.6 (10.5–24.6)	17.2 (9.8–24.6)	17.6 (10.5–24.6)
Business professional	186	11.8 (6.4–17.3)	12.2 (6.6–17.7)	0.0 (–)
Service holder	135	8.1 (1.5–14.8)	6.5 (0.5–12.5)	14.8 (–)
Others‡	301	15.6 (8.6–22.7)	13.3 (7.0–19.5)	18.5 (8.6–28.4)
Education				
No formal education (0)	564	26.6 (20.1–33.1)	17.2 (11.0–23.5)	35.0 (25.4–44.6)
Any primary education (1-5)	456	15.6 (9.4–21.8)	14.2 (6.9–21.4)	17.0 (8.8–25.3)
Any secondary education (6-10)	538	18.0 (12.1–24.0)	15.4 (7.6–23.2)	20.2 (13.8–26.6)
Above secondary (≥11 years)	285	8.8 (5.4–12.2)	6.2 (0.2–12.2)	11.5 (6.7–16.3)
Married‡	334	19.3 (14.2–24.3)	14.7 (9.5–19.9)	23.5 (17.5–29.5)
Wealth index quartile§				
1st	476	21.6 (14.5–28.8)	18.4 (11.7–25.2)	24.1 (14.5–33.6)
2nd	462	19.9 (11.4–28.4)	15.5 (6.4–24.5)	24.0 (14.5–33.5)
3rd	448	15.8 (10.8–20.9)	11.3 (6.0–16.5)	20.7 (13.3–28.2)
4th	457	16.8 (11.6–22.1)	11.9 (6.5–17.3)	22.1 (15.6–28.5)
Residence				
Urban	716	16.6 (11.6–21.6)	11.3 (7.4–15.2)	21.6 (13.4–29.7)
Rural	1127	19.9 (12.6–27.1)	15.9 (8.4–23.4)	19.9 (12.6–27.1)
Strenuous physical activity ^l	51	14.4 (7.9–20.9)	14.6 (7.4–21.4)	11.1 (–)
History of physical trauma	178	27.0 (19.5–24.4)	26 (15.9–36.4)	27.8 (15.4–40.2)
Current tobacco use	172	19.1 (14.1–23.9)	15 (9.9–20.1)	27.9 (20.0–35.8)

95% CI: 95% confidence interval

All values are number (percent) unless stated otherwise.

* Adjusted for WHO World Population 2000-2020.

† Labourer includes: farmer, daily worker, rickshaw puller, garments worker, field worker and others.

Other occupations: retired, weaver and housekeeper

‡ Includes currently married, divorced, separated and widowed.

§ The wealth index was constructed using principal component analysis out of a list of 20 household assets (see Methods section for details);

^l Fourth quartile of the MET-minutes distribution of work-related physical activity. Commutation and leisure time physical activities were not considered because these were negligible contributors.

– 95% confidence interval not reported due number of respondents <25.

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Table 3: Odds ratios of risk factors for low back pain in Bangladeshi adults, musculoskeletal disease survey 2015

Factors	Odds ratio (95% confidence interval)	
	Unadjusted	Adjusted
Age group, years (35–99=1, 18–34=0)	2.2 (1.7–2.9)**	2.5 (1.8–3.4)**
Sex (woman=1, man=0)	1.9 (1.5–2.4)**	2.4 (1.8–3.2)**
Labourer† (yes=1, no=0)	0.9 (0.7–1.1)	-
No formal education (yes=1, no=0)	1.9 (1.5–2.5)**	1.5 (1.1–1.9)*
Low wealth index (yes=1, no=0)	1.3 (1.0–1.6)	-
Strenuous physical activity‡ (yes=1, no=0)	0.7 (0.5–0.9)*	1.0 (0.7–1.4)
Overweight (body mass index ≥ 25 Kg/m ²) (yes=1, no=0)	1.3 (1.0–1.7)	-
History of physical trauma (yes=1, no=0)	1.9 (1.3–2.7)**	1.9 (1.3–2.8)*
Current tobacco user (yes=1, no=0)	1.1 (0.9–1.4)	-
Hypertension (yes=1, no=0)	1.7 (1.3–2.4)**	1.4 (1.0–1.9)
Diabetes mellitus (yes=1, no=0)	1.1 (0.6–1.9)	-

LBP: low back pain; MSD: musculoskeletal disorder

* $P < 0.05$

** $P < 0.001$

† Labourer includes: farmer, daily worker, rickshaw puller, garments worker, field worker and others.

‡ Fourth quartile of the MET-minutes distribution of work-related physical activity. Commutation and leisure time physical activities were not considered because these were negligible contributors.

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3 418 **Figures**
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5 419 **Fig. 1 Flow chart on the selection of low back pain patients from the national survey on**
6 **musculoskeletal conditions in Bangladesh (2015) adapted from Ahmad Zahid-Al-**
7 **Quadir *et al*²¹**
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10 423 * Eight divisions from Sept 2015. Randomly 15 districts were selected out of 64.

11 424 ** PPS indicates population proportion to size.

12 425 *** Out-migration, broken house, locked house, no tenant, out of home, refusal. Two recall visits were done if
13 426 the selected house was locked and the person chosen was not available at home at the time of the interviewer's
14 427 visit. In case of non-participation after the second recall visit, the targeted household/individual was declared
15 428 non-respondents.

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3 **434 Fig. 2 Prevalence of LBP in different (Unadjusted overall prevalence (percent, 95%**
4 **confidence interval) of low back pain and in) associated co-conditions (n=343)**
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6 **436**

7 **437** *Diabetes was defined as random capillary glucose level ≥ 11.1 or medication for diabetes

8 **438** †Overweight is defined as body mass index ≥ 25 Kg/m²;

9 **439** ‡Hypertension was defined as systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 or medication for
10 **440** hypertension;

11 **441** §Respondents with multiple MSDs suffered from LBP, knee osteoarthritis, soft tissue rheumatism, non-
12 **442** inflammatory musculoskeletal disorders, cervical spondylosis etc.

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3 445 **Fig. 3 Health assessment questionnaire – disability index (HAQ-DI) scores (A) and days**
4 446 **lost from work (B) in low back pain (LBP) and no musculoskeletal disorder (MSD)**
5 447 **groups.**

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9 449 * Kruskal-Wallis H test
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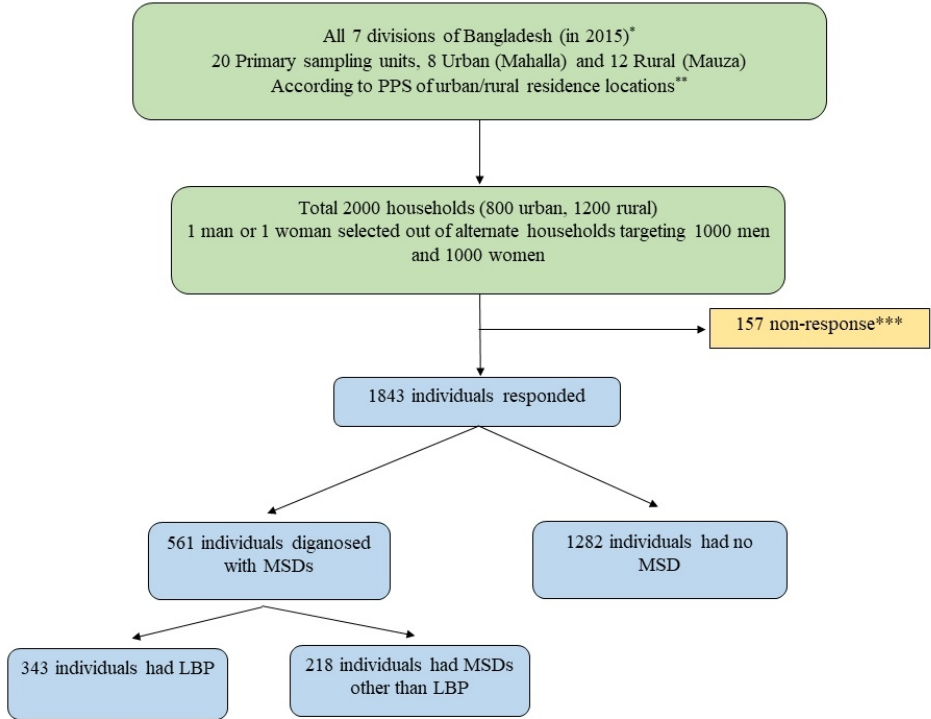
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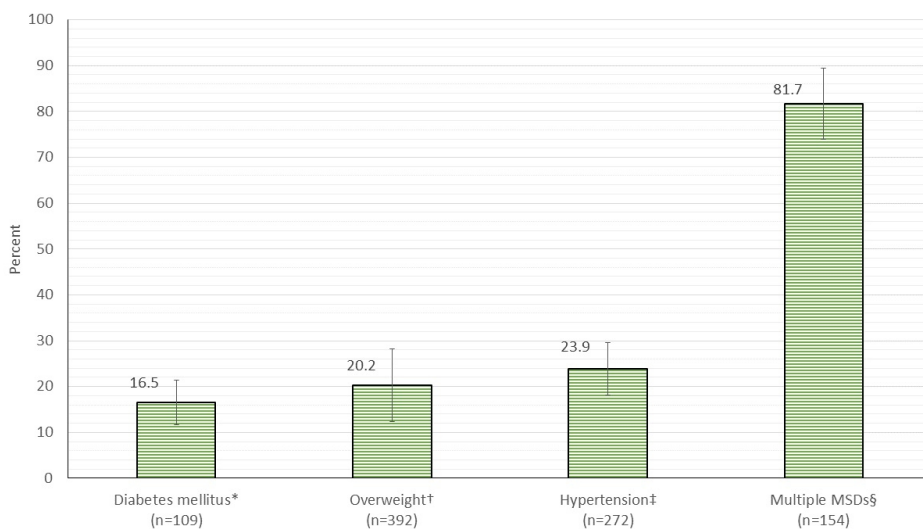
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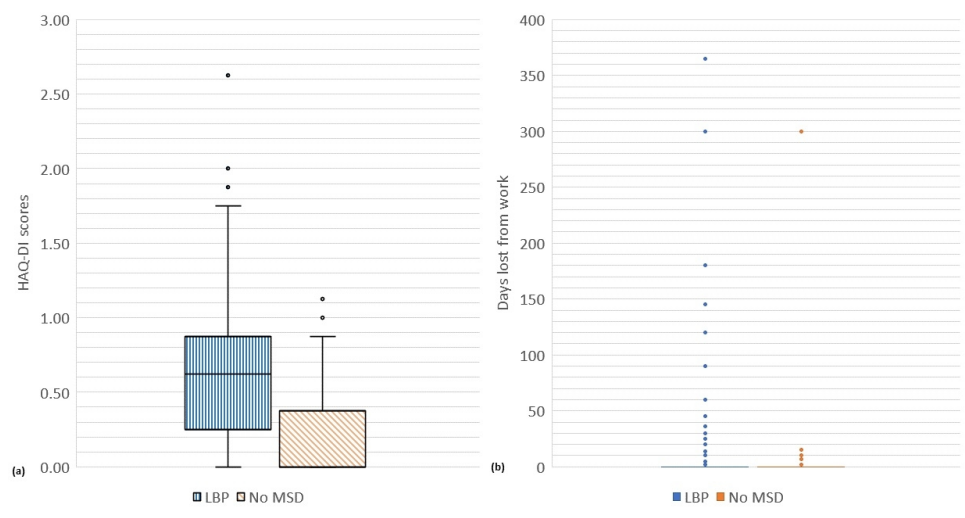


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BMJ Open

Low Back Pain in the Bangladeshi Adult Population: A Cross-sectional National Survey

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-059192.R1
Article Type:	Original research
Date Submitted by the Author:	06-Jul-2022
Complete List of Authors:	Momen Majumder, Muhammad Shoaib; Bangabandhu Sheikh Mujib Medical University, Rheumatology Hakim, Ferdous; World Health Organization Bangladesh Bandhan, Iftekhar ; Bangabandhu Sheikh Mujib Medical University, Rheumatology Razzaque, Mohammad Abdur; Chittagong Medical College, Medicine Zahid-Al-Quadir, Ahmad ; Sylhet MAG Osmani Medical College, Medicine Ahmed, Shamim; Bangabandhu Sheikh Mujib Medical University Choudhury, Minhaj; Bangabandhu Sheikh Mujib Medical University, Rheumatology Haq, Syed; Bangabandhu Sheikh Mujib Medical University, Rheumatology Zaman, MM; WHO Bangladesh
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Rheumatology
Keywords:	EPIDEMIOLOGY, RHEUMATOLOGY, PUBLIC HEALTH, PREVENTIVE MEDICINE

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1 Low Back Pain in the Bangladeshi Adult Population: A Cross-sectional National Survey

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34 **Counts:** Number of words (abstract): 264, number of words (body): 3580, number of
35 references: 61, number of tables: 04, number of figures: 02

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10 53 **ABSTRACT**

11 54 **Objective:**

12 55 Low back pain (LBP) is a common musculoskeletal disorder. This study aims to determine
13 56 the residence- and sex-specific prevalence and the risk factors of LBP in Bangladesh.
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19 58 **Methods:**

20 59 The study subjects (ages ≥ 18 years) were identified from 20 primary sampling units of the
21 60 national census following a cross-sectional multi-stage stratified sampling design. We
22 61 considered the mechanical type of LBP for this study. A Bangla version of the modified
23 62 Community Oriented Program for Control of Rheumatic Disorders questionnaire was used.
24 63 A team of trained field workers, rheumatology residents and rheumatologists collected the
25 64 data. Analysis was done using weighted data.
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32 66 **Results:**

33 67 Two thousand subjects were approached, but 1843 could be screened. Among them, 561 had
34 68 musculoskeletal disorders, and 343 were diagnosed with LBP. The weighted prevalence of
35 69 LBP was 18.5% (95% confidence interval, CI: 11.8–25.2) and age-standardized prevalence of
36 70 LBP was 19.4% (95% confidence interval, CI: 14.0–24.8), which was higher in women
37 71 (27.2%, 19.3–35.1) than men (14.0%, 8.7–19.3). The prevalence persistently increased from
38 72 the age group 18–34 years (10.5%, 5.7–15.4) to ≥ 55 years (27.8%, 16.1–39.5). People with
39 73 no education had the highest prevalence (31.3%, 22.3–40.4). The prevalence did not differ
40 74 between urban and rural residential locations. Four factors were significantly associated with
41 75 LBP: age (adjusted odds ratio (2.4, 95% CI: 1.7–3.4), female sex (2.2, 1.5–3.3), absence of
42 76 formal education (2.3, 1.6–3.3), and hypertension (1.7, 1.1–2.6).
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54 78 **Conclusion:**

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4 79 LBP is a common problem in Bangladeshi adults. The risk factors are age, female sex, no
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6 80 formal education, and hypertension. These should be addressed adequately to prevent and
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8 81 treat LBP.
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11 83 **Keywords:** Low back pain, risk factors, Bangladesh, prevalence, cross-sectional survey
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14 85 **Strengths and Limitations**

15
16 86 ▪ We report the weighted prevalence of low back pain by sociodemographic characteristics,
17
18 87 co-morbidities, disability and work loss and identified risk factors for low back pain
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20 88 patients for the first time in Bangladesh.

21 89 ▪ All the diagnoses were made by rheumatology residents and expert rheumatologists in the
22
23 90 field.

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25 91 ▪ Some diagnoses of evolving rheumatological conditions might lack validity because of the
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27 92 lack of quality laboratory facilities in the field.

28 93 ▪ The sample size calculation is based on the combined prevalence of musculoskeletal
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30 94 disorders that warrant cautious interpretation of the results because of inadequate sample
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32 95 size, especially when split into reporting domains.

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34 96 ▪ The recall period for determining work loss was 12 months which might induce bias.
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98 INTRODUCTION

99 Low back pain (LBP) is one of the most frequent medical problems globally¹. It is defined as
100 pain, stiffness, or muscle tension localised below the costal margin and above the inferior
101 gluteal folds². Up to 84% of adults suffer from LBP at some point in life³. The prevalence of
102 chronic LBP is about 23%⁴. Around 11–12% of the population become disabled due to
103 LBP¹. It causes substantial personal, social and financial burdens globally¹. In the USA,
104 LBP is the second most frequent cause for a physician consultation⁵. LBP is ranked globally
105 as the topmost cause of disability as it affects mostly working-age people⁶. It accounted for
106 60.1 million disability-adjusted life-years in 2015⁷. There was a significant increase in LBP
107 by 54% since 1990, and the highest escalation took place in the low and middle-income
108 countries (LMICs)⁷. Disability from LBP is a primary concern for the LMICs, including
109 Bangladesh, where manual labour—rickshaw pulling, day labourers, housemaids, work
110 exposure to the lifting of heavy weight during their day-to-day activities etc.—is common⁷.
111 The scope for job switching is restricted in resource constraint countries.

112
113 LBP has multi-sectorial health outcomes like a lower quality of life, poorer self-reported
114 health, depression and more workspace absenteeism⁸. As a result, LBP has become an
115 important cause of sick leave and early retirement among the working population⁹. In the
116 USA, approximately 149 million workdays are lost due to LBP, leading to an estimated loss
117 of 100–200 billion US dollars per year¹⁰. Non-specific LBP is the commonest of all causes
118 of LBP⁴. Non-specific LBP is defined as LBP not particularly attributable to specific
119 aetiology like malignancy, infection, fracture, inflammatory condition, radiculopathy or
120 cauda equina syndrome⁴.

121
122 Albeit high in most studies, there is a difference in LBP prevalence in various
123 epidemiological studies. The estimated lifetime prevalence was 84.1% in a Canadian study¹¹,
124 70% in Denmark¹², and 59% in the UK¹³. In Iran, the prevalence of LBP was 29.3%¹⁴. The
125 estimated prevalence of LBP in India ranged between 42 and 83%^{15 16}. A recent cross-
126 sectional, community-based, epidemiological study conducted in Northern India yielded an
127 estimated lifetime prevalence of 47% in man 57% in women¹⁷. A Community Oriented
128 Program for Control of Rheumatic Disorders (COPCORD) survey in Bangladesh published
129 in 2005 showed 6.6%, 9.9%, and 9.2% prevalence of LBP in the rural, urban slum, and

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4 130 affluent urban areas, respectively¹⁸. A cross-sectional national study in Bangladesh in 2015
5 131 showed LBP was the top-ranking musculoskeletal disorder (MSD) with a prevalence of
6 132 18.6%¹⁹. We have further analysed the data from the 2015 study and reported the population-
7 133 weighted prevalence according to sociodemographic factors, co-morbid conditions, disability
8 134 and work loss due to LBP, and identified the risk factors of LBP.
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14 136 **METHODS**

15 137 A detailed description of the methodology is beyond the scope of this article and is described
16 138 elsewhere¹⁹. Adults aged 18 years or more comprised the study population through a
17 139 household-level multi-stage stratified cross-sectional survey. The sampling frame was based
18 140 on the 2001 Bangladesh Census²⁰. Based on a point prevalence of MSD and with a design
19 141 effect of 1.5 and 85% response rate for four reporting domains (man-woman, urban-rural),
20 142 the calculated sample size was 1,978, which was rounded to 2,000. It was stratified into
21 143 seven divisions of rural (Mauza) and urban (Mahalla) areas. Twenty (8 urban and 12 rural)
22 144 primary sampling units (PSUs) were selected. The first 100 households were consecutively
23 145 included from each PSU, where even numbers were assigned as man and odd numbers as
24 146 woman households. In each household, a single respondent was identified from a list of
25 147 eligible household members with the help of a Kish table. Data were collected in November
26 148 and December of 2015. **(Figure 1)**
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38 150 A detailed manual was prepared before the training for this survey and was used by all field
39 151 staff. All investigators and the WHO technical team coordinated and conducted the training.
40 152 The modified COPCORD questionnaire was the survey tool²¹. The English version of the
41 153 first part of the questionnaire was translated to Bangla, then adapted according to the
42 154 guideline of Beaton et al.²², validated by Chassany's Method²³, and administered by the
43 155 interviewers. Data were collected for six days from each PSU. There were two recall visits
44 156 to ensure participation. The research physician interviewed the suspected respondents for
45 157 MSDs. A subject was considered a positive respondent if he/she reported pain in muscles,
46 158 bones, joints, or any part of the body (musculoskeletal system) during the preceding seven
47 159 days. Subjects who were taking pain medications like non-steroidal anti-inflammatory drugs
48 160 (NSAID) or steroids were considered positive respondents even if they did not report pain on
49 161 those seven days. All positive respondents were interviewed and examined by the research
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4 162 physicians. Internationally accepted criteria were used for the diagnosis of the diseases. For
5 163 the conditions without any internationally accepted criteria, relevant investigations and
6 164 clinical judgment of the research physician were used. A rheumatologist checked and
7 165 verified the final diagnoses during their visit to respective PSUs.
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12
13 167 LBP group of disorders were operationally defined as mechanical type back pain that
14 168 included non-specific LBP and lumbar spondylosis. Considering the limitation of
15 169 differentiating investigation in the field, we did not classify LBP beyond this. LBP duration
16 170 was classified into three groups: acute: up to 6 weeks; subacute: 6-12 weeks; and chronic,
17 171 which persists beyond 12 weeks²⁴. Respondents with pain in the muscles, bones, joints, or
18 172 any part of the body (musculoskeletal symptom) during the preceding seven days or on pain
19 173 medication with no pain were considered positive respondents. The research physicians
20 174 interviewed and thoroughly examined all 'positive' respondents. Data on physical activity
21 175 were calculated into metabolic equivalent tasks (MET)-minutes per week using the
22 176 STEPwise Surveillance of noncommunicable disease risk factors (STEPS) protocol and
23 177 divided into quartiles²⁵. The 4th quartile was labelled as strenuous physical activity.
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34 179 The study participants were divided into three subgroups as per age in years: 18-34, 35-54
35 180 and 55-99. We considered ownership of household asset items (electricity, television,
36 181 refrigerator, etc.) for constructing wealth index. In addition, the type of main material used
37 182 for the roof of the main house (cement, tin and katcha such as bamboo/thatched/straw/gunny
38 183 etc.) was also included in the model. A principal component analysis was used to create
39 184 standardised factor scores for each of the items. The total scores for the respondents were
40 185 calculated and categorised into quartiles for description from one (lowest household wealth)
41 186 to four (highest household wealth)¹⁹.
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188 A validated Bangla version of the Bangla Health Assessment Questionnaire - Disability Index
189 (HAQ-DI) was used for the disability score. For determining work loss, the recall period was
190 12 months²⁶. Random capillary blood glucose was measured by using glucometer (Accu-
191 Check Germany). Using height (meters) and weight (kilograms) measurements, we
192 calculated BMI [weight (kg)/height (meter)²]. Waist circumference was measured by placing
193 a measuring tape horizontally above the iliac crest. Diabetes was defined as random blood

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4 194 glucose ≥ 11.1 mmol/l or the use of anti-diabetic medications. Obesity was defined as a body
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6 195 mass index of ≥ 25 kg/meter squared²⁷.

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9 197 **Statistical analysis:**

10 198 The survey data were entered and cleaned using Microsoft Excel. We have weighted²⁸ the
11 199 data to reflect the population frame of Bangladesh for the year 2015. Base weight—for the
12 200 sampled population—was calculated using the probability of selection of respondents among
13 201 the eligible number of members of the household in a cluster defined by divisions (7), age
14 202 groups (3) and sexes (2). The base weight was adjusted with non-response weights
15 203 separately for men and women by three age groups. The final weight was generated after
16 204 calibration to frame population (2015) in domains by division, sex and age groups. Analysis
17 205 was done using the final weights.

18 206

19 207 Statistical analysis was done using Epi Info Version 7.1.5.2 and SPSS Version 20.0.

20 208 Continuous variables were categorised before analysis as appropriate. We estimated the
21 209 prevalence of LBP with 95% confidence intervals. The prevalence was segregated by
22 210 residence (urban/ rural) and sex (man/ woman). Nonparametric test (Kruskal-Wallis H test)
23 211 was used to analyse data that were not normally distributed. The confidence intervals were
24 212 suppressed whenever we encountered an unweighted respondent size of less than 25. Age-
25 213 standardization of prevalence estimates was made for global comparison using the WHO
26 214 World Population 2000-2025²⁹. Factors were checked for association with LBP by
27 215 comparing LBP with no MSD through 2x2 tables. Univariate logistic regression analysis was
28 216 done to obtain unadjusted odds ratios. All statistically significant relationships ($P < 0.05$) were
29 217 entered into a model for logistic regression analysis. The adjusted odds ratios and their 95%
30 218 confidence limits were calculated to identify the strength of association of LBP factors. A
31 219 detailed description of categorisation and analysis of other variables was described
32 220 elsewhere¹⁹.

33 221

34 222 **Ethics Approval and Consent to Participate:**

35 223 Ethical guidelines, as outlined by the Declaration of Helsinki, were followed throughout the
36 224 study³⁰. Ethical clearance was obtained from the Institutional Review Board of Bangabandhu

225 Sheikh Mujib Medical University (ID 1100). Informed written consent was obtained from
226 the respondents in Bangla per Institutional Review Board's guidelines.

227

228 **Patient and Public Involvement:**

229 Patients or the public were not involved in this study's design, conduct, reporting, or
230 dissemination plans.

231

232 **RESULTS**

233 **Characteristics of respondents:**

234 In this nationally representative study, 2,000 adults 18 years or older were approached, and
235 1,843 (92.2%) agreed to participate¹⁹. The mean age of the participants was 40.5 (standard
236 deviation 14.7) years, and 51.6% were women. A total of 561 (30.4%) had some type of
237 MSDs. LBP was the most common among MSDs (18.6%, unadjusted), followed by knee
238 osteoarthritis (7.3%) and soft-tissue rheumatism (5.2%). Among the inflammatory rheumatic
239 diseases, the common conditions were rheumatoid arthritis (1.6%) and spondyloarthritis
240 (1.3%).

241

242 **Table 1** shows the changes brought in by the weighting procedure on the unweighted sample.
243 The weighted percentages are more in line with the projected Population Frame²⁰ from which
244 the study sample was drawn.

245

246 **Characteristics of respondents with LBP:**

247 **Prevalence:**

248 We report here (**Table 2**) weighted prevalence of LBP was 18.5% (95% CI: 11.8–25.2).
249 However, the age-standardised prevalence of LBP is 19.4% (95% CI: 14.0–24.8), which is
250 significantly higher in women (27.2%, 19.3–35.1) than in men (14.0%, 8.7–19.3). There has
251 been a persistent increase in prevalence from 10.5% (95% CI 5.7–15.4) in the 18–34 years
252 age group to 27.8% (95% CI 16.1–39.5) in the 55–99 years age group. This trend was more
253 prominent in women. The prevalence did not vary significantly among occupational groups.
254 People with no formal education had a significantly highest prevalence of LBP (31.3%, 22.3–
255 40.4) compared to other educational groups. Although the highest prevalence (23.5% (13.9–
256 33.0)) was observed in the 1st quartile of the wealth index, it did not vary significantly. LBP

was not significantly associated with strenuous physical activity in our sample. We checked LBP prevalence in urban (14.6%, 9.9–19.2) and rural (20.2%, 11.0.6–29.3) categories, but it did not differ significantly. Among the co-morbidities, the prevalence of LBP was higher among patients with hypertension (26.7%, 15.0–38.4) and obesity (20.6%, 13.0–28.3). The highest prevalence of LBP (87.3%, 80.2–94.4) was seen in respondents who had multiple (two or more) MSDs such as LBP, knee osteoarthritis, soft tissue rheumatism, non-inflammatory MSDs, cervical spondylosis etc. (Figure 2)

Background characteristics:

Among the LBP respondents (n=343), 63.3% were women, and 65.3% were from rural areas. The mean age in years (95% confidence interval) was 45.3 (43.0–47.7) overall, and 48.3 (45.8–50.9) in men and 44.0 (41.0–47.0) in women. The study participants were divided into three subgroups per age, and the highest LBP was observed in the 35–54 age group. More than half (%, 95% confidence interval: 57.4%, 48.2–66.6) were homemakers (all women), while the rest constituted other occupations like a labourer, business professional, service holder and others. Almost half of the participants with LBP had no formal education (53.2%, 41.6–64.9). Overall, according to the wealth index, 33.2% (22.6–43.9) of respondents belonged to the 1st quartile (lowest socioeconomic status). About three-fourths of the respondents (77%, 55.9–98.0) had a rural residence. (Table 3)

Disability and work loss:

The distribution of Bengali HAQ-DI scores was not normally distributed among the LBP patients. The scores ranged from 0–2.6. The LBP group's median (interquartile range) was 0.6 (0.3–0.9). The difference in Bangla HAQ-DI score between LBP (n=343) and no MSD (n=60) is statistically significant (P<0.0001) by the Kruskal-Wallis H test, indicating that LBP is associated with a higher disability. The LBP group's days lost from work had a highly skewed distribution and ranged from 0–365 days. However, the difference of days lost from work (n=1,625) between LBP (n=343) and no MSD (n=1,282) is statistically significant (P<0.0001) by the Kruskal-Wallis H test, indicating that LBP is associated with more days lost.

Risk factors:

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4 289 Univariate logistic regression analysis did not show any significant association of LBP with
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6 290 occupation, strenuous physical activity, wealth indices, tobacco use, obesity, and diabetes
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8 291 (Table 4). A significant association was observed for the age group 35–99 years, female sex,
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10 292 lack of education, history of physical trauma, and hypertension according to the unadjusted
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12 293 odds ratio and their 95% confidence intervals ($P<0.05$). These significant associations
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14 294 ($P<0.01$) persisted in the multiple logistic regression analysis having age, sex, education and
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16 295 hypertension into the model simultaneously.

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17 297 DISCUSSION

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20 298 LBP is a common medical problem with very high personal and societal impact, leading to
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22 299 poor quality of life and workability³¹. In this survey, we report that one in five adults in
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24 300 Bangladesh suffers from LBP. The prevalence in Bangladesh is similar to Kuwait (22.7%)³²
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26 301 and Qatar (23.3%)³³ but lower than northern India (32%)³⁴ and Iran (29.3%)¹⁴. Malaysia
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28 302 (11.6%)³⁵ has a lower prevalence of LBP than we report here. In some previous studies in
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30 303 Bangladesh, the prevalence was found at 25.6% among medical students³⁶, 36.6% among
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32 304 bank employees³⁷, and 60.8% among physiotherapists³⁸. Lack of maintenance of correct
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34 305 posture during sitting and scarcity of knowledge, understanding, or application of ergonomics
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36 306 are responsible for the high prevalence rate among these groups^{36 38}.

35 307

37 308 A systematic review of 165 studies from 54 countries revealed the global prevalence of LBP
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39 309 of 12–33%¹. According to the systematic analysis of the Global Burden of Disease Study
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41 310 2017, LBP was the leading cause of YLDs (years lived with disability)³⁹. In our study, the
42
43 311 rural people had a higher prevalence of LBP than the urban people. This difference—though
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45 312 not statistically significant—was probably due to lower doctor concentration in the rural areas,
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47 313 financial limitations, and less education status. However, regional variation was observed in
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49 314 other studies¹⁴.

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51 316 Age was a risk factor for LBP in this study. LBP prevalence persistently increased with age
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53 317 but was not statistically significant. However, an analysis reported that the risk and
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55 318 prevalence of low back pain increased with age⁵. A systematic review of the global
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57 319 prevalence of LBP revealed the association of age was highest in the 40–49 age group^{1 40}.
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59 320 The overall prevalence rises with age 65, which gradually reduces after that⁴¹. Some possible

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4 321 explanations are LBP characteristics in older adults that differ from the middle-aged
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6 322 population (less intense back pain, more leg pain, and more depression)⁴². Our study showed
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8 323 a higher prevalence of LBP among women than men, consistent with some other analyses^{1 41}.
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10 324 This could be due to more household or domestic activities among women than men. This
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12 325 finding agrees with the results from the national health survey on the Iranian population¹⁴.
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14 326 Another Indian study found no significant difference in age and sex scores in their study⁴³.
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16 327 Higher women's prevalence can be partially explained that they have a lower pain threshold
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18 328 than men⁴⁴. The sex differences may be implied by gonadal steroid hormones like estradiol
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20 329 and testosterone that modulate sensitivity to pain and analgesia⁴⁵. Women always
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22 330 experienced a higher frequency of visceral pain (e.g., during menstruation, pregnancy) than
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24 331 men⁴⁶. It seems that in painful conditions, women exhibit a greater prevalence than men as
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26 332 women report more pain⁴⁷.

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28 334 Leboeuf-Yde considered body weight as a possible weak indicator for LBP in his systematic
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30 335 literature review due to lack of evidence⁴⁸. The results obtained in our study did not
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32 336 demonstrate a statistically significant association between LBP and higher BMI. Some other
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34 337 studies found obesity or high BMI associated with an increased risk of LBP development and
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36 338 severity^{14 49}. However, a cross-sectional study including nine countries found BMI $\geq 25\text{kg/m}^2$
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38 339 as a risk factor for LBP in five countries (Finland, Poland, Russia, South Africa and Spain).
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40 340 In contrast, it was not associated with LBP in the remaining four countries (China, Ghana,
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42 341 India and Mexico)⁵⁰.

43 342
44 343 Our research found that the absence of formal education is significantly associated with LBP.
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46 344 A cross-sectional study in the United States found that LBP is more common in people who
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48 345 have had less than high school education⁵¹. Other studies in the USA, UK, and Iran found
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50 346 lower educational status had an increased association with LBP and found higher education
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52 347 inversely associated with LBP^{14 52}. Several proposed mechanisms may explain the
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54 348 relationship between low academic status and back pain. The amount of formal education
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56 349 contributes to the types of jobs that an individual may involve in, and subsequently, the types
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58 350 of jobs influence LBP⁵³. Moreover, health education regarding posture management, lifestyle
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60 351 changes, physical exercises, and stress management was poorly reached among people
352 without formal education. We didn't find any significant association of LBP with occupation.

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4 353 However, in our opinion, the larger number of homemakers affected with LBP might be
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6 354 linked with their nature of heavy work, such as squatting, bending, lifting heavy objects,
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8 355 prolonged standing etc., in the household. In a US-based study, LBP was significantly
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10 356 related to occupational factors such as truck driving, lifting, carrying, pulling, pushing,
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12 357 twisting, and non-driving vibrational exposure⁵⁴. In some European countries, workers
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14 358 involved in heavy weightlifting (≥ 25 kg) suffered more from LBP⁵⁵.
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16 359
17 360 Studies reported associations between LBP and lower social class^{14 51}, but we did not find any
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19 361 significant association of LBP with economic status. This finding is coherent with a Danish
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21 362 study that did not find any possible relationship between socioeconomic status and LBP⁵⁶. In
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23 363 our analysis, trauma tended to be associated (unadjusted OR) with overall LBP, but the
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25 364 association was lost after adjustment. Trauma is not supposed to lead to chronic LBP, and
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27 365 the persistence of back pain was more associated with psychological factors like stress, low
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29 366 education status, etc., than the trauma itself⁵⁷. We found a positive relationship between
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31 367 hypertension and LBP. LBP may cause inactivity and lack of exercise resulting in weight
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33 368 gain, subsequently creating or exaggerating co-morbid conditions like hypertension and
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35 369 diabetes mellitus. The Hong Kong Disc Degeneration-Cardiovascular Cohort showed that
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37 370 HTN increases the possibility of moderate or severe disc degeneration, which is highly
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39 371 associated with LBP⁵⁸. Another long-term Finish study revealed that both SBP and DBP
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41 372 were positively associated with LBP suggesting atherosclerosis of lumbar vessels as a
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43 373 possible mechanism of development of LBP⁵⁹. In a Korean survey, the lifetime prevalence of
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45 374 LBP was 34.4% among the hypertensive respondents, but the adjusted OR of LBP prevalence
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47 375 was significantly lower than the normotensive subjects (fully adjusted 0.79, 95% CI 0.70-
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49 376 0.90)⁶⁰. A Bangladeshi study conducted among the doctors working in a tertiary care hospital
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51 377 found that HTN was the most common co-morbid condition among the LBP sufferers⁶¹.
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53 378 There was no association between diabetes and LBP in this study.
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55 379

51 380 ***Strengths and Limitations***

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53 381 This is the first nationally representative survey report on LBP in Bangladesh and probably,
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55 382 among all south Asian nations. Although we have weighted the data for national
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57 383 representation, the sample size calculation for the original study was based on the point
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59 384 prevalence of MSD¹⁹. We now know that the prevalence of LBP was 18.5%, and the
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4 385 prevalence of MSD was 30.4%. A larger sample size maintaining adequate power was
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6 386 needed for the generalizability of the study results. Therefore, a cautious interpretation is
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8 387 necessary because of the inadequate sample size, especially when split into reporting
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10 388 domains. We have operationally defined the recall period for reporting work loss days as 12
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12 389 months which might induce bias. Trained rheumatology residents diagnosed the patients,
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14 390 which the experienced rheumatologists verified in the field. Some diagnoses of evolving
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16 391 rheumatological conditions might lack sufficient validity because of
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18 392 inadequate laboratory facilities in the field.
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20 394 **CONCLUSION**

21 395 This nationally representative study reports the population-weighted prevalence of LBP by
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23 396 sociodemographic background, co-morbidities and risk factors in Bangladesh. One in five
24
25 397 adults suffers from LBP. Education and hypertension are modifiable risk factors that warrant
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27 398 intervention. An increase in the level of education, care for the middle and older population,
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29 399 and good control of hypertension may reduce the LBP burden. Special attention is needed to
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31 400 prevent LBP in women. Further study with a larger sample size addressing these neglected
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33 401 issues may have more clarifications to decrease the burden of LBP.
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4 **402 Abbreviations and acronyms:**
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6	BMI	Body mass index
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8	BSMMU	Bangabandhu Sheikh Mujib Medical University
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10	CI	Confidence interval
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12	COPCORD	Community oriented program from control of rheumatic diseases
13		
14	HAQ-DI	Health Assessment Questionnaire - Disability Index
15		
16	LBP	Low back pain
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18	MSK	Musculoskeletal
19		
20	MSD	Musculoskeletal disorder
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22	OR	Odds ratio
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24	PPS	Population proportion to size
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26	PSU	Primary sampling unit
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28	WHO	World health organisation

29 **403**

30 **404 Acknowledgement:** We gratefully acknowledge the field team, divisional coordinators, civil
31
32 surgeons, upazila health and family planning officers and health assistants for their support.
33

34 **406**

35
36 **407 Author contribution:**

37 **408** Muhammad Shoaib Momen Majumder (MSMM): Conceptualised the area of work, and
38 prepared the first draft of the manuscript and revised the subsequent drafts.
39

40 **410** Ferdous Hakim (FH): analysed the data, guided preparation of graphs and tables, interpreted
41 the results, revised the draft manuscript, and coordinated the writing exercise.
42

43 **411** Iftexhar Hussain Bandhan (IHB): prepared graphs and tables, revised the draft manuscript.
44

45 **412** Mohammad Abdur Razzaque (MAR): reviewed the manuscript and with special reference to
46 the literature review.
47

48 **414** Ahmed Zahid-Al-Quadir and Shamim Ahmed: Prepared the training manual, trained the field
49 team, executed the field operation in coordination with the divisional investigators;
50

51 **416** Minhaj R Choudhury, Syed Atiqul Haq and Mohammad Mostafa Zaman: Designed the study,
52 guided the analysis and manuscript writing, critically reviewed the results and manuscript
53

54 **417** Minhaj R Choudhury, Syed Atiqul Haq and Mohammad Mostafa Zaman: Designed the study,
55 guided the analysis and manuscript writing, critically reviewed the results and manuscript
56

57 **419** drafts, ensured integrity of data.
58

59 **420** All authors: Approved publication.
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4 421 **Funding:** Preparing this manuscript did not require any funding. However, the base study
5
6 422 was supported by the World Health Organization, Bangladesh (Agreement Reference:
7
8 423 SEBAN140895) back in 2015. As a part of its mandate to strengthen national research
9
10 424 capacity, WHO provided technical guidance in designing, implementing, analysing data, and
11
12 425 writing the report. However, it does not have any influence on the results.
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14 427 **Consent to publish:** All authors contributed to the manuscript and provided consent to
15
16 428 publish.
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18 430 **Availability of data and materials:** The dataset used for this manuscript is available with
19
20 431 the corresponding author upon reasonable request.
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22 433 **Disclosure of Conflicts of Interest:** None of the authors has any conflict of interest to
23
24 434 disclose. The authors alone are responsible for their views expressed in this article, which do
25
26 435 not necessarily represent the institutions' views, decisions, or policies with which they are
27
28 436 affiliated.
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30 438 **Ethical Publication Statement:** We confirm that we have read the Journal's position on
31
32 439 issues involved in ethical publication and affirm that this report is consistent with those
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34 440 guidelines.
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442 **Tables**

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Table 1. Characteristics of the respondents with LBP by unweighted and weighted numbers, Musculoskeletal Disease Survey 2015

Sociodemographic characteristics	Unweighted sample (n=1,843)	Weighted* sample (N=94,794,164)
	number (percent)	number (percent)
Total	1843 (100.0)	94,794,164 (100.0)
Sex		
Men	892 (48.4)	41,553,976 (43.8)
Women	951 (51.6)	53,240,188 (56.2)
Residence		
Urban	716 (38.9)	27,772,657 (29.3)
Rural	1127 (61.2)	67,021,507 (70.7)
Age, years		
18-34	711 (38.6)	41,343,470 (43.6)
35-54	774 (42.0)	35,278,850 (37.2)
55-99	358 (19.4)	18,171,844 (19.2)

* Weighted to projected population of Bangladesh from 2001 Population Census Frame of Bangladesh Bureau of Statistics.

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Table 2. Weighted prevalence of low back pain by sociodemographic characteristics in Bangladesh, Musculoskeletal Disease Survey 2015

Sociodemographic characteristics	Total	Men	Women
	Percent (95% CI)	Percent (95% CI)	
Overall	18.5 (11.8–25.2)	13.1 (6.4–19.9)	22.7 (15.3–30.2)
Overall (age-standardized)*	19.4 (14.0–24.8)	14.0 (8.7–19.3)	27.2 (19.3–35.1)
Age in years			
18-34	10.5 (5.7–15.4)	5.2 (1.3–9.0)	13.5 (7.2–19.9)
35-54	23.1 (15.3–30.9)	18.8 (8.7–28.8)	26.7 (18.3–35.1)
55-99	27.8 (16.1–39.5)	15.7 (6.7–24.7)	44.5 (23.9–65.1)
Occupation			
Homemaker	23.6 (15.9–31.2)	–	23.6 (15.9–31.2)
Laborer†	18.2 (9.4–27.0)	17.9 (8.6–27.3)	21.2 (6.2–36.3)
Business professional	9.6 (1.9–17.2)	9.8 (1.9–17.6)	–
Service holder	10.7 (1.2–20.1)	10.3 (0.4–20.2)	–
Others‡	13.9 (4.1–23.6)	8.6 (1.7–15.5)	20.3 (6.0–34.6)
Education			
No formal education (0)	31.3 (22.3–40.4)	20.3 (13.4–27.2)	37.4 (24.3–50.5)
Any primary education (1-5)	13.3 (6.7–19.9)	12.1 (3.9–20.3)	14.4 (7.8–21.0)
Any secondary education (6-10)	14.9 (7.4–22.3)	12.0 (2.4–21.6)	17.5 (9.9–25.0)
Above secondary (≥11 years)	6.9 (3.8–10.1)	–	8.0 (3.7–12.3)
Married‡	19.6 (12.4–26.7)	14.1 (6.7–21.4)	23.7 (15.7–31.7)
Wealth index quartile§			
1st	23.5 (13.9–33.0)	19.5 (11.2–27.8)	25.5 (12.9–38.2)
2nd	19.8 (8.4–31.2)	17.3 (3.7–30.9)	21.6 (10.3–32.9)
3rd	14.1 (7.6–20.5)	8.3 (2.3–14.2)	19.8 (11.7–28.0)
4th	16.6 (9.3–23.8)	10.3 (3.2–17.4)	23.1 (11.5–34.7)
Residence			
Urban	14.6 (9.1–20.0)	9.8 (3.9–15.6)	17.7 (8.5–26.8)
Rural	20.2 (10.5–29.8)	14.3 (4.8–23.9)	25.1 (14.7–35.4)
Strenuous physical activity ^l	17.1 (4.3–29.8)	17.2 (4.0–30.4)	–
History of physical trauma	24.5 (14.2–34.7)	24.6 (13.0–36.2)	24.4 (7.9–40.9)

All values are percent (95% confidence interval). Weighted percentages shown are calculated from Census 2001 Population Frame by Bangladesh Bureau of Statistics to reflect projected population of Bangladesh (N=94,794,164).

Bold face values denote statistically significant higher prevalence in women compared to men.

* Standardised for WHO World Population 2000-2020.

† Labourer includes: farmer, daily worker, rickshaw puller, garments worker, field worker and others.

Other occupations: retired, weaver and housekeeper

‡ Includes currently married, divorced, separated and widowed.

§ The wealth index was constructed using principal component analysis out of a list of 20 household assets (see Methods section for details);

^l Fourth quartile of the MET-minutes distribution of work-related physical activity. Commutation and leisure time physical activities were not considered because these were negligible contributors.

– 95% confidence interval not reported as number of respondents are <25.

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Table 3. Socioeconomic characteristics of patients of low back pain in Bangladesh, Musculoskeletal Disease Survey 2015

Sociodemographic characteristics	Total	Men	Women
	Weighted percentage (95% confidence interval)		
Age in years			
Mean (95% confidence interval)	45.3 (43.0–47.7)	48.3 (45.8–50.9)	44.0 (41.0–47.0)
18–34	24.8 (18.8–30.7)	14.1 (6.9–21.3)	29.6 (21.3–37.9)
35–54	46.4 (40.6–52.2)	55.6 (40.3–70.9)	42.3 (34.4–50.2)
55–99	28.8 (22.5–35.1)	30.3 (17.0–43.7)	28.1 (22.2–34.0)
Occupation			
Homemaker	57.4 (48.2–66.6)	–	83.2 (72.0–94.5)
Laborer†	20.4 (13.6–27.2)	59.7 (38.8–80.5)	2.7 (0.1–5.4)
Business professional	5.2 (1.2–9.1)	16.6 (5.0–28.2)	–
Service holder	–	–	–
Others‡	13.5 (2.7–24.3)	14.8 (2.8–26.8)	13.0 (1.5–24.4)
Education			
No formal education (0)	53.2 (41.6–64.9)	39.1 (24.3–54.0)	59.6 (46.9–72.3)
Any primary education (1-5)	17.2 (13.8–20.5)	23.9 (17.1–42.6)	14.1 (10.1–18.1)
Any secondary education (6-10)	24.1 (15.9–32.4)	29.9 (17.1–42.6)	21.6 (13.1–30.1)
Above secondary (≥11 years)	5.5 (1.0–9.9)	–	–
Married‡	97.8 (94.8–100.8)	96.8 (92.2–101.3)	98.3 (95.5–101.1)
Wealth index quartile§			
1st	33.2 (22.6–43.9)	30.1 (18.8–41.4)	34.7 (21.7–47.7)
2nd	25.5 (14.8–36.2)	29.5 (11.5–47.5)	23.7 (14.6–32.7)
3rd	19.7 (11.0–28.4)	18.5 (6.7–30.3)	20.3 (10.5–30.1)
4th	21.6 (9.2–33.9)	21.9 (9.4–34.5)	21.4 (7.1–35.7)
Rural residence	77.0 (55.9–98.0)	80.3 (60.2–100.4)	75.5 (52.8–98.1)

* All values are percent (95% confidence interval) unless stated otherwise. Weighted percentages shown are calculated from Census 2001 Population Frame by Bangladesh Bureau of Statistics to reflect projected population of Bangladesh (N=94,794,164).

† Labourer include: farmer, daily worker, rickshaw puller, garments worker, field worker and others. Other occupations: retired, weaver and housekeeper etc.

‡ Includes currently married, divorced, separated and widowed.

§ The wealth index was constructed using principal component analysis out of a list of 20 household assets (see Methods section for details);

- numbers are low

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Table 4: Odds ratios of risk factors for low back pain compared with no musculoskeletal disorders in Bangladeshi adults, Musculoskeletal Disease Survey 2015

Factors	Odds ratio (95% confidence interval)	
	Unadjusted	Adjusted
Age group, years (35–99=1, 18–34=0)	3.2 (2.5–4.2)** 1.0	2.4 (1.7–3.4)** 1.0
Sex (woman=1, man=0)	2.1 (1.3–3.3)** 1.0	2.2 (1.5–3.3)** 1.0
Labourer† (yes=1, no=0)	0.9 (0.7–1.3) 1.0	- -
No formal education (yes=1, no=0)	3.5 (2.5–5.0)** 1.0	2.3 (1.6–3.3)** 1.0
Low wealth index (yes=1, no=0)	1.6 (1.1–2.3)** 1.0	1.0 (0.6–1.5) 1.0
Strenuous physical activity‡ (yes=1, no=0)	0.8 (0.4–1.6) 1.0	- -
Obesity (body mass index ≥ 25 Kg/m ²) (yes=1, no=0)	1.3 (0.8–2.1) 1.0	- -
History of physical trauma (yes=1, no=0)	1.8 (1.1–3.2)* 1.0	1.6 (0.9–2.8) 1.0
Current tobacco user (yes=1, no=0)	1.1 (0.8–1.6) 1.0	- -
Hypertension (yes=1, no=0)	2.3 (1.3–4.0)** 1.0	1.7 (1.1–2.6)* 1.0
Diabetes mellitus (yes=1, no=0)	1.0 (0.5–1.7) 1.0	- -

LBP: low back pain; MSD: musculoskeletal disorder

* $P < 0.05$, ** $P < 0.01$

† Labourer includes: farmer, daily worker, rickshaw puller, garments worker, field worker and others.

‡ Fourth quartile of the MET-minutes distribution of work-related physical activity. Commutation and leisure time physical activities were not considered because these were negligible contributors.

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4 **454 Figures**
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6 **455 Fig. 1 Flow chart on the selection of low back pain patients from the national survey on**
7 **456 musculoskeletal conditions in Bangladesh (2015) adapted from Ahmad Zahid-Al-**
8 **457 Quadir *et al*²¹**
9

10 **458**
11 **459** * Eight divisions from Sept 2015. Randomly 15 districts were selected out of 64.

12 **460** ** PPS indicates population proportion to size.

13 **461** *** Out-migration, broken house, locked house, no tenant, out of home, refusal. Two recall visits were done if
14 **462** the selected house was locked and the person chosen was not available at home at the time of the interviewer's
15 **463** visit. In case of non-participation after the second recall visit, the targeted household/individual was declared
16 **464** non-respondents.

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4 **470 Fig. 2 Prevalence of LBP in different (Unadjusted overall prevalence (percent, 95%**
5 **confidence interval) of low back pain and in) associated co-conditions (n=343)**
6 **471**
7 **472**

9 *Diabetes was defined as random capillary glucose level ≥ 11.1 or on medication for diabetes

10 †Obesity is defined as, body mass index ≥ 25 kg/m²;

11 ‡Hypertension was defined as systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 or medication for
12 hypertension;

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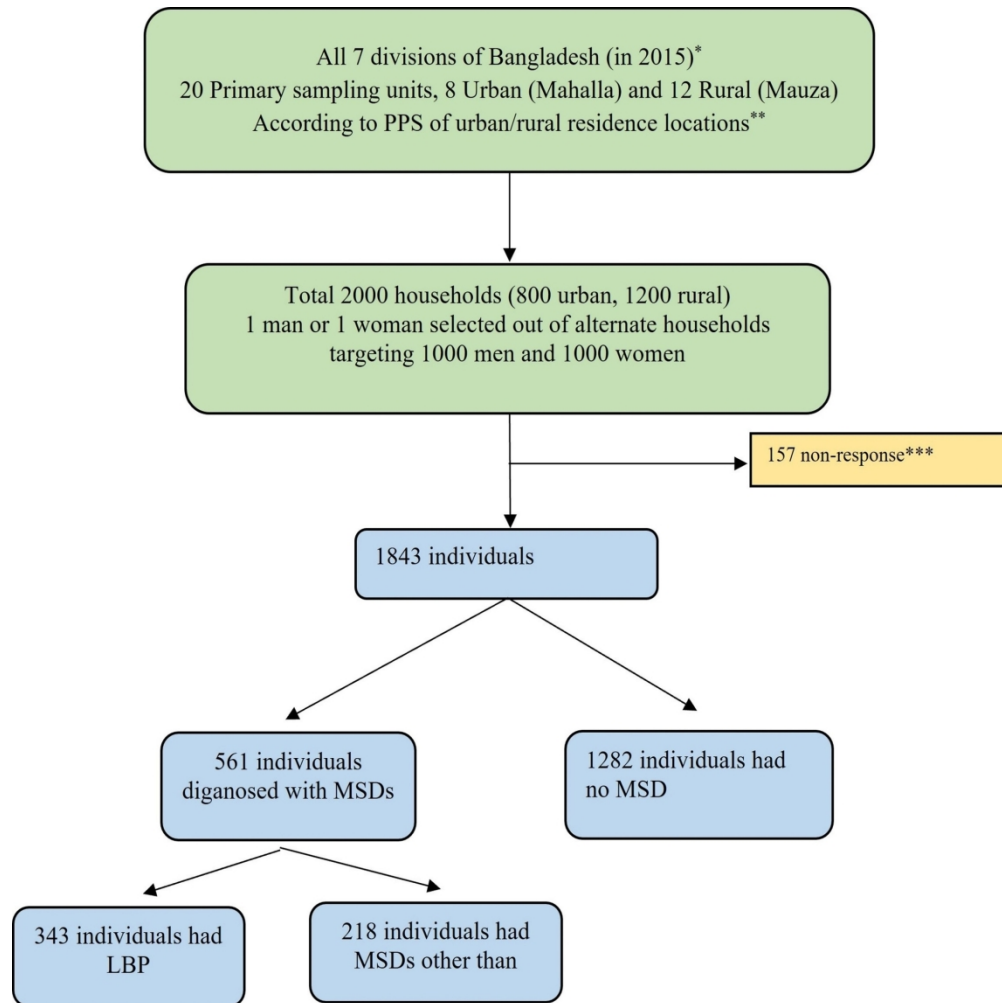
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Caption:

Fig. 1 Flow chart on the selection of low back pain patients from the national survey on musculoskeletal conditions in Bangladesh (2015) adapted from Ahmad Zahid-Al-Quadir et al 21

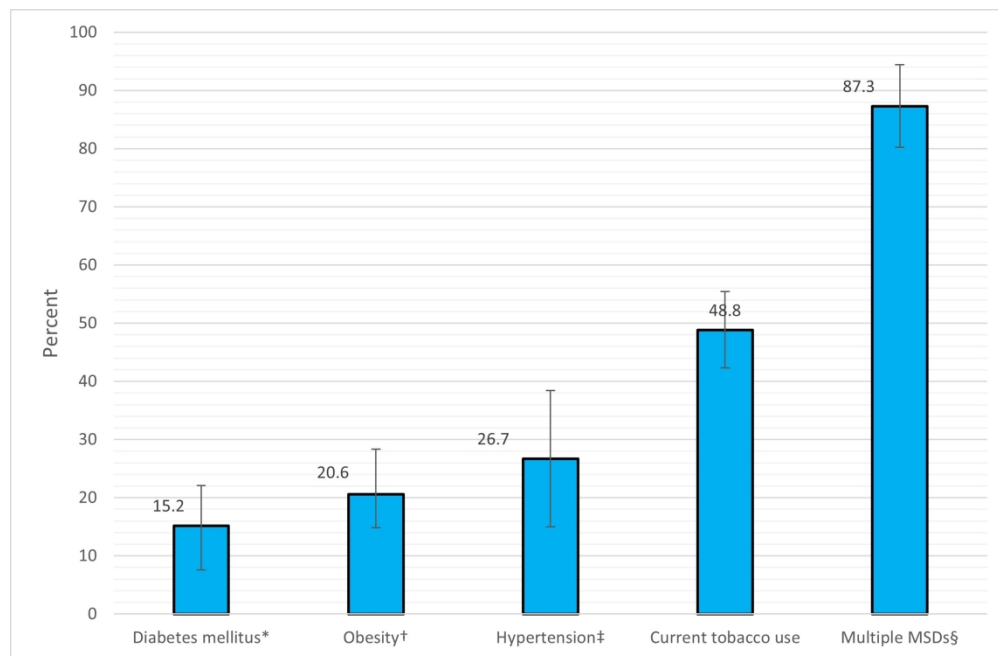
Legend:

* Eight divisions from Sept 2015. Randomly 15 districts were selected out of 64.

** PPS indicates population proportion to size.

*** Out-migration, broken house, locked house, no tenant, out of home, refusal. Two recall visits were done if the selected house was locked and the person chosen was not available at home at the time of the interviewer's visit. In case of non-participation after the second recall visit, the targeted household/individual was declared non-respondents.

190x190mm (300 x 300 DPI)



Caption:

Fig. 2 Prevalence of LBP in different (Unadjusted overall prevalence (percent, 95% confidence interval) of low back pain and in) associated co-conditions (n=343)

Legend:

*Diabetes was defined as random capillary glucose level ≥ 11.1 or on medication for diabetes

†Obesity is defined as, body mass index ≥ 25 kg/m²;

‡Hypertension was defined as systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 or medication for hypertension

597x389mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4, 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5, 6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5, 6
Bias	9	Describe any efforts to address potential sources of bias	5, 6
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	7
		(e) Describe any sensitivity analyses	Not applicable
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5, 22
		(b) Give reasons for non-participation at each stage	19
		(c) Consider use of a flow diagram	19
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 8
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	8, 9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9
		(b) Report category boundaries when continuous variables were categorized	6
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	3
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11, 12
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Low Back Pain in the Bangladeshi Adult Population: A Cross-sectional National Survey

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-059192.R2
Article Type:	Original research
Date Submitted by the Author:	17-Aug-2022
Complete List of Authors:	Momen Majumder, Muhammad Shoaib; Bangabandhu Sheikh Mujib Medical University, Rheumatology Hakim, Ferdous; World Health Organization Bangladesh Bandhan, Iftekhar ; Bangabandhu Sheikh Mujib Medical University, Rheumatology Razzaque, Mohammad Abdur; Chittagong Medical College, Medicine Zahid-Al-Quadir, Ahmad ; Sylhet MAG Osmani Medical College, Medicine Ahmed, Shamim; Bangabandhu Sheikh Mujib Medical University Choudhury, Minhaj; Bangabandhu Sheikh Mujib Medical University, Rheumatology Haq, Syed; Bangabandhu Sheikh Mujib Medical University, Rheumatology Zaman, MM; WHO Bangladesh
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Rheumatology
Keywords:	EPIDEMIOLOGY, RHEUMATOLOGY, PUBLIC HEALTH, PREVENTIVE MEDICINE

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1 Low Back Pain in the Bangladeshi Adult Population: A Cross-sectional National Survey

2 3 *Short Running Head: Low Back Pain in Bangladesh*

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34 **Counts:** Number of words (abstract): 263, number of words (body): 3471, number of
35 references: 61, number of tables: 04, number of figures: 02

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10 53 **ABSTRACT**

11 54 **Objective:**

12 55 Low back pain (LBP) is a common musculoskeletal disorder. This study aims to determine
13 56 the residence- and sex-specific prevalence and the factors associated with LBP in
14 57 Bangladesh.
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20 59 **Methods:**

21 60 The study subjects (ages ≥ 18 years) were identified from 20 primary sampling units of the
22 61 national census following a cross-sectional multi-stage stratified sampling design. We
23 62 considered the mechanical type of LBP for this study. A Bangla version of the modified
24 63 Community Oriented Program for Control of Rheumatic Disorders questionnaire was used. A
25 64 team of trained field workers, rheumatology residents and rheumatologists collected the data.
26 65 Analysis was done using weighted data.
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35 67 **Results:**

36 68 Two thousand subjects were approached, but 1843 could be screened. Among them, 561 had
37 69 musculoskeletal disorders, and 343 were diagnosed with LBP. The weighted prevalence of
38 70 LBP was 18.5% (95% confidence interval, CI: 11.8–25.2) and age-standardized prevalence of
39 71 LBP was 19.4% (95% confidence interval, CI: 14.0–24.8), which was higher in women
40 72 (27.2%, 19.3–35.1) than men (14.0%, 8.7–19.3). The prevalence persistently increased from
41 73 age group 18–34 years (10.5%, 5.7–15.4) to ≥ 55 years (27.8%, 16.1–39.5). People with no
42 74 education had the highest prevalence (31.3%, 22.3–40.4). The prevalence did not differ
43 75 between urban and rural residential locations. Four factors were significantly associated with
44 76 LBP: age (adjusted odds ratio (2.4, 95% CI: 1.7–3.4), female sex (2.2, 1.5–3.3), absence of
45 77 formal education (2.3, 1.6–3.3), and hypertension (1.7, 1.1–2.6).
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56 79 **Conclusion:**

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4 80 LBP is a common problem in Bangladeshi adults. The factors identified are age, female sex,
5
6 81 no formal education, and hypertension. These should be addressed adequately to prevent and
7
8 82 treat LBP.
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10 83

11 84 **Keywords:** Low back pain, factors, Bangladesh, prevalence, cross-sectional survey
12

13 85

14 86 **Strengths and Limitations**

15
16 87 ▪ We report the weighted prevalence of low back pain by sociodemographic characteristics,
17
18 88 comorbidities, disability and work loss, and identified factors associated with back pain
19
20 89 patients, for the first time in Bangladesh.

21
22 90 ▪ All the diagnoses were made by rheumatology residents and expert rheumatologists in the
23
24 91 field.

25
26 92 ▪ Some diagnoses of evolving rheumatological conditions might lack validity because of
27
28 93 lack of quality laboratory facilities in the field.

29
30 94 ▪ The sample size calculation is based on combined prevalence of musculoskeletal disorders
31
32 95 that warrant cautious interpretation of the results because of inadequate sample size,
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34 96 especially when split into reporting domains.

35
36 97 ▪ Recall period for determining work loss was 12 months which might induce bias.
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99 INTRODUCTION

100 Low back pain (LBP) is one of the most frequent medical problems globally [1]. It is defined
101 as pain, stiffness, or muscle tension localized below the costal margin and above the inferior
102 gluteal folds [2]. Up to 84% of adults suffer from LBP at some point in life [3]. The
103 prevalence of chronic LBP is about 23% [4]. Around 11–12% of the population become
104 disabled due to LBP [1]. It causes substantial personal, social and financial burdens globally
105 [1]. In the USA, LBP is the second most frequent cause for a physician consultation [5]. LBP
106 is ranked globally as the topmost cause of disability as it affects mostly working-age people
107 [6]. It accounted for 60.1 million disability-adjusted life-years in 2015 [7]. There was a
108 significant increase of LBP by 54% since 1990, and the highest escalation took place in the
109 low and middle-income countries (LMICs) [7]. Disability from LBP is a primary concern for
110 the LMICs, specially in Bangladesh where manual labour–rickshaw pulling, day laborers,
111 house maids, work exposure to lifting of heavy weight during their day-to-day activities etc.–
112 is common [7]. The scope for job switching is restricted in resource constraint countries.

113
114 LBP has multi-sectorial health outcomes like a lower quality of life, poorer self-reported
115 health, depression and more workspace absenteeism [8]. As a result, LBP has become an
116 important cause of sick leave and early retirement among the working population [9]. In the
117 USA, approximately 149 million workdays are lost due to LBP, leading to an estimated loss
118 of 100–200 billion US dollars per year [10]. Non-specific LBP is the commonest of all causes
119 of LBP [4]. Non-specific LBP is defined as LBP not particularly attributable to specific
120 aetiology like malignancy, infection, fracture, inflammatory condition, radiculopathy or
121 cauda equina syndrome [4].

122
123 Albeit high in most studies, there is a difference in LBP prevalence in various
124 epidemiological studies. The estimated lifetime prevalence was 84.1% in a Canadian study
125 [11], 70% in Denmark [12], 59% in the UK [13]. In Iran, the prevalence of LBP was 29.3%
126 [14]. The estimated prevalence of LBP in India ranged between 42 and 83% [15, 16]. A
127 recent cross-sectional, community-based, epidemiological study conducted in Northern India
128 yielded an estimated lifetime prevalence of 47% in man 57% in women [17]. A Community
129 Oriented Program for Control of Rheumatic Disorders (COPCORD) survey in Bangladesh
130 published in 2005 showed 6.6%, 9.9%, and 9.2% prevalence of LBP in the rural, urban slum,

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4 131 and affluent urban areas, respectively [18]. A cross-sectional national study in Bangladesh in
5 132 2015 showed LBP was the top-ranking musculoskeletal disorder (MSD) with a prevalence of
6 133 18.6% [19]. We have further analyzed the data from the 2015 study and report the population
7 134 weighted prevalence according to sociodemographic factors, comorbid conditions, disability
8 135 and work loss due to LBP, and identify the factors associated with LBP.
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14 137 **METHODS**

15 138 A detailed description of the methodology is beyond the scope of this article and is described
16 139 elsewhere [19]. Adults aged 18 years or more comprised the study population through a
17 140 household level multi-stage stratified cross-sectional survey. The sampling frame was based
18 141 on the 2001 Bangladesh Census [20]. Based on a point prevalence of MSD and with a design
19 142 effect of 1.5 and 85% response rate for four reporting domains (man-woman, urban-rural),
20 143 the calculated sample size was 1,978, which was rounded to 2,000. It was stratified into seven
21 144 divisions of rural (Mauza) and urban (Mahalla) areas. Twenty (8 urban and 12 rural) primary
22 145 sampling units (PSUs) were selected. The first 100 households were consecutively included
23 146 from each PSU, where even numbers were assigned as man and odd numbers as woman
24 147 households. In each household, the single respondent was identified from a list of eligible
25 148 household members with the help of a Kish table. Data was collected in November and
26 149 December of 2015. (**Figure 1**)
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37 150

38 151 A detailed manual was prepared before the training for this survey and was used by all field
39 152 staff. All investigators and the WHO technical team coordinated and conducted the training.
40 153 The modified COPCORD questionnaire was the survey tool [21]. The English version of the
41 154 first part of the questionnaire was translated to Bangla, then adapted according to the
42 155 guideline of Beaton et al [22], validated by Chassany's Method [23], and administered by the
43 156 interviewers. Data were collected for six days from each PSU. There were two recall visits to
44 157 ensure participation. The research physician interviewed the suspected respondents for
45 158 MSDs. A subject was considered a positive respondent if he/she reported pain in muscles,
46 159 bones, joints, or any part of the body (musculoskeletal system) during the preceding seven
47 160 days. Subjects who were taking pain medications like non-steroidal anti-inflammatory drugs
48 161 (NSAID) or steroids were considered as positive respondent even if they did not report pain
49 162 on those seven days. All positive respondents were interviewed and examined by the research
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4 163 physicians. Internationally accepted criteria were used for the diagnosis of the diseases. For
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6 164 the conditions without any internationally accepted criteria, relevant investigations and
7
8 165 clinical judgment of the research physician was used. The final diagnoses were checked and
9
10 166 verified by a rheumatologist during their visit to respective PSUs.

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12
13 168 LBP group of disorders were operationally defined as mechanical type back pain that
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15 169 included non-specific LBP and lumbar spondylosis. Considering the limitation of
16
17 170 differentiating investigation in the field, we did not classify LBP beyond this. LBP duration
18
19 171 was classified into three groups: acute: up to 6 weeks, subacute: 6-12 weeks, and chronic that
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21 172 persists beyond 12 weeks [24]. Respondents with pain in the muscles, bones, joints, or any
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23 173 part of the body (musculoskeletal symptom) during the preceding seven days or on pain
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25 174 medication with no pain were considered as positive respondents. The research physicians
26
27 175 interviewed and thoroughly examined all 'positive' respondents. Data on physical activity
28
29 176 were calculated into metabolic equivalent tasks (MET)-minutes per week using the
30
31 177 STEPwise Surveillance of noncommunicable disease risk factors (STEPS) protocol and
32
33 178 divided into quartiles [25]. The 4th quartile was labelled as strenuous physical activity.

34 179
35 180 The study participants were divided into three subgroups as per age in years: 18-34, 35-54
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37 181 and 55-99. We considered ownership of household asset items (electricity, television,
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39 182 refrigerator, etc.) for constructing wealth index. In addition, the type of main material used
40
41 183 for the roof of the main house (cement, tin and katcha such as bamboo/thatched/straw/gunny
42
43 184 etc.) was also included in the model. A principal component analysis was used to create
44
45 185 standardized factor scores for each of the items. The total scores for the respondents were
46
47 186 calculated and categorized those into quartiles for description from one (lowest household
48
49 187 wealth) to four (highest household wealth) [19].

50 188
51 189 A validated Bangla version of the Bangla Health Assessment Questionnaire - Disability Index
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53 190 (HAQ-DI) was used for the disability score. For determining work loss, the recall period was
54
55 191 12 months [26]. Random capillary blood glucose was measured by using glucometer (Accu-
56
57 192 Check Germany). Using height (meters) and weight (kilograms) measurements, we calculated
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59 193 BMI [weight (kg)/height (meter)²]. Waist circumference was measured by horizontally
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194 placing a measuring tape above the iliac crest. Diabetes was defined as random blood glucose

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4 195 ≥ 11.1 mmol/l or the use of anti-diabetic medications. Obesity was defined as a body mass
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6 196 index of ≥ 25 kg/meter squared [27].
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9 198 **Statistical analysis:**

10
11 199 The survey data were entered in and cleaned using Microsoft Excel. We have weighted [28]
12
13 200 the data to reflect population frame of Bangladesh for the year 2015. Base weight—for the
14
15 201 sampled population—was calculated using probability of selection of respondents among the
16
17 202 eligible number of members of household in a cluster defined by divisions (7), age groups (3)
18
19 203 and sexes (2). The base weight was adjusted with non-response weights separately for men
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21 204 and women by three age groups. The final weight was generated after calibration to frame
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23 205 population (2015) in domains by division, sex and age groups. Analysis was done using the
24
25 206 final weights.

26 207

27 208 Statistical analysis was done using Epi Info Version 7.1.5.2 and in SPSS Version 20.0.

28 209 Continuous variables were categorized before analysis as appropriate. We estimated the

29 210 prevalence of LBP with 95% confidence intervals. The prevalence was segregated by

30 211 residence (urban/ rural) and sex (man/ woman). Nonparametric test (Kruskal-Wallis H test)

31 212 was used to analyze data that were not normally distributed. Whenever we encountered an

32 213 unweighted respondent size of less than 25, the confidence intervals were suppressed. Age-

33 214 standardization of prevalence estimates was made for global comparison using the WHO

34 215 World Population 2000-2025 [29]. Factors were checked for association with LBP by

35 216 comparing LBP with no MSD through 2x2 tables. Univariate logistic regression analysis was

36 217 done to obtain unadjusted odds ratios. All statistically significant relationships ($P < 0.05$) were

37 218 entered into a model for logistic regression analysis. The adjusted odds ratios and their 95%

38 219 confidence limits were calculated to identify the strength of association of LBP factors. A

39 220 detailed description of categorization and analysis of other variables was described elsewhere

40 221 [19].
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43 223 **Ethics Approval and Consent to Participate:**

44 224 Ethical guidelines, as outlined by the Declaration of Helsinki, were followed throughout the

45 225 study [30]. Ethical clearance was obtained from the Institutional Review Board of
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226 Bangabandhu Sheikh Mujib Medical University (ID 1100). Informed written consent was
227 obtained from the respondents in Bangla as per Institutional Review Board's guidelines.

228

229 **Patient and Public Involvement:**

230 Patient or the public were not involved in the design, or conduct, or reporting, or
231 dissemination plans of this study.

232

233 **RESULTS**

234 **Characteristics of respondents:**

235 In this nationally representative study, 2,000 adults 18 years or older were approached, and
236 1,843 (92.2%) agreed to participate [19]. The mean age of the participants was 40.5 (standard
237 deviation 14.7) years, and 51.6% were women. A total of 561 (30.4%) had some type of
238 MSDs. LBP was the most common among MSDs (18.6%, unadjusted), followed by knee
239 osteoarthritis (7.3%) and soft-tissue rheumatism (5.2%). Among the inflammatory rheumatic
240 diseases, the common conditions were rheumatoid arthritis (1.6%) and spondyloarthritis
241 (1.3%).

242

243 **Table 1** shows the changes brought in by the weighting procedure on the unweighted sample.

244 The weighted percentages are more in line with the projected Population Frame [20] from
245 which the study sample was drawn.

246

247 **Characteristics of respondents with LBP:**

248 **Prevalence:**

249 We report here (**Table 2**) weighted prevalence of LBP was 18.5% (95% CI: 11.8–25.2).
250 However, the age-standardized prevalence of LBP to be 19.4% (95% CI: 14.0–24.8), which is
251 significantly higher in women (27.2%, 19.3–35.1) than men (14.0%, 8.7–19.3). There has
252 been a persistent increase in prevalence from 10.5% (95% CI 5.7–15.4) in 18–34 years age
253 group to 27.8% (95% CI 16.1–39.5) in 55–99 years age group. This trend was more
254 prominent in women. The prevalence did not vary significantly among occupational groups.
255 People with no formal education had significantly highest prevalence of LBP (31.3%, 22.3–
256 40.4) compared to other educational groups. Although the highest prevalence (23.5% (13.9–
257 33.0)) was observed in the 1st quartile of the wealth index, it did not vary significantly. LBP

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4 258 was not significantly associated with strenuous physical activity in our sample. We checked
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6 259 LBP prevalence by urban (14.6%, 9.9–19.2) and rural (20.2%, 11.0.6–29.3) categories, but it
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8 260 did not differ significantly. Among the co-morbidities, the prevalence of LBP was higher
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10 261 among patients of hypertension (26.7%, 15.0–38.4) and obesity (20.6%, 13.0–28.3). The
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12 262 highest prevalence of LBP (87.3%, 80.2–94.4) was seen in respondents who had multiple
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14 263 (two or more) MSDs such as LBP, knee osteoarthritis, soft tissue rheumatism, non-
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16 264 inflammatory MSDs, cervical spondylosis etc. **(Figure 2)**

16 265

17 266 ***Background characteristics:***

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19 267 Among the LBP respondents (n=343), 63.3% were women, and 65.3% were from rural areas.
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21 268 Mean age in years (95% confidence interval) was 45.3 (43.0–47.7) overall, and 48.3 (45.8–
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23 269 50.9) in men and 44.0 (41.0–47.0) in women. The study participants were divided into three
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25 270 subgroups as per age, and the highest number of LBP was observed in the 35–54 age group.
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27 271 More than half (%), 95% confidence interval: 57.4%, 48.2–66.6) were homemakers (all
28
29 272 women), while the rest constituted other occupations like laborer, business professional,
30
31 273 service holder and others. Almost half of the participants with LBP had no formal education
32
33 274 (53.2%, 41.6–64.9). Overall, according to the wealth index, 33.2% (22.6–43.9) of
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35 275 respondents belonged to the 1st quartile (lowest socioeconomic status). About three-fourth of
36
37 276 the respondents (77%, 55.9–98.0) had rural residence. **(Table 3)**

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38 278 ***Disability and work loss:***

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40 279 The distribution of Bengali HAQ-DI scores was not normally distributed among the LBP
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42 280 patients. The scores ranged from 0–2.6. The LBP group's median (interquartile range) was
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44 281 0.6 (0.3–0.9). The difference of Bangla HAQ-DI score between LBP (n=343) and no MSD
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46 282 (n=60) is statistically significant (P<0.0001) by the Kruskal-Wallis H test, indicating that
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48 283 LBP is associated with a higher disability. The distribution of days lost from work for LBP
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50 284 group had a highly skewed distribution and ranged from 0–365 days. However, the difference
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52 285 of days lost from work (n=1,625) between LBP (n=343) and no MSD (n=1,282) is
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54 286 statistically significant (P<0.0001) by the Kruskal-Wallis H test, indicating that LBP is
55
56 287 associated with more days lost.

56 288

57 289 ***Factors associated:***

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4 290 Univariate logistic regression analysis did not show any significant association of LBP with
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6 291 occupation, strenuous physical activity, wealth indices, tobacco use, obesity, and diabetes
7
8 292 (Table 4). A significant association was observed for age group 35–99 years, female sex,
9
10 293 lack of education, history of physical trauma, and hypertension according to the unadjusted
11
12 294 odds ratio and their 95% confidence intervals ($P<0.05$). These significant associations
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14 295 ($P<0.01$) persisted in the multiple logistic regression analysis having age sex, education and
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16 296 hypertension. into the model simultaneously.

17 297

18 298 **DISCUSSION**

19
20 299 LBP is a common medical problem with very high personal and societal impact, leading to
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22 300 poor quality of life and workability [31]. In this survey we report that one in five adults in
23
24 301 Bangladesh suffers from LBP. The prevalence in Bangladesh is similar to Kuwait (22.7%)
25
26 302 [32] and Qatar (23.3%) [33] but lower than northern India (32%) [34] and Iran (29.3%) [14].
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28 303 Malaysia (11.6%) [35] has a lower prevalence of LBP than we report here. In some previous
29
30 304 studies in Bangladesh the prevalence was found 25.6% among medical students [36], 36.6%
31
32 305 in bank employees [37], 60.8% among physiotherapists [38]. Lack of maintenance of correct
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34 306 posture during sitting and scarcity of knowledge, understanding, or application of ergonomics
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36 307 are responsible for high prevalence rate among these groups [36, 38].

37 308

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39 309 A systematic review of 165 studies from 54 countries revealed the global prevalence of LBP
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41 310 of 12–33% [1]. According to the systematic analysis of the Global Burden of Disease Study
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43 311 2017, LBP was the leading cause of YLDs (years lived with disability) [39]. In our study, the
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45 312 rural people had a higher prevalence of LBP than the urban people. This difference—though
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47 313 not statistically significant—was probably due to lower doctor concentration in the rural areas,
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49 314 financial limitations, and less education status. However, regional variation was observed in
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51 315 other studies [14].

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54 317 Age was a factor associated with LBP in this study. The prevalence of LBP persistently
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56 318 increased with age but this was not statistically significant. However, an analysis reported
57
58 319 that the risk and prevalence of low back pain increased with age [5]. A systematic review of
59
60 320 the global prevalence of LBP revealed the association of age was highest in the 40–49 age
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322 group [1, 40]. The overall prevalence rises with age 65, which gradually reduces thereafter

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4 322 [41]. Some possible explanations are LBP characteristics in older adults that differ from the
5
6 323 middle-aged population (less intense back pain, more leg pain, and more depression) [42].
7
8 324 Our study showed a higher prevalence of LBP among women than men, consistent with some
9
10 325 other analyses [1, 41]. This could be due to more household or domestic activities among
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12 326 women compared to men. This finding agrees with the results from the national health survey
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14 327 on the Iranian population [14]. Another Indian study found no significant difference in age
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16 328 and sex scores in their study [43]. Higher women prevalence can be partially explained that
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18 329 they have a lower pain threshold than men [44]. The sex differences may be implied with
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20 330 gonadal steroid hormones like estradiol and testosterone that modulate sensitivity to pain and
21
22 331 analgesia [45]. Women always experienced a higher frequency of visceral pain (e.g., during
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24 332 menstruation, pregnancy) than men [46]. It seems that in painful conditions, women exhibit a
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26 333 greater prevalence than men as women report more pain [47].
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30 335 Leboeuf-Yde considered body weight as a possible weak indicator for LBP in his systematic
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32 336 literature review due to lack of evidence [48]. The results obtained in our study did not
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34 337 demonstrate a statistically significant association between LBP and higher BMI. Some other
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36 338 studies found obesity or high BMI associated with increased risk LBP development and
37
38 339 severity [14, 49]. However, a cross-sectional study including nine countries found BMI
39
40 340 $\geq 25\text{kg/m}^2$ as a risk factor for LBP in five countries (Finland, Poland, Russia, South Africa
41
42 341 and Spain), whereas it was not associated with LBP in the remaining four countries (China,
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44 342 Ghana, India and Mexico) [50].
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47
48 344 In our research, we found that the absence of formal education is significantly associated with
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50 345 LBP. A cross-sectional study in the United States found that LBP is more common in people
51
52 346 who have had less than high school education [51]. Other studies in the USA, UK, and Iran
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54 347 found lower educational status had an increased association with LBP and found higher
55
56 348 education inversely associated with LBP [14, 52]. Several proposed mechanisms may
57
58 349 account for the relationship between low academic status and back pain. The amount of
59
60 350 formal education contributes to the types of jobs that an individual may involve in, and
351 subsequently, the types of jobs influence LBP [53]. Moreover, health education regarding
352 posture management, lifestyle changes, physical exercises, stress management poorly reached
353 among people with an absence of formal education. We didn't find any significant association

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4 354 of LBP with occupation. However, in our opinion, the larger number of homemakers affected
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6 355 with LBP might be linked with their nature of heavy work such as squatting, bending lifting
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8 356 heavy objects, prolonged standing etc. in the household. In a US-based study, LBP was
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10 357 significantly related to occupational factors such as truck driving, lifting, carrying, pulling,
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12 358 pushing, twisting, and non-driving vibrational exposure [54]. In some European countries,
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14 359 workers involved in heavy weightlifting (≥ 25 kg) suffered more from LBP [55].

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16 361 Studies reported associations between LBP and lower social class [14, 51] but we did not find
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18 362 any significant association of LBP with economic status. This finding is coherent with a
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20 363 Danish study where they did not find any possible relationship between socioeconomic status
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22 364 and LBP [56]. In our analysis, trauma tended to be associated (unadjusted OR) with overall
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24 365 LBP, but the association was lost after adjustment. Trauma is not supposed to lead to chronic
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26 366 LBP and the persistence of back pain was more associated with psychological factors like
27
28 367 stress, low education status, etc., than trauma itself [57]. We found a positive relationship
29
30 368 between hypertension and LBP. LBP may cause inactivity and lack of exercise resulting
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32 369 in weight gain, subsequently creating or exaggerating co-morbid conditions like hypertension
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34 370 and diabetes mellitus. The Hong Kong Disc Degeneration-Cardiovascular Cohort showed
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36 371 that HTN increases the possibility of moderate or severe disc degeneration which is highly
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38 372 associated with LBP [58]. Another long-term Finish study revealed that both SBP and DBP
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40 373 were positively associated with LBP suggesting atherosclerosis of lumbar vessels a possible
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42 374 mechanism of development of LBP [59]. In a Korean survey, the lifetime prevalence of LBP
43
44 375 was 34.4% among the hypertensive respondents, but the adjusted OR of LBP prevalence was
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46 376 significantly lower than the normotensive subjects (fully adjusted 0.79, 95% CI 0.70-0.90)
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48 377 [60]. A Bangladeshi study conducted among the doctors working in a tertiary care hospital
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50 378 found that HTN was the most common comorbid condition among the LBP sufferers [61].
51
52 379 There was no association between diabetes and LBP in this study.

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54 381 ***Strengths and Limitations***

55 382 This is the first nationally representative survey report on LBP in Bangladesh, and probably,
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57 383 among all south Asian nations. Although we have weighted the data for national
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59 384 representation, the sample size calculation for the original study was based on point
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385 prevalence of MSD [19]. We now know that the prevalence of LBP was 19.4% and

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4 386 prevalence of MSD was 30.4%. A larger sample size maintaining adequate power was
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6 387 needed for generalizability of the study results. Therefore, a cautious interpretation is
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8 388 necessary because of inadequate sample size, especially when split into reporting domains.
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10 389 We have operationally defined the recall period for reporting work loss days as 12 months
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12 390 which might induce bias. Trained rheumatology residents diagnosed the patients which was
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14 391 verified by experienced rheumatologists in the field. Some diagnoses of evolving
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16 392 rheumatological conditions might lack sufficient validity because of a lack of
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18 393 adequate laboratory facilities in the field.
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20 395 **CONCLUSION**

21 396 This nationally representative study reports the population weighted prevalence of LBP by
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23 397 sociodemographic background, comorbidities and associated factors in Bangladesh. One in
24
25 398 five adults suffer from LBP. Education and hypertension are modifiable factors that warrant
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27 399 intervention. Increase in level of education, care to middle and older population, and good
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29 400 control of hypertension may reduce LBP burden. A special attention is needed to prevent
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31 401 LBP in women. Further study with a larger sample size addressing these neglected issues
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33 402 may have more clarifications to decrease the burden of LBP.
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4 **403 Abbreviations and acronyms:**
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6	BMI	Body mass index
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8	BSMMU	Bangabandhu Sheikh Mujib Medical University
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10	CI	Confidence interval
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12	COPCORD	Community oriented program from control of rheumatic diseases
13		
14	HAQ-DI	Health Assessment Questionnaire - Disability Index
15		
16	LBP	Low back pain
17		
18	MSK	Musculoskeletal
19		
20	MSD	Musculoskeletal disorder
21		
22	OR	Odds ratio
23		
24	PPS	Population proportion to size
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26	PSU	Primary sampling unit
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28	WHO	World health organization

29 **404**

30 **405 Acknowledgement:** We gratefully acknowledge the field team, divisional coordinators, civil
31
32 surgeons, upazila health and family planning officers and health assistants for their support.
33

34 **407**

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36 **408 Author contribution:**

37 **409** Muhammad Shoaib Momen Majumder (MSMM): Conceptualized the area of work, and
38 prepared the first draft of the manuscript and revised the subsequent drafts.
39

40 **411** Ferdous Hakim (FH): analyzed the data, guided preparation of graphs and tables, interpreted
41 the results, revised the draft manuscript, and coordinated the writing exercise.
42

43 **412** Iftexhar Hussain Bandhan (IHB): prepared graphs and tables, revised the draft manuscript.
44

45 **413** Mohammad Abdur Razzaque (MAR): reviewed the manuscript and with special reference to
46 the literature review.
47

48 **414** Ahmed Zahid-Al-Quadir and Shamim Ahmed: Prepared the training manual, trained the field
49 team, executed the field operation in coordination with the divisional investigators;
50

51 **417** Minhaj R Choudhury, Syed Atiqul Haq and Mohammad Mostafa Zaman: Designed the study,
52 guided the analysis and manuscript writing, critically reviewed the results and manuscript
53

54 **418** drafts, ensured integrity of data.
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56 **420** All authors: Approved publication.
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4 422 **Funding:** Preparing this manuscript did not require any funding. However, the base study
5 423 was supported by the World Health Organization, Bangladesh (Agreement Reference:
6 424 SEBAN140895) back in 2015. As a part of its mandate to strengthen national research
7 425 capacity, WHO provided technical guidance in designing, implementing, analysing data, and
8 426 writing the report. However, it does not have any influence on the results.
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14 428 **Consent to publish:** All authors contributed to the manuscript and provided consent to
15 429 publish.
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19 431 **Availability of data and materials:** The dataset used for this manuscript is available with
20 432 the corresponding author upon reasonable request.
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24 434 **Disclosure of Conflicts of Interest:** None of the authors has any conflict of interest to
25 435 disclose. The authors alone are responsible for their views expressed in this article, which do
26 436 not necessarily represent the institutions' views, decisions, or policies with which they are
27 437 affiliated.
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31 439 **Ethical Publication Statement:** We confirm that we have read the Journal's position on
32 440 issues involved in ethical publication and affirm that this report is consistent with those
33 441 guidelines.
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443 Tables

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445**Table 1. Characteristics of the respondents with LBP by unweighted and weighted numbers, Musculoskeletal Disease Survey 2015**

Sociodemographic characteristics	Unweighted sample (n=1,843)	Weighted* sample (N=94,794,164)
	number (percent)	number (percent)
Total	1843 (100.0)	94,794,164 (100.0)
Sex		
Men	892 (48.4)	41,553,976 (43.8)
Women	951 (51.6)	53,240,188 (56.2)
Residence		
Urban	716 (38.9)	27,772,657 (29.3)
Rural	1127 (61.2)	67,021,507 (70.7)
Age, years		
18-34	711 (38.6)	41,343,470 (43.6)
35-54	774 (42.0)	35,278,850 (37.2)
55-99	358 (19.4)	18,171,844 (19.2)

* Weighted to projected population of Bangladesh from 2001 Population Census Frame of Bangladesh Bureau of Statistics.

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Table 2. Weighted prevalence of low back pain by sociodemographic characteristics in Bangladesh, Musculoskeletal Disease Survey 2015

Sociodemographic characteristics	Total	Men	Women
	Percent (95% CI)	Percent (95% CI)	
Overall	18.5 (11.8–25.2)	13.1 (6.4–19.9)	22.7 (15.3–30.2)
Overall (age-standardized)*	19.4 (14.0–24.8)	14.0 (8.7–19.3)	27.2 (19.3–35.1)
Age in years			
18-34	10.5 (5.7–15.4)	5.2 (1.3–9.0)	13.5 (7.2–19.9)
35-54	23.1 (15.3–30.9)	18.8 (8.7–28.8)	26.7 (18.3–35.1)
55-99	27.8 (16.1–39.5)	15.7 (6.7–24.7)	44.5 (23.9–65.1)
Occupation			
Homemaker	23.6 (15.9–31.2)	–	23.6 (15.9–31.2)
Laborer†	18.2 (9.4–27.0)	17.9 (8.6–27.3)	21.2 (6.2–36.3)
Business professional	9.6 (1.9–17.2)	9.8 (1.9–17.6)	–
Service holder	10.7 (1.2–20.1)	10.3 (0.4–20.2)	–
Others‡	13.9 (4.1–23.6)	8.6 (1.7–15.5)	20.3 (6.0–34.6)
Education			
No formal education (0)	31.3 (22.3–40.4)	20.3 (13.4–27.2)	37.4 (24.3–50.5)
Any primary education (1-5)	13.3 (6.7–19.9)	12.1 (3.9–20.3)	14.4 (7.8–21.0)
Any secondary education (6-10)	14.9 (7.4–22.3)	12.0 (2.4–21.6)	17.5 (9.9–25.0)
Above secondary (≥11 years)	6.9 (3.8–10.1)	–	8.0 (3.7–12.3)
Married‡	19.6 (12.4–26.7)	14.1 (6.7–21.4)	23.7 (15.7–31.7)
Wealth index quartile§			
1st	23.5 (13.9–33.0)	19.5 (11.2–27.8)	25.5 (12.9–38.2)
2nd	19.8 (8.4–31.2)	17.3 (3.7–30.9)	21.6 (10.3–32.9)
3rd	14.1 (7.6–20.5)	8.3 (2.3–14.2)	19.8 (11.7–28.0)
4th	16.6 (9.3–23.8)	10.3 (3.2–17.4)	23.1 (11.5–34.7)
Residence			
Urban	14.6 (9.1–20.0)	9.8 (3.9–15.6)	17.7 (8.5–26.8)
Rural	20.2 (10.5–29.8)	14.3 (4.8–23.9)	25.1 (14.7–35.4)
Strenuous physical activity ^l	17.1 (4.3–29.8)	17.2 (4.0–30.4)	–
History of physical trauma	24.5 (14.2–34.7)	24.6 (13.0–36.2)	24.4 (7.9–40.9)

All values are percent (95% confidence interval). Weighted percentages shown are calculated from Census 2001 Population Frame by Bangladesh Bureau of Statistics to reflect projected population of Bangladesh (N=94,794,164).

Bold face values denote statistically significant higher prevalence in women compared to men.

* Standardized for WHO World Population 2000-2020.

† Labourer includes: farmer, daily worker, rickshaw puller, garments worker, field worker and others.

Other occupations: retired, weaver and housekeeper

‡ Includes currently married, divorced, separated and widowed.

§ The wealth index was constructed using principal component analysis out of a list of 20 household assets (see Methods section for details);

^l Fourth quartile of the MET-minutes distribution of work-related physical activity. Commutation and leisure time physical activities were not considered because these were negligible contributors.

– 95% confidence interval not reported as number of respondents are <25.

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Table 3. Socioeconomic characteristics of patients of low back pain in Bangladesh, Musculoskeletal Disease Survey 2015

Sociodemographic characteristics	Total	Men	Women
	Weighted percentage (95% confidence interval)		
Age in years			
Mean (95% confidence interval)	45.3 (43.0–47.7)	48.3 (45.8–50.9)	44.0 (41.0–47.0)
18–34	24.8 (18.8–30.7)	14.1 (6.9–21.3)	29.6 (21.3–37.9)
35–54	46.4 (40.6–52.2)	55.6 (40.3–70.9)	42.3 (34.4–50.2)
55–99	28.8 (22.5–35.1)	30.3 (17.0–43.7)	28.1 (22.2–34.0)
Occupation			
Homemaker	57.4 (48.2–66.6)	–	83.2 (72.0–94.5)
Laborer†	20.4 (13.6–27.2)	59.7 (38.8–80.5)	2.7 (0.1–5.4)
Business professional	5.2 (1.2–9.1)	16.6 (5.0–28.2)	–
Service holder	–	–	–
Others‡	13.5 (2.7–24.3)	14.8 (2.8–26.8)	13.0 (1.5–24.4)
Education			
No formal education (0)	53.2 (41.6–64.9)	39.1 (24.3–54.0)	59.6 (46.9–72.3)
Any primary education (1-5)	17.2 (13.8–20.5)	23.9 (17.1–42.6)	14.1 (10.1–18.1)
Any secondary education (6-10)	24.1 (15.9–32.4)	29.9 (17.1–42.6)	21.6 (13.1–30.1)
Above secondary (≥11 years)	5.5 (1.0–9.9)	–	–
Married‡	97.8 (94.8–100.8)	96.8 (92.2–101.3)	98.3 (95.5–101.1)
Wealth index quartile§			
1st	33.2 (22.6–43.9)	30.1 (18.8–41.4)	34.7 (21.7–47.7)
2nd	25.5 (14.8–36.2)	29.5 (11.5–47.5)	23.7 (14.6–32.7)
3rd	19.7 (11.0–28.4)	18.5 (6.7–30.3)	20.3 (10.5–30.1)
4th	21.6 (9.2–33.9)	21.9 (9.4–34.5)	21.4 (7.1–35.7)
Rural residence	77.0 (55.9–98.0)	80.3 (60.2–100.4)	75.5 (52.8–98.1)

* All values are percent (95% confidence interval) unless stated otherwise. Weighted percentages shown are calculated from Census 2001 Population Frame by Bangladesh Bureau of Statistics to reflect projected population of Bangladesh (N=94,794,164).

† Labourer include: farmer, daily worker, rickshaw puller, garments worker, field worker and others. Other occupations: retired, weaver and housekeeper etc.

‡ Includes currently married, divorced, separated and widowed.

§ The wealth index was constructed using principal component analysis out of a list of 20 household assets (see Methods section for details);

- numbers are low

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Table 4: Odds ratios of factors associated with low back pain compared with no musculoskeletal disorders in Bangladeshi adults, Musculoskeletal Disease Survey 2015

Factors	Odds ratio (95% confidence interval)	
	Unadjusted	Adjusted
Age group, years (35–99=1, 18–34=0)	3.2 (2.5–4.2)** 1.0	2.4 (1.7–3.4)** 1.0
Sex (woman=1, man=0)	2.1 (1.3–3.3)** 1.0	2.2 (1.5–3.3)** 1.0
Labourer† (yes=1, no=0)	0.9 (0.7–1.3) 1.0	- -
No formal education (yes=1, no=0)	3.5 (2.5–5.0)** 1.0	2.3 (1.6–3.3)** 1.0
Low wealth index (yes=1, no=0)	1.6 (1.1–2.3)** 1.0	1.0 (0.6–1.5) 1.0
Strenuous physical activity‡ (yes=1, no=0)	0.8 (0.4–1.6) 1.0	- -
Obesity (body mass index ≥ 25 Kg/m ²) (yes=1, no=0)	1.3 (0.8–2.1) 1.0	- -
History of physical trauma (yes=1, no=0)	1.8 (1.1–3.2)* 1.0	1.6 (0.9–2.8) 1.0
Current tobacco user (yes=1, no=0)	1.1 (0.8–1.6) 1.0	- -
Hypertension (yes=1, no=0)	2.3 (1.3–4.0)** 1.0	1.7 (1.1–2.6)* 1.0
Diabetes mellitus (yes=1, no=0)	1.0 (0.5–1.7) 1.0	- -

LBP: low back pain; MSD: musculoskeletal disorder

* $P < 0.05$, ** $P < 0.01$

† Labourer includes: farmer, daily worker, rickshaw puller, garments worker, field worker and others.

‡ Fourth quartile of the MET-minutes distribution of work-related physical activity. Commutation and leisure time physical activities were not considered because these were negligible contributors.

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4 **455 Figures**
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6 **456 Fig. 1 Flow chart on the selection of low back pain patients from the national survey on**
7 **457 musculoskeletal conditions in Bangladesh (2015) adapted from Ahmad Zahid-Al-**
8 **458 Quadir *et al* [21]**
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10 **459**
11 **460** * Eight divisions from Sept 2015. Randomly 15 districts were selected out of 64.

12 **461** ** PPS indicates population proportion to size.

13 **462** *** Out-migration, broken house, locked house, no tenant, out of home, refusal. Two recall visits were done if
14 **463** the selected house was locked and the person chosen was not available at home at the time of the interviewer's
15 **464** visit. In case of non-participation after the second recall visit, the targeted household/individual was declared
16 **465** non-respondents.

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4 **471 Fig. 2 Weighted prevalences (percent) of low back pain in co-morbid conditions (error**
5 **472 bars indicate 95% confidence intervals)**

7 *Diabetes was defined as random capillary glucose level ≥ 11.1 or on medication for diabetes

8 †Obesity is defined as, body mass index ≥ 25 kg/m²;

9 ‡Hypertension was defined as systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 or medication for
10 hypertension;

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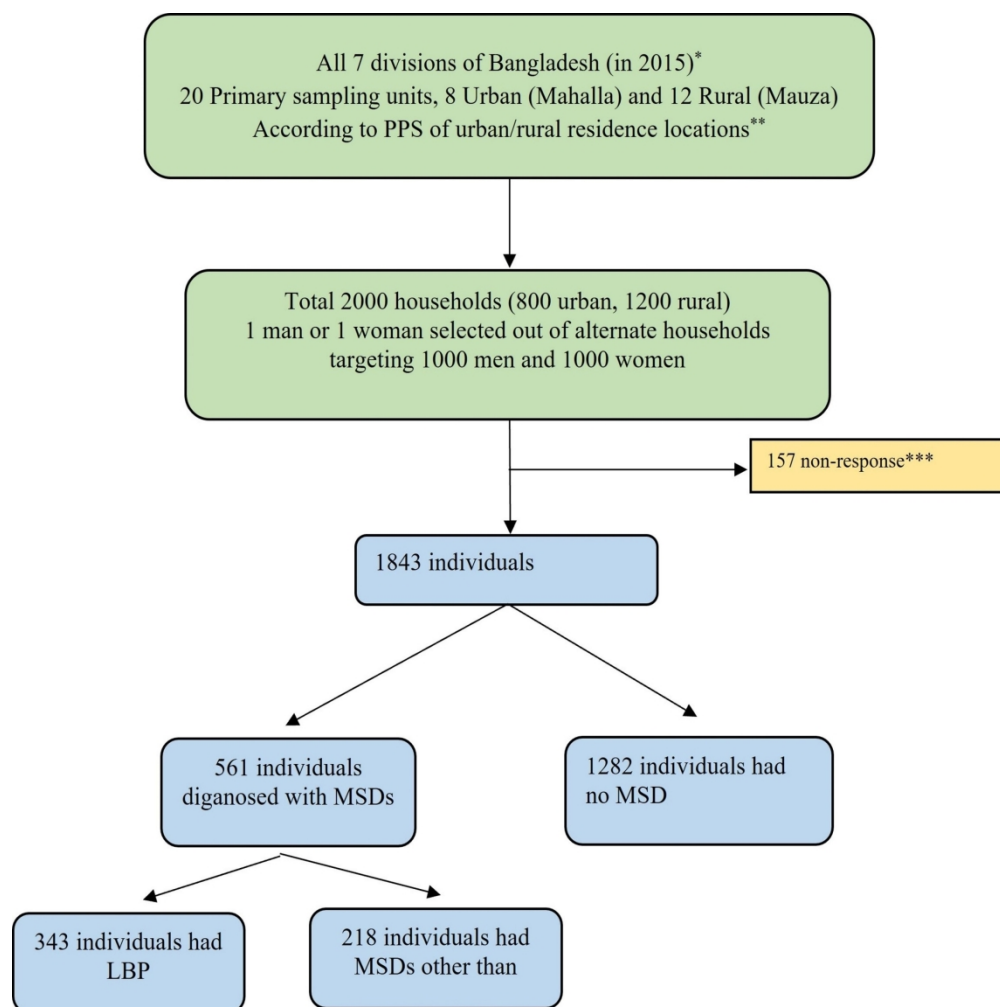
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39 Caption:

40 Fig. 1 Flow chart on the selection of low back pain patients from the national survey on musculoskeletal
41 conditions in Bangladesh (2015) adapted from Ahmad Zahid-Al-Quadir et al 21

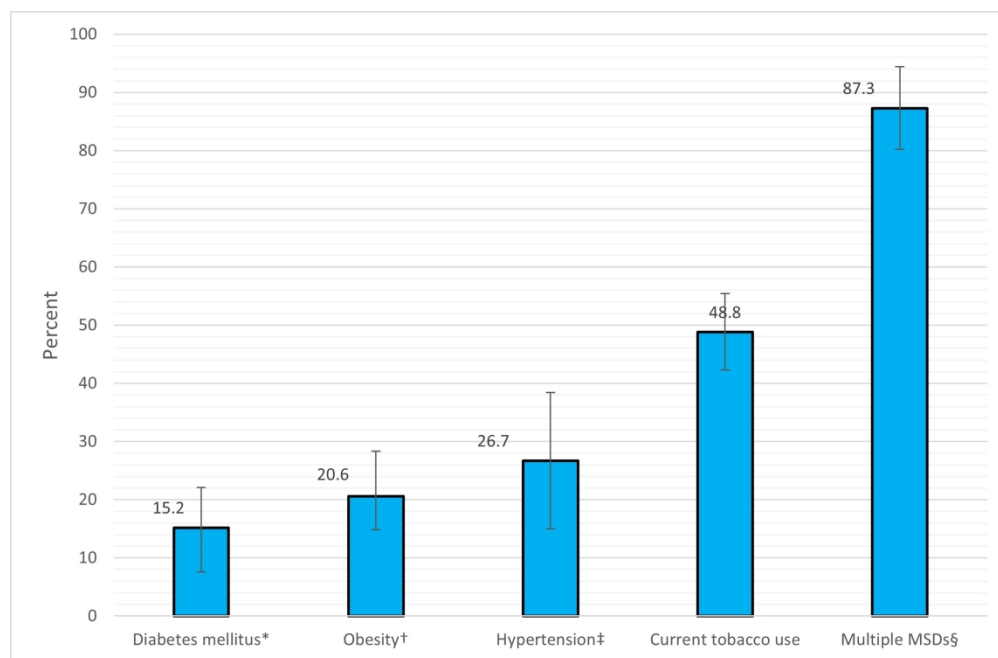
42 Legend:

43 * Eight divisions from Sept 2015. Randomly 15 districts were selected out of 64.

44 ** PPS indicates population proportion to size.

45 *** Out-migration, broken house, locked house, no tenant, out of home, refusal. Two recall visits were
46 done if the selected house was locked and the person chosen was not available at home at the time of the
47 interviewer's visit. In case of non-participation after the second recall visit, the targeted
48 household/individual was declared non-respondents.

49 190x190mm (330 x 330 DPI)



Caption:Fig. Weighted prevalences (percent) of low back pain in co-morbid conditions (error bars indicate 95% confidence intervals)Legend:*Diabetes was defined as random capillary glucose level ≥ 11.1 or on medication for diabetes†Obesity is defined as body mass index ≥ 25 kg/m²;‡Hypertension was defined as systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 or medication for hypertension

597x389mm (330 x 330 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4, 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5, 6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5, 6
Bias	9	Describe any efforts to address potential sources of bias	5, 6
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	7
		(e) Describe any sensitivity analyses	Not applicable
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5, 22
		(b) Give reasons for non-participation at each stage	19
		(c) Consider use of a flow diagram	19
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 8
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	8, 9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9
		(b) Report category boundaries when continuous variables were categorized	6
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	3
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11, 12
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.