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An assessment of staffing needs for physicians and nurses at Upazila Health Complexes in Bangladesh using WHO workload indicators of staffing need (WISN) method

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1 ****Title page**

2 **An assessment of staffing needs for physicians and nurses at Upazila Health**
3 **Complexes in Bangladesh using WHO workload indicators of staffing need**
4 **(WISN) method**

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23 **Abstract**

24 **Objective** This study aimed to assess the current workload and staffing need of Physicians and
25 Nurses for delivering optimum health care services at the Upazila Health Complexes (UpHCs) in
26 Bangladesh.

27 **Design** Mixed-methods, combining qualitative (e.g., document reviews, key informant interviews,
28 in-depth interviews, observations) and quantitative methods (time-motion survey)

29 **Setting** Study was conducted in 24 health facilities of Bangladesh. However, UpHCs being the
30 nucleus of primary health care in Bangladesh, this manuscript limits itself to reporting the findings
31 from the providers at four UpHCs under this project.

32 **Participants** 18 Physicians and 51 Nurses, males and females.

33 **Primary outcome measures** Workload components were defined based on inputs from five
34 experts, refined by nine service providers. Using WHO WISN software, standard workload,
35 category allowance factor, individual allowance factor, total required number of staff, WISN
36 Difference, and WISN Ratio were calculated.

37 **Results:** Physicians have Very High (WISN Ratio 0.43) and Nurse High (WISN Ratio 0.69)
38 workload pressure. 50% of Nurses' time are occupied with support activities, instead of nursing
39 care. There are different workloads among the same staff category in different health facilities. If
40 only the vacant posts are filled, the workload is reduced. In fact, sanctioned number of Physicians
41 and Nurses is more than actual need.

42 **Conclusions:** It is evident that high workload pressures prevail for Physicians and Nurses at the
43 UpHCs. This reveals high demand for these health workforces in the respective sub-districts.
44 WISN method can aid the policy-makers in optimizing utilization of existing human resources.
45 Therefore, the government should adopt flexible health workforce planning and recruitment policy

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3 46 to manage the patient load and disease burden. WISN should thus be incorporated as a planning
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5 47 tool for health managers. There should be a regular review of health workforce management
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8 48 decisions, and these should be amended based on periodic reviews.
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12 13 50 **Strengths and limitations**

- 15 51 • Time-motion study helped the research team gain a better understanding of the service
16
17 52 context of the staffs. When the key informants or experts suggested an unrealistic activity
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20 53 standard, we presented them the time-motion findings and helped them suggest more
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22 54 context sensitive standards.
- 25 55 • Using both qualitative and quantitative methods for primary data collection complemented
26
27 56 each other for bringing data accuracy.
- 29 57 • Technical inputs from the WHO technical experts in WISN application in other countries,
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31 58 and officials of the Ministry of Health improved the data quality as they were directly
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34 59 involved in quality checks at the field level.
- 36 60 • One limitation was that some service statistics data, essential for establishing standard
37
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39 61 workloads, were unavailable.
- 41 62 • Due to lack of scope in WISN methodology, patient engagement was minimal.

43 44 63 **Keywords**

46 64 Human Resources for Health, Workforce Management, Workload Indicators of Staffing Need,
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49 65 Bangladesh, Upazila Health Complex, Health Systems
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67 **Background**

68 Shortage of Human Resources for Health (HRH) has been one of the major challenges faced by the
69 health system and globally, more than 90 countries are haunted by this crisis. According to
70 International Labor Organization (ILO), there are on average 34.5 health workers per 10,000
71 population and about one third of the world's population lack access to health care because of
72 shortage of health workforce¹. According to the Global strategy on human resources for health:
73 workforce 2030, the estimated global shortage of skilled health workers will be around 18 million
74 by 2030². This problem has reached a critical stage in three (Bangladesh, Myanmar and Bhutan)
75 South-East Asia Region countries with <23 health workers (doctors, nurses and midwives)
76 per 10,000 population, limiting access to health services³.

77
78 Improving health workers' performance and productivity is vital for better health service provision
79 in the country. Poor performance of the health workers has been reported in the literature resulting
80 from too few staff, or staff not providing care according to standards^{4,5,6}. The extent of the shortage
81 is reflected in health worker density rates and workforce vacancy rates, and its impact in health
82 system performance indicators. Factors that contribute to poor performance of health workers
83 include limited employment opportunities and low salaries; poor working conditions, weak
84 support and supervision, and limited opportunities for professional development⁷.

85
86 Bangladesh's health workforce scenario is characterized by "shortage, inappropriate skill mix and
87 inequitable distribution"^{8,9}. Equitable access to skilled and motivated health worker in a functional
88 health system is essential for achieving Universal Health Coverage (UHC) and the Sustainable
89 Development Goals¹⁰. In 2015, Government of Bangladesh (GoB) approved the Bangladesh

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3 90 Health Workforce Strategy which affirms government's vision of equitable availability of skilled,
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5 91 motivated and responsive health workforce in adequate numbers across the country¹¹. However,
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7 92 there is lack of comprehensive, nationally representative data on HRH workload and optimum staff
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9 93 need in health care facilities in Bangladesh. A small scale qualitative study found overwhelming
10
11 94 workload as one of the critical components that hinders retention of doctors and nurses at rural
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13 95 healthcare facilities in Bangladesh¹². Another policy analysis on retention of HRH (physicians and
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15 96 nurses) also found that deficiency of adequate workforce and consequent high workload acted as
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17 97 a deterrent against rural retention¹³.

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24 99 Workload management is very important for any country or institution to deliver quality services,
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26 100 retain staffs and reduce turnover¹⁴. Even the seminal document on HRH, "Global strategy on
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28 101 human resources for health: Workforce 2030", emphasized on developing country level workforce
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30 102 strategies, drawing on workload analysis studies¹⁵. Such studies can provide detailed insight into
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32 103 the current state of workload in a system, coping strategies of the staff for regular extra work
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34 104 pressure, causes behind the excessive workloads, and ways to deal with it. This study aimed to fill-
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36 105 in this knowledge gap with respect to workload and optimum staff need for physicians and nurses
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38 106 at the Upazila or Sub-district level (i.e., at Upazila Health Complex [UpHC]). It is expected that
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40 107 this workload analysis will contribute in improving performance, ensuring quality of services, and
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42 108 facilitating uninterrupted service delivery through efficient management of staff.
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50 110 **Workload Indicator of Staffing Need (WISN) overview**

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53 111 WHO developed the Workload Indicator of Staffing Need (WISN) method in 1998, which was
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55 112 later updated based on learning from implementation in different countries. This method is simple,
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3 113 useful and time-saving, which was borrowed from the industrial sector for use in the health sector
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5 114 by Peter Shipp in 1984. The result is expressed in terms of differences and ratios, the former
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7 115 indicating worker shortage or surplus, and the latter workload pressure experienced by the staff¹⁶.
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12 117 WISN results help in human resource decision-making in several ways (Figure 1). For example,
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14 118 recruitment and transfer of HRH can be based on geographic comparison of WISN ratios, staffing
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16 119 of health facilities can be informed by WISN-based workload projection, etc.

19 120 **Methods**

23 121 **Study design**

25 122 We followed the updated WISN manual¹⁶, but contextualized it for Bangladeshi setting. The WISN
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27 123 steps have been summarized in Figure 2. The research project was developed based on close
28
29 124 collaboration among and mutual insights from three types of committees:

- 32 125 1. **Steering Committee (SC):** The SC was consisting 13 members, established by the Ministry
33
34 126 of Health and Family Welfare (MOHFW) with membership from senior government officials
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36 127 (seven): WHO official (one); professional organization of the physicians, Bangladesh Medical
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38 128 Association (one); and relevant academia (four) such as BRAC University (two persons),
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40 129 Bangladesh University of Health Sciences, and Center for Medical Education. All seven senior
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42 130 government officials were directly involved in decision making regarding daily management
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44 131 of the health workforce in their respective departments. WHO officer was there to respond to
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46 132 WISN related technical issues and application. All four academicians were part of the
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48 133 committee because they had expertise in their respective areas (i.e. education, policy making,
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50 134 curriculum development and performance assessment) of the health workforce. They were also
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3 135 well known in the community of scientific writing and academic teaching. The role of the SC
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5 136 was to guide and endorse the overall study based on the WISN strategy and its implementation.
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8 137 2. **Technical Taskforce (TT):** TT was responsible for guiding the implementation of the WISN
9
10 138 process. Researchers from implementing research institution (the school of public health of a
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12 139 Bangladeshi university, BRAC University); and experts from WHO Bangladesh Country
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14 140 Office; an international non-governmental organization (NGO), Save the Children; and
15
16 141 another university, Bangladesh University of Health Sciences served in the Taskforce.
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18

19 142 3. **Expert Working Groups (EWG):** There were multiple EWGs, one for each of the following
20
21 143 professional groups: General Physicians (Medical Officer [MO], Emergency Medical Officer
22
23 144 [EMO], Residential Medical Officer [RMO]), and Nursing Staff (Senior Staff Nurse, Nursing
24
25 145 Supervisor). The respective EWG defined the workload components and set activity standard
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27 146 for the specific staff category.
28
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30
31 147 The qualitative part of this research involved document reviews, key informant interviews (KII)
32
33 148 with policy level persons related to HRH issues in Bangladesh (mostly from among SC and EWG
34
35 149 members), in-depth interviews (IDI) with individual service providers (e.g., physicians, nurses,
36
37 150 etc. working in UpHCs under this study), and observations. The quantitative component involved
38
39 151 time-motion survey which is a work measurement technique for recording the times and rates of
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41 152 working for the elements of a specific job though observing a subject continuously or in a certain
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43 153 period of time¹⁷. Time motion data served as a guide to determine the activity standard for WISN
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45 154 analyses.
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156 **Study duration, setting and population**

157 The research continued from July to November 2017 and was carried out in two pre-selected
158 Districts of Bangladesh (Figure 3):

- 159 • Jhenaidah, located in south-western part of Bangladesh, under Khulna Division
- 160 • Moulvibazar, located in north-eastern part of Bangladesh, under Sylhet Division

161
162 The selection of the districts was made by the Human Resources Unit, Ministry of Health and
163 Family Welfare **in collaboration with the development partners (Save the Children and WHO**
164 **Bangladesh) in a workshop nationally organized in November 2016. Later the selection of**
165 **the UpHCs was made in consultation with the SC, taking into consideration some**
166 **performance indicators such as** number of beds, number of total deliveries, number of live births,
167 bed occupancy rates as well as patient load including the number of outpatient visits. **From each**
168 **district, two highest performing UpHCs were included in the study**¹⁸. Thus, Shailkupa and
169 Kotchandpur UpHCs were selected from Jhenaidah District and Kulaura and Sreemangal from the
170 Moulvibazar. Because future applications need to be based on optimum quality standards, the
171 highest performing UpHCs were selected to serve as a model for other health facilities. From each
172 of these four UpHCs, physicians (Medical Officers and Residential Medical Officers) and nurses
173 (Senior Staff Nurse and Nursing Supervisor) were included for workload analysis. A total of 24
174 health facilities from the two districts were studied. This included two district hospitals, four
175 UpHCs, two Maternal and Child Welfare Centers, eight Union Sub Centers, eight Union Health
176 and Family Welfare Centers, and eight Community Clinics. This manuscript reported findings
177 from all the four UpHCs under this study, as UpHCs are the nucleus of the primary health care
178 delivery in Bangladesh, serving the rural population.

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56 180 **Sampling strategy**
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89 181 **Qualitative part**
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12 182 Documents for review were selected based on the suggestions from the experts (members of SC,
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14 183 TT, and EWG), supplemented by reference tracking of government reports and published literature
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16 184 on HRH of Bangladesh. Key Informants were selected on the principles of purposive sampling¹⁹,
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18 185 supplemented by snowball sampling (i.e., based on the reference or suggestion from the key
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20 186 informants). IDI respondents were selected through purposive sampling, based on the respondent's
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22 187 seniority and designation (e.g., Residential Medical Officer, Nursing Supervisors, etc.). These
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24 188 respondents were practicing individuals and had more than 10 years of experience and played a
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26 189 supervisory role in their respective health facilities.
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3233 191 **Quantitative part**
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36 192 For time-motion study, time sampling was done for each consenting staff available during the data
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38 193 collection period. Field Data Collectors (FDCs) observed each staff twice for 45-minutes duration,
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40 194 once during the first half of their service duration and again during the second half. This was done
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42 195 to minimize the bias in the time data due to the patient load (assuming higher patient load in the
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44 196 first half and lower in the second).
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198 **Tool development, pretest, training of data collectors, agreement test**

199 For qualitative data collection, semi-structured guidelines, including that for document reviews,
200 KIIs, IDIs, and observation, were developed. For the time-motion study, structured observation
201 tool was designed. The structured observation tools contained three sections:

- 202 1. Background information of observation setting and the person under observation
- 203 2. Time-motion data sheet (containing three columns: type of activity, time spent in minutes,
204 and remarks)
- 205 3. Example of the activities (health service activities, support activities, and additional
206 activities)

207
208 Health service activities, according to WISN manual, are performed by all members of the staff
209 category and regular service statistics are available for them for example, obstetrical service,
210 emergency service, outpatient service, etc. Support activities are also performed by all members
211 of the staff category, but regular service statistics are not available for them for example, record
212 keeping and reporting, attending meetings, instrument sterilization, etc. Additional activities are
213 performed by only certain members of the staff category (e.g., the supervisor or a senior member),
214 and regular service statistics are not available for them for example, duty roster preparation,
215 preparing staff evaluation reports, supervision of cleanliness, etc.¹⁷.

216
217 The examples of health service activities were primarily drawn from the list of the activities
218 mentioned in the Essential Services Package (ESP)²⁰ for respective health facility type. Since
219 service statistics were not available according the ESP activity list, it was adjusted for the local
220 context with inputs from the respondents (through KII, followed by IDI), in alignment with the

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3 221 availability of service statistics. An ‘hourglass’ approach was adopted for defining the workload
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5 222 components based on the ESP (Figure 4). Tools were pre-tested in a UpHC near Dhaka, before
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7 223 applying for actual data collection. Qualitative tools were also pre-tested through mock IDIs and
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9 224 KIIs. The pre-testing exercise was followed by the training of the Field Supervisors (FSs) and
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11 225 Field Data Collectors (FDCs).
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18 227 **Data collection and quality control**

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20 228 At first, FSs were sent to respective districts to orient the personnel on the project, seek support,
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22 229 and assess the availability of the service statistics. The FSs spent one week in each district and
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24 230 conducted qualitative observation of the service provision at the UpHCs, to gain a firsthand
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26 231 understanding of the context.
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32 233 In the second step, we conducted five KIIs to define workload components, in light of the ESP
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34 234 document’s standard of services by facility level²⁰. The workload components were further refined
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36 235 based on IDIs with a total of eight physicians and eight nurses.
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41 237 In the third step, the FDCs, under the supervision of FSs, conducted time-motion study, using a
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43 238 mobile device (SurveyCTO software). During the time FDCs were collecting time-motion data,
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45 239 the FS, in addition to supervising the FDCs, conducted additional IDIs and collected data on
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47 240 available working time; time required for health service, support, and additional activities; and
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49 241 service statistics.
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243 The next step was data validation and set activity standards. Primary data validation was done
 244 through phone calls made to the services providers, and health facility statisticians. Secondly, these
 245 were shared with the SC and TT members. Finally, interviews were conducted with the EWG
 246 members to finalize the activity standards (Table 1).

248 **Table 1 Number of interviewees representing EWG of staff categories**

EWG representing staff category	Number
Physicians: MO, EMO, RMO	2
Nurses: Nursing Supervisor, Senior Staff Nurse	7
Total	9

250 We presented the time-motion findings to the EWG members and requested them to be as realistic
 251 as possible in suggesting activity standards. We also requested them to account for the variability
 252 of patient load due to factors such as seasonality, timing of day, facility catchment population, etc.
 253 Finally, through multiple meetings, debates and deliberations, the activity standard was finalized,
 254 taking into account the information from the IDIs and KIIs, and inputs from the EWG members
 255 (Table 2).

257 **Table 2 Service standard for Physicians and Nurses in UpHCs, Bangladesh, 2017**

Activities	Service standard		Unit
	Physician	Nurse	

Obstetrical Service (Caesarean Section) ^a	90	90	min/patient
Obstetrical Service (Normal Delivery)	60	120	min/patient
Newborn Management	15	15	min/inpatient day
Emergency Service	15	Not applicable	min/patient
IMCI/ Nutritional Service	15	15	min/patient
OPD Service (including NCD management)	10	Not applicable	min/patient
First ANC	20	20	min/patient
Follow-up ANC	10	10	min/patient
PNC	15	15	min/patient
Indoor Services (Round, including minor bedside procedures) ^b	25.65	34	min/inpatient day
Bedside patient care	Not applicable	17	min/inpatient day
Patient admission and discharge	Not applicable	20	min/inpatient day
Death certification and associated arrangements	20	30	min/patient

258 **Note:** ^aFor Nurses: Assist Obstetrical Service (Caesarean Section); ^bFor Nurses: Indoor Services
 259 (Round with Physician)

260 # IMCI: Integrated Management of Childhood Illness; OPD: Out Patient Department; NCD: Non-
 261 communicable Diseases; ANC: Antenatal Care; PNC: Postnatal Care.

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7 263 In order to ensure the quality of data, the Principal Expert (lead author of this article), Co-experts
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9 264 (two co-experts – one was leading data collection and the other was leading data quality check and
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11 265 reporting), WHO team consisting of national and international technical experts, and officials from
12
13 266 the Human Resource Branch of Ministry of Health and Family Welfare (MoHFW) conducted field
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15 267 visits to each study District and the health facilities therein. During the time-motion data collection
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17 268 period, the Co-experts monitored the data and their geographic location in real-time. They also
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19 269 regularly checked the consistency of the data. Our field based data collection team saved contact
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21 270 information of all the respondents; so, in case of any confusion or need for clarification, the Co-
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23 271 experts called the respondents over phone.
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31 **Data management and analysis**

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34 274 The first analytic step was to estimate available working time of the staffs. This is the time a health
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36 275 worker has available in one year to do his or her work, taking into account authorized and
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38 276 unauthorised absences¹⁷. For all categories of staff, a uniform number of weeks per year (52
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40 277 weeks), working days in one week (six days), possible working days in one year ($52 * 6 = 312$
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42 278 days) were estimated. Next, absent days, such as public holidays (20 days), earned leave (average
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44 279 for each staff category, based on Health Management Information System data), and casual leave
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46 280 (20 days) were deducted to obtain the annual working time in days. Multiplying this with daily
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48 281 working hours (six hours per day), we obtained annual working time in hours.
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3 283 Workload components were defined through the inputs from the key informants; activity standards
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5 284 were also set through the interviews with the EWG members. An activity standard is the time
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8 285 necessary for a well-trained, skilled and motivated worker to perform an activity to professional
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10 286 standards in the local circumstances¹⁷. Both service standards (for health service activities),
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12 287 category allowance standards (for support activities), and individual allowance standards (for
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15 288 additional activities) were determined in the same way.

16
17 289 The next analytic step was to establish standard workload, which was done by dividing the annual
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19 290 working time by unit time of health service activities. A standard workload is the amount of work
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21 291 within a health services workload component that one health service provider can do in a year
22
23 292 hypothetically¹⁷. Then category allowance factor and individual allowance factors were calculated
24
25 293 using the following formula, respectively:

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28 294 $\text{Category allowance factor} = 1 / \{1 - (\text{Total category allowance standard} / 100)\}$

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31 295 $\text{Individual allowance factor} = \text{Total individual allowance standard} / \text{Available working time in}$
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33 296 hours

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38 298 Next, exact number of required staff was calculated by the following formula:

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40 299 $\text{Total required number of staff} = (\text{Staff needed for health service activity} * \text{Category allowance}$
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42 300 $\text{factor}) + \text{Individual allowance factor}$

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45 301 The fractional results were rounded up or down, following the guideline provided in the WISN
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47 302 manual¹⁷:

- 48
49 303 • 1.0 – 1.1 is rounded down to 1 and >1.1 – 1.9 is rounded up to 2
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51 304 • 2.0 – 2.2 is rounded down to 2 and >2.2 – 2.9 is rounded up to 3
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54 305 • 3.0 – 3.3 is rounded down to 3 and >3.3 – 3.9 is rounded up to 4
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3 306 • 4.0 – 4.4 is rounded down to 4 and >4.4 – 4.9 is rounded up to 5
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5 307 • 5.0 – 5.5 is rounded down to 5 and >5.5 – 5.9 is rounded up to 6
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10 309 Finally, based on the existing number of staff in the respective health facilities, we calculated both
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12 310 the difference (current number of staff – required number of staff by WISN), and the ratio (current
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14 311 number of staff / required number of staff by WISN). The WISN difference indicates whether the
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16 312 health facilities are relatively understaffed (i.e., when the WISN difference is negative),
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18 313 overstaffed (i.e., when the WISN difference is positive), or balanced (i.e., when the WISN
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20 314 difference is zero). The WISN Ratio indicates whether the staffs are experiencing high workload
21
22 315 (i.e., when the WISN Ratio is lower than one), low workload (i.e., when the WISN Ratio is higher
23
24 316 than one), or normal workload (i.e., when the WISN Ratio is equal to one). For this calculation,
25
26 317 we used the de-facto number of current staff, i.e., the number of staff that we actually found
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28 318 working in the health facilities during our data collection period; not the number shown in the
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30 319 office records or statistics.
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39 321 **Ethical considerations**

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41 322 Ethical approval for this study was obtained from the Ethical Review Committee (ERC) of BRAC
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43 323 James P Grant School of Public Health, BRAC University. All ethical principles, were strictly
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45 324 adhered to. Appropriate consent process was followed before collecting any research data.
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51 326 **Results**

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327 **General WISN findings across levels**

328 For descriptive purposes, we have categorized the workload pressure as Extremely High (WISN
 329 Ratio between 0.10 and 0.29), Very High (WISN Ratio between 0.30 and 0.49), High (WISN Ratio
 330 between 0.50 and 0.69), Moderately High (WISN Ratio between 0.70 and 0.89), Normal (WISN
 331 Ratio between 0.90 and 1.19), and Low (WISN Ratio greater than or equal to 1.20). Based on this
 332 categorization, at an aggregate level (i.e., considering the average required number and WISN
 333 Ratio across the same types of health facilities), physicians are found to have a Very High (WISN
 334 Ratio 0.43) and nurses High (WISN Ratio 0.69) workload pressure. To cope with the workload,
 335 on an average 11 physicians (on average 4.50 were available during data collection) and 19 nurses
 336 (On average 12.75 were available during data collection) are needed in each UpHC (Table 3). This
 337 means, there was an average deficit of six members in each staff categories.

338
 339 **Table 3 Analysis of WISN results at aggregate level (average required number and WISN**
 340 **Ratio across same types of health facilities)**

36 Staff	37 Required staff to	38 Average	39 Deficit	40 Average	41 Workload
42 category	43 cope with the	44 number of	45 of staff	46 WISN	47 pressure
	48 demand	49 existing staff		50 Ratio	
51 Physician	52 10.59	53 4.50	54 6.09	55 0.43	56 Very high
57 Nurse	58 18.86	59 12.75	60 6.11	0.69	High

341

342 Tabulating the total percentage of time spent on all support activities (i.e., category allowance
 343 standards) by different staff categories, we found that, 50% of nurses' time are occupied with
 344 support activities (Table 4).

346 **Table 4 Comparison of Support Activities across staff categories**

Staff category	Total % of support activities
Physician	24%
Nurse	50%

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348 **WISN results disaggregated by UpHCs**

349 The required number of staff ranges from eight to 12 among Physicians, and 16 to 23 among
 350 Nurses. Highest shortage is observed in Nurses of Sreemangal UpHC (-8.46), followed by
 351 Physicians of Kulaura UpHC (-8.28). Workload pressure is the highest among Physicians of
 352 Kotchandpur UpHC (WISN Ratio 0.28) and lowest among Nurses of Shailkupa (WISN Ratio 0.87)
 353 (Table 5).

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355 **Table 5 Analysis of WISN results of Upazila level health staff**

Health facility	Current number of staff	Required number, based on WISN	Shortage or excess	WISN Ratio	Workload pressure
Staff category: Physician					

Shailkupa UpHC	4	8.14	-4.14	0.49	Very High
Kotchandpur UpHC	3	10.71	-7.71	0.28	Extremely High
Kulaura UpHC	4	12.28	-8.28	0.33	Very High
Sreemangal UpHC	7	11.23	-4.23	0.62	High
Staff category: Nurse					
Shailkupa UpHC	14	16.08	-2.08	0.87	Moderately High
Kotchandpur UpHC	15	22.80	-7.8	0.66	High
Kulaura UpHC	10	16.08	-6.08	0.62	High
Sreemangal UpHC	12	20.46	-8.46	0.59	High

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357 **Change of workload if vacancies are filled**

358 If the vacant posts are filled, understandably, the workload is reduced. In most of the cases,
 359 sanctioned number of Physicians and Nurses is more than what is actually needed to tackle the
 360 workload. However, only filling up the vacant posts are not enough in case of some of the staff
 361 categories, such as the Nurses at Kotchandpur and Physicians at Sreemangal (Table 6).

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363 **Table 6 Change of workload if vacancies in Physician and Nursing posts are filled**

Health facility	Staff category	Current number of staff	Required number, based on WISN	WISN Ratio	Sanctioned number of staff	WISN Ratio as per sanctioned number of staff
Shailkupa UpHC	Physician	4	8.14	0.49	10	1.25
	Nurse	14	16.08	0.87	21	1.31
Kotchandpur UpHC	Physician	3	10.71	0.28	20	1.82
	Nurse	15	22.80	0.66	20	0.87
Kulaura UpHC	Physician	4	12.28	0.33	20	1.67
	Nurse	10	16.08	0.62	26	1.62
Sreemangal UpHC	Physician	7	11.23	0.62	10	0.91
	Nurse	12	20.46	0.59	22	1.10

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365 **Discussion and recommendations**366 **Discussion**

367 Findings from this WISN study clearly indicates that the public-sector healthcare providers in
 368 Bangladesh are suffering from a very high workload pressure. Nurses are predominantly occupied
 369 with support activities rather than actual nursing care. There is unequal workload across UpHCs,
 370 indicating potential for workforce re-distribution. The unequal workload mainly stems from

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3 371 differing patient load, due to geographic location, number of catchment population, and
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5 372 epidemiological characteristics, at different UpHCs. Inappropriate number of sanctioned posts
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8 373 indicate the necessity of WISN-based workforce planning.
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12 375 High workload pressure may arise from absolute or relative shortage of health workforce. Absolute
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14 376 shortage appears when there is inadequate production of a particular staff category while relative
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16 377 shortage appears when health workforce is not distributed evenly between the urban and rural areas
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18 378 throughout the country for various reasons. For example, absolute shortage in HRH production is
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20 379 revealed by the fact that there are only 4.90 registered physicians and 2.90 registered nurses per
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22 380 10,000 populations¹⁸, rendering the country to be one of the 57 critical workforce shortage
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24 381 countries in the world⁶. On top of this absolute shortage, Bangladesh also suffers from relative
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26 382 shortage, as evidenced from the fact that physician to population ratio in urban areas is 1:1,500,
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28 383 but in rural areas it is 1:15,000²¹. Workload pressure has some serious consequences as well,
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30 384 namely, fatigue and burnout of service providers, lack of motivation, and compromised quality of
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32 385 care²². High workload is, however, not unique to Bangladesh. WISN studies in Low- and Middle-
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34 386 Income Countries (LMICs) like Namibia²³, Uganda²⁴, Kenya²⁵, Burkina Faso²⁶, and Iran²⁷ also
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36 387 identified high workload pressure among their HRH.
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44 389 It is expected that the nurses would spend most of their service times beside the patients, providing
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46 390 nursing care. Unfortunately, this is not the case in Bangladesh as well as in some other comparable
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48 391 settings. A qualitative study in Bangladesh showed, nurses' maximum time is spent on
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50 392 administrative and paperwork tasks²⁸. Excessive support activities of nurses is reported in studies
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52 393 conducted in Iran²⁷, and Uganda²⁴ as well. A recent WISN study conducted in Iran showed, nurses
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3 394 are overburdened; and support activities account for 31% of their workload²⁷. Nurses' excessive
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5 395 engagement in paperwork or other support activities may result from deficient human resource
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8 396 planning and management.
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12 398 Despite the fact that most of the staff are already overworked, staffs in some health facilities may
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14 399 be more so, compared to a neighboring one. Presence of different number of staffs causes
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16 400 fluctuation in the amount of workload at different health facilities. In places where workload of a
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18 401 staff category is 'Extremely High', some supports from nearby health facilities with lower
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20 402 workload should be sought. Or, in places where workload of a staff category is 'Normal' or 'Low',
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22 403 some support may be transferred to health facilities with higher workload. For example, in
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24 404 Sreemangal UpHC, there are seven physicians, with a High workload pressure. However,
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26 405 workload pressure in nearby Kulaura UpHC is Very High, with only four physicians (Table 5). At
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28 406 least one physician from Sreemangal can be reallocated to Kulaura to tackle the high workload.
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31 407 Similar action may be taken regarding the Nurses by transferring some from Shailkupa
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33 408 (Moderately High workload) to Kotchandpur (High workload). This is just an example how WISN
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35 409 can help in decision-making regarding allocation of human resources. Similar situation was
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37 410 identified in Namibia, where researchers suggested redistribution of health workers from one area
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39 411 to the other²³.
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47 413 We found that many posts remained vacant in different health facilities. Some staffs were not
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49 414 present at their service locations for various reasons, such as training, deputation to another health
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51 415 facility, etc. Even if the existing posts are filled-up, a large portion of the workload would be
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53 416 curbed. For example, according to the Standard Setup document of the Ministry of Public
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3 417 Administration, 18 physician posts (10 Junior Consultants, one Residential Medical Officer, seven
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5 418 Assistant Surgeons) have been proposed for a 50 bed hospital²⁹. We have found 4.5 Physicians on
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7 419 an average in each UpHC. The average required number is 11 (Table 3). Our proposition is that,
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9 420 even if it is not possible to reach the ideal workforce setup for a health facility, filling-up at least
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11 421 the vacant positions, and ensuring regular presence of all staffs would reduce the workload.
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13 422 Supportive supervision and monitoring of the staff is essential to ensure the presence of posted
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15 423 staff. Researchers in Namibia came up with the similar finding and proposed a similar solution for
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17 424 the problem²³. WISN was used over standard staffing schedule in HIV Clinics in Kenya as well to
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19 425 resolve a similar crisis²⁵.
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27 427 **Recommendations**

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29 428 Based on the findings and its in-depth analysis, we propose few short-term and long-term
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31 429 recommendations. The short-term recommendations require administrative or management
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33 430 decisions, relatively easier to implement and tackle the immediate crisis. On the other hand, the
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35 431 long-term recommendations demand radical policy amendments following careful examination.
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41 433 Short-term recommendations include: reallocation of staff from low workload areas to high
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43 434 workload areas, fill-up existing vacant positions and strengthen supervision and monitoring.
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45 435 Nurses are the most needed staff, the most overloaded, and are short in supply. On top of all these,
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47 436 they are burdened with support activities. If some of their support and additional activities can be
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49 437 shifted to other staff, nurses can devote their time better in nursing care.
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3 439 The study yields some long-term recommendations as well, for the policy-makers. For example,
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5 440 in order to increase the availability of workforce, especially Nurses, and decrease their workload,
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7 441 their number needs to increase. Hence, long term policy response is needed to increase the intake
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9 442 of nursing students, train them with quality education, and deploy them in larger numbers in a
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11 443 secure and gender-friendly work environment. In the same vein, incentives should be given to
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13 444 increase the number of nurses in both public and private sector educational institutions.
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15 445 Regulations should be developed and implemented so that medical colleges can be established
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17 446 only when a nursing school is established alongside. Otherwise, the skill-mix imbalance between
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19 447 physicians and nurses would jeopardize the quality of care. Quality and quantity of physicians
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21 448 should also increase.

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26 449 Secondly, since the Nurses are found to be predominantly engaged in support activities at the
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28 450 expense of actual patient care, a separate staff category for administrative/ support activities is
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30 451 greatly warranted. This will free up the valuable yet scarce clinical time of the service providers.

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33 452 Thirdly, instead of the existing approach of deploying a fixed number of workforce at all health
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35 453 facilities, a flexible recruitment and HRH planning is needed, based on patient load and disease
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37 454 burden. This can be supported by determination of absolute requirement of HRH in those health
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39 455 facilities by using the WHO methodology on workload indicators of staffing need. It is important
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41 456 to recognize that, decisions in health sector are very much contingent on the local context,
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43 457 especially the patient load, demographic drivers (e.g., age structure of the population, gender ratio,
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45 458 etc.), and epidemiologic profile. Therefore, the government should adopt flexible health workforce
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47 459 planning and recruitment policy in place to keep up with the local patient load and disease burden.
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49 460 The culture of bottom-up decision-making should be adopted eventually.
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462 **Strengths and limitations**

463 This study had a number of strengths. First, we conducted time-motion study, which helped the
464 research team gain a better understanding of the service context of the staffs. Secondly, when the
465 key informants or experts suggested an unrealistic activity standard, we presented them the time-
466 motion findings and helped them suggest a more context sensitive standards. Thirdly, the research
467 team used both qualitative and quantitative methods for primary data collection, which
468 complement each other for bringing data accuracy. Fourthly, WHO technical officers, who had
469 expertise in WISN application in other countries, and the Ministry of Health officials were directly
470 involved in the field level data quality checks.

471
472 However, despite careful planning and painstaking implementation of the research, we faced some
473 challenges during different stages of the WISN process. First, some service statistics data, which
474 were essential for establishing standard workloads, were not readily available due to poor record
475 keeping systems at some health facilities. Secondly, the research did not take into account the
476 patients' opinion or stakeholders' stance. Notwithstanding the fact that these perspectives are
477 gaining momentum in health workforce decision-making, we could not take advantage of them in
478 the interest of adhering to the highly structured nature of the WISN methodology. Thirdly, the
479 official number of existing staffs often did not match with the number of staffs we observed
480 providing services.

482 **Conclusions**

483 Human resource management is a big challenge, especially in a resource-poor setting like
484 Bangladesh. With a vision of becoming a middle-income country by 2021, Bangladesh needs to

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3 485 strive for optimizing its existing resources, including human resources. This type of study can aid
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5 486 the decision-making in this direction, using the WISN as a planning tool for the managers.
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7 487 Implementation research is needed regarding how this workload-based staffing decisions can be
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9 488 integrated into the health systems in the most effective way. We expect that, these types of studies
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11 489 would pave the way for evidence-based HRH decision-making in the context of health system of
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13 490 Bangladesh.
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20 492 **List of abbreviations**

21
22 493 ANC: Antenatal Care;
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24 494 EMO: Emergency Medical Officer;
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26 495 ERC: Ethical Review Committee;
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28 496 ESP: Essential Services Package;
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30 497 EWG: Expert Working Groups;
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32 498 FDCs: Field Data Collectors;
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34 499 FSs: Field Supervisors;
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36 500 GoB: Government of Bangladesh;
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38 501 HRH: Human Resources for Health;
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40 502 IDI: In-depth Interviews;
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42 503 IMCI: Integrated Management of Childhood Illness;
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44 504 KII: Key Informant Interviews;
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46 505 LMICs: Low- and Middle-Income Countries;
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48 506 MO: Medical Officer;
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50 507 MoHFW: Ministry of Health and Family Welfare;
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3 508 NCD: Non-communicable Diseases;
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5 509 OPD: Out Patient Department;
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8 510 PNC: Postnatal Care;
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10 511 RMO: Residential Medical Officer;
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12 512 SC: Steering Committee;
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14 513 TT: Technical Taskforce;
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16 514 UHC: Universal Health Coverage;
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18 515 UpHCs: Upazila Health Complexes;
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21 516 WISN: Workload Indicators of Staffing Need
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518 **Declarations**

519 *Consent for publication*

520 During the data collection process, while the ethical consents were obtained from the respondents,
521 they were informed that their data might be used for publication in future. They were also informed
522 that their identity will remain anonymous. Institutional consents for publication were obtained as
523 well.

524 *Availability of data and materials*

525 As our study is not involved in developing new software, or new database, therefore, the datasets
526 generated and analyzed during this study (which was developed using WISN software) are not
527 publicly available. But if necessary, we will share our database for future research purposes.

528

529 *Competing interests*

530 The authors declared that they do not have any competing interests.

531

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534 researchers at BRAC James P Grant School of Public Health, BRAC University.

535

536 *Authors' contributions*

537 TJ conceived and designed the study. TJ and SNBKT carried out the data analyses and drafted the
538 manuscript. MN, SA, VOC, and TZ thoroughly reviewed the manuscript and contributed
539 substantially with necessary revision. TJ and SNBKT again reviewed the manuscript and prepared
540 for final submission. All authors approved the final manuscript.

541

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548 inputs at different stages of the project. Finally, we would like to extend our sincere gratitude to
549 the Field Supervisors and Data Collectors for their contribution throughout the qualitative and
550 quantitative data collection.

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6 552 **Patient and Public Involvement statement:** No patient involved
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47 594 [nks/54662f200cf25b85d17f5b5b.pdf#page=4](https://www.researchgate.net/profile/Robin_Perry3/publication/237430886_A_Critical_Appraisal_of_What_Child_Welfare_Workers_Do_Findings_From_a_Task_Analysis_Study_in_Florida/links/54662f200cf25b85d17f5b5b.pdf#page=4).
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30 632 20, 31, 50, 100, 150, 200, 250, 500, 500 bed general hospitals at Union, Upazila, District, and
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32 633 Division levels, under Ministry of Health and Family Welfare'. Bangladesh. 2008.
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Figure 1

Comparative analysis of WISN Ratio across different geographical areas (and health facilities therein)

- can help decision-making on recruitment of new staff and transfer of existing staff

Comparative analysis of WISN Ratio across comparable staff categories

- can help decision-making on allocating new functions on certain staff categories or removing their functions to other staff

Comparative analysis of current professional standards with the activity standards (developed for the WISN study)

- can help evaluating current professional performance and decision-making on additional staff requirement for performance improvement

Analysis of projected workload

- can help decision-making on future staffing of health facilities

Alternative scenario based WISN analysis (e.g., changing length of working week, changing leave days, changing training policies, etc.)

- can help examining the impact of different conditions on staff requirement

Figure 1. The ways WISN can help in human resource decision-making

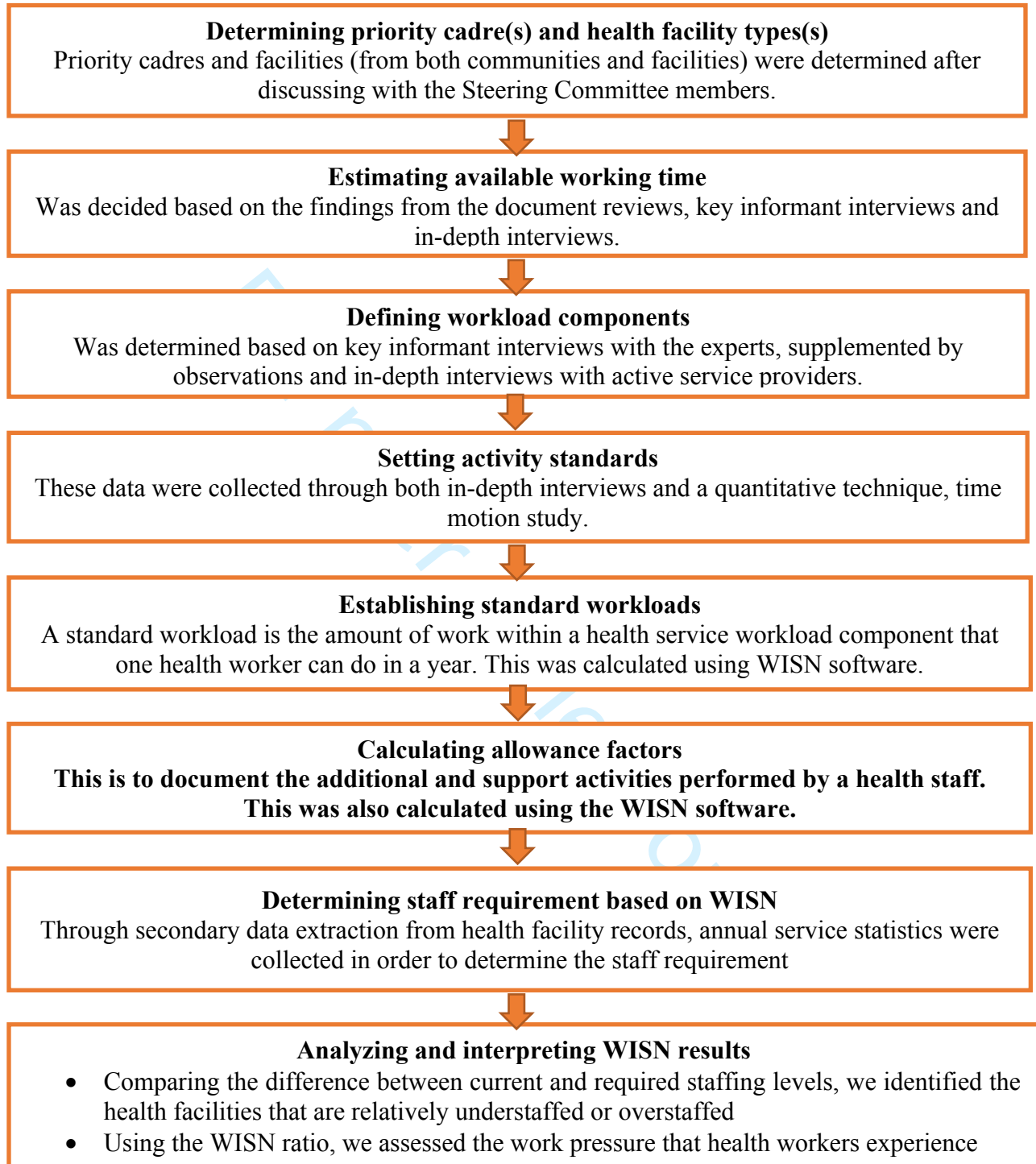
Figure 2**Figure 1 Methods applied in each WISN step**

Figure 3

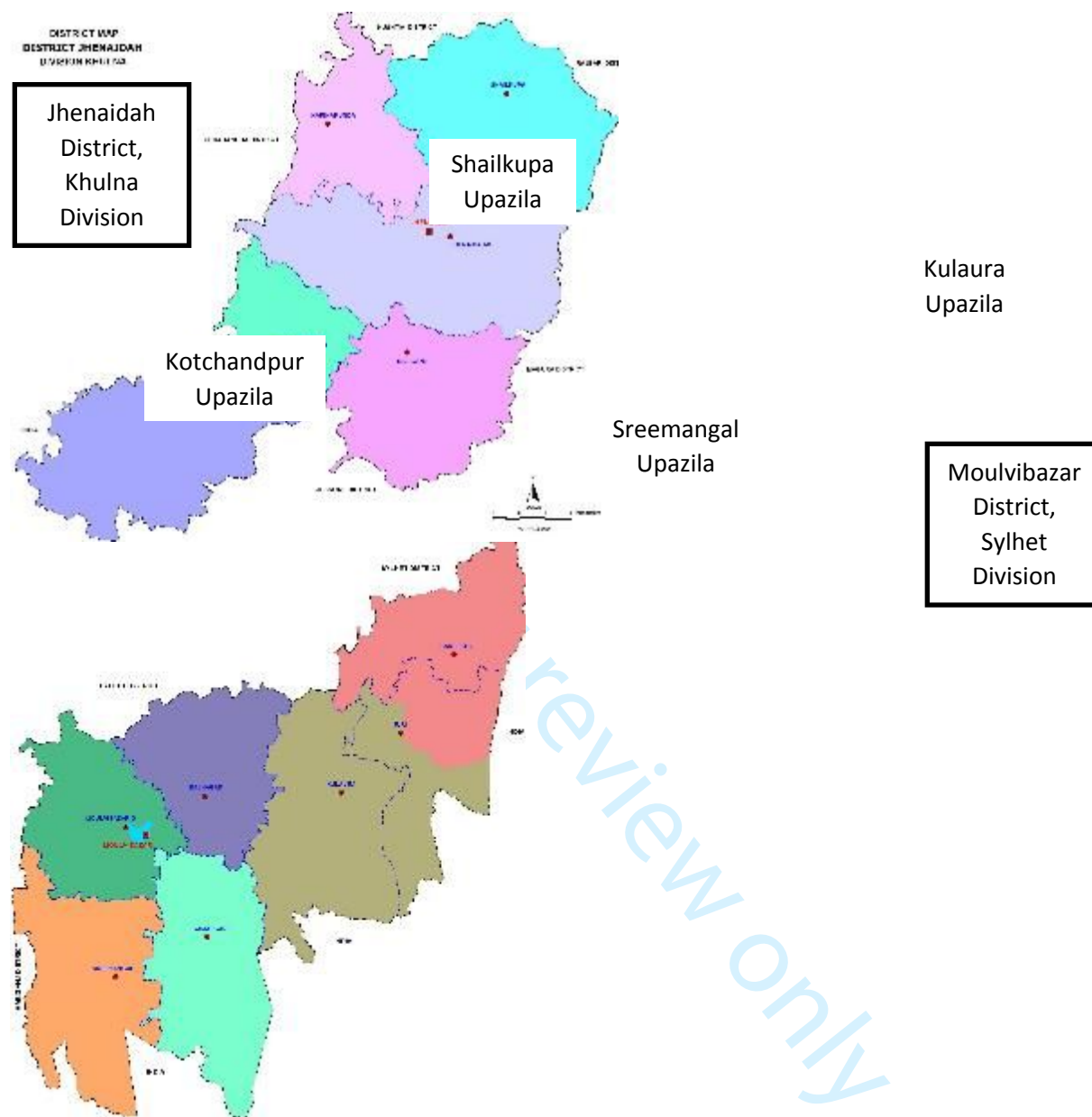


Figure 1 Map of Jhenaidah and Moulvibazar Districts with study Upazilas identified

Figure 4

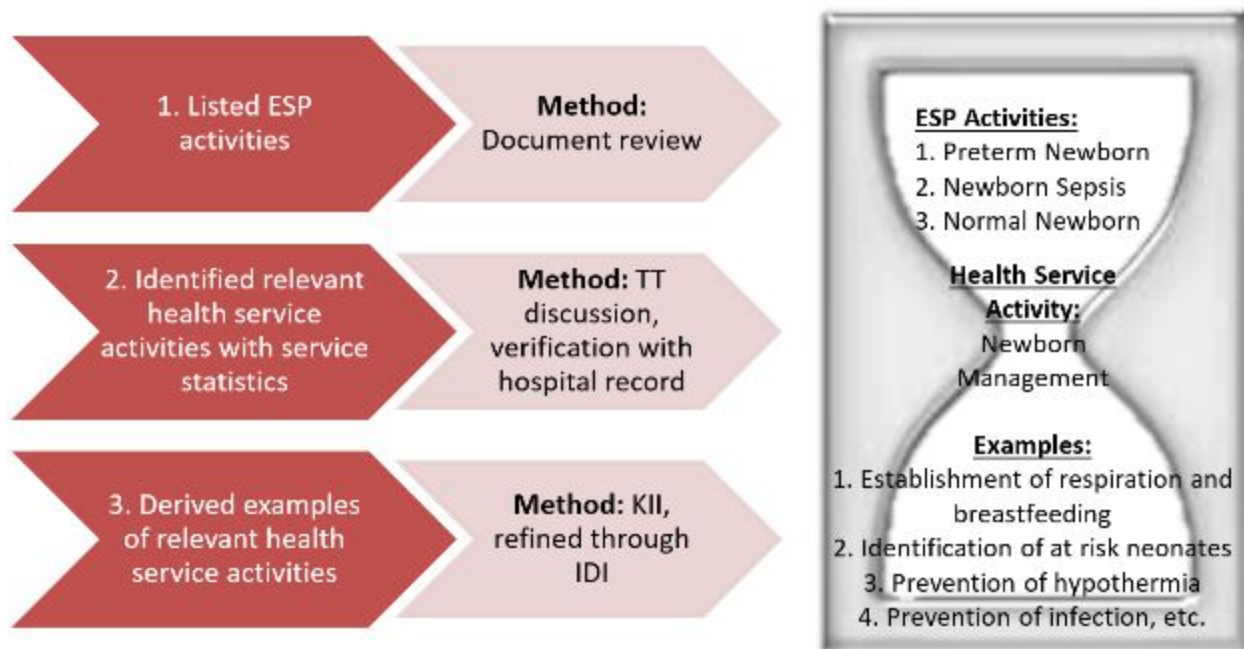


Figure 1 Approach of integration of ESP components in defining workload components of health service activity

BMJ Open

An assessment of staffing needs for physicians and nurses at Upazila Health Complexes in Bangladesh using WHO workload indicators of staffing need (WISN) method

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1 ****Title page**

2 **An assessment of staffing needs for physicians and nurses at Upazila Health**
3 **Complexes in Bangladesh using WHO workload indicators of staffing need**
4 **(WISN) method**

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23 **Abstract**

24 **Objective** This study aimed to assess the current workload and staffing need of Physicians and
25 Nurses for delivering optimum health care services at the Upazila Health Complexes (UpHCs) in
26 Bangladesh.

27 **Design** Mixed-methods, combining qualitative (e.g., document reviews, key informant interviews,
28 in-depth interviews, observations) and quantitative methods (time-motion survey)

29 **Setting** Study was conducted in 24 health facilities of Bangladesh. However, UpHCs being the
30 nucleus of primary health care in Bangladesh, this manuscript limits itself to reporting the findings
31 from the providers at four UpHCs under this project.

32 **Participants** 18 Physicians and 51 Nurses, males and females.

33 **Primary outcome measures** Workload components were defined based on inputs from five
34 experts, refined by nine service providers. Using WHO WISN software, standard workload,
35 category allowance factor, individual allowance factor, total required number of staff, WISN
36 Difference, and WISN Ratio were calculated.

37 **Results:** Physicians have Very High (WISN Ratio 0.43) and Nurse High (WISN Ratio 0.69)
38 workload pressure. 50% of Nurses' time are occupied with support activities, instead of nursing
39 care. There are different workloads among the same staff category in different health facilities. If
40 only the vacant posts are filled, the workload is reduced. In fact, sanctioned number of Physicians
41 and Nurses is more than actual need.

42 **Conclusions:** It is evident that high workload pressures prevail for Physicians and Nurses at the
43 UpHCs. This reveals high demand for these health workforces in the respective sub-districts.
44 WISN method can aid the policy-makers in optimizing utilization of existing human resources.
45 Therefore, the government should adopt flexible health workforce planning and recruitment policy

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3 46 to manage the patient load and disease burden. WISN should thus be incorporated as a planning
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5 47 tool for health managers. There should be a regular review of health workforce management
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8 48 decisions, and these should be amended based on periodic reviews.
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12 13 50 **Strengths and limitations**

- 15 51 • Time-motion findings helped the experts suggest a more context sensitive activity
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17 52 standards.
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20 53 • Using both qualitative and quantitative methods for primary data collection complemented
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22 54 each other for bringing data accuracy.
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25 55 • Technical inputs from the WHO technical experts in WISN application in other countries,
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27 56 and officials of the Ministry of Health improved the data quality as they were directly
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29 57 involved in quality checks at the field level.
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32 58 • One limitation was that some service statistics data, essential for establishing standard
33
34 59 workloads, were unavailable.
- 35
36 60 • Due to lack of scope in WISN methodology, patient engagement was minimal.
- 37
38

39 61 **Keywords**

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42 62 Human Resources for Health, Workforce Management, Workload Indicators of Staffing Need,
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44 63 Bangladesh, Upazila Health Complex, Health Systems
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65 **Background**

66 Shortage of Human Resources for Health (HRH) has been one of the major challenges faced by the
67 health system and globally, more than 90 countries are haunted by this crisis. According to
68 International Labor Organization (ILO), there are on average 34.5 health workers per 10,000
69 population and about one third of the world's population lack access to health care because of
70 shortage of health workforce¹. According to the Global strategy on human resources for health:
71 workforce 2030, the estimated global shortage of skilled health workers will be around 18 million
72 by 2030². This problem has reached a critical stage in three (Bangladesh, Myanmar and Bhutan)
73 South-East Asia Region countries with <23 health workers (doctors, nurses and midwives)
74 per 10,000 population, limiting access to health services³.

76 Improving health workers' performance and productivity is vital for better health service provision
77 in the country. Poor performance of the health workers has been reported in the literature resulting
78 from too few staff, or staff not providing care according to standards^{4,5,6}. The extent of the shortage
79 is reflected in health worker density rates and workforce vacancy rates, and its impact in health
80 system performance indicators. Factors that contribute to poor performance of health workers
81 include limited employment opportunities and low salaries; poor working conditions, weak
82 support and supervision, and limited opportunities for professional development⁷.

84 Bangladesh's health workforce scenario is characterized by "shortage, inappropriate skill mix and
85 inequitable distribution"^{8,9}. Equitable access to skilled and motivated health worker in a functional
86 health system is essential for achieving Universal Health Coverage (UHC) and the Sustainable
87 Development Goals¹⁰. In 2015, Government of Bangladesh (GoB) approved the Bangladesh

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3 88 Health Workforce Strategy which affirms government's vision of equitable availability of skilled,
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5 89 motivated and responsive health workforce in adequate numbers across the country¹¹. However,
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7 90 there is lack of comprehensive, nationally representative data on HRH workload and optimum staff
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9 91 need in health care facilities in Bangladesh. A small scale qualitative study found overwhelming
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11 92 workload as one of the critical components that hinders retention of doctors and nurses at rural
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13 93 healthcare facilities in Bangladesh¹². Another policy analysis on retention of HRH (physicians and
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15 94 nurses) also found that deficiency of adequate workforce and consequent high workload acted as
16
17 95 a deterrent against rural retention¹³.

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23 97 Workload management is very important for any country or institution to deliver quality services,
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25 98 retain staffs and reduce turnover¹⁴. Even the seminal document on HRH, "Global strategy on
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27 99 human resources for health: Workforce 2030", emphasized on developing country level workforce
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29 100 strategies, drawing on workload analysis studies¹⁵. Such studies can provide detailed insight into
30
31 101 the current state of workload in a system, coping strategies of the staff for regular extra work
32
33 102 pressure, causes behind the excessive workloads, and ways to deal with it. This study aimed to fill-
34
35 103 in this knowledge gap with respect to workload and optimum staff need for physicians and nurses
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37 104 at the Upazila or Sub-district level (i.e., at Upazila Health Complex [UpHC]). It is expected that
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39 105 this workload analysis will contribute in improving performance, ensuring quality of services, and
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41 106 facilitating uninterrupted service delivery through efficient management of staff.
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108 **Workload Indicator of Staffing Need (WISN) overview**

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53 109 WHO developed the Workload Indicator of Staffing Need (WISN) method in 1998, which was
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55 110 later updated based on learning from implementation in different countries. This method is simple,
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3 111 useful and time-saving, which was borrowed from the industrial sector for use in the health sector
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5 112 by Peter Shipp in 1984. The result is expressed in terms of differences and ratios, the former
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7 113 indicating worker shortage or surplus, and the latter workload pressure experienced by the staff¹⁶.
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12 115 WISN results help in human resource decision-making in several ways (Figure 1). For example,
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14 116 recruitment and transfer of HRH can be based on geographic comparison of WISN ratios, staffing
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16 117 of health facilities can be informed by WISN-based workload projection, etc.

19 118 **Methods**

23 119 **Study design**

24
25 120 We followed the updated WISN manual¹⁶, but contextualized it for Bangladeshi setting. The WISN
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27 121 steps have been summarized in Figure 2. The research project was developed based on close
28
29 122 collaboration among and mutual insights from three types of committees:

- 32 123 1. **Steering Committee (SC):** The SC was consisting 13 members, established by the Ministry
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34 124 of Health and Family Welfare (MOHFW) with membership from senior government officials
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36 125 (seven): WHO official (one); professional organization of the physicians, Bangladesh Medical
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38 126 Association (one); and relevant academia (four) such as BRAC University (two persons),
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40 127 Bangladesh University of Health Sciences, and Center for Medical Education. All seven senior
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42 128 government officials were directly involved in decision making regarding daily management
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44 129 of the health workforce in their respective departments. WHO officer was there to respond to
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46 130 WISN related technical issues and application. All four academicians were part of the
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48 131 committee because they had expertise in their respective areas (i.e. education, policy making,
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50 132 curriculum development and performance assessment) of the health workforce. They were also
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3 133 well known in the community of scientific writing and academic teaching. The role of the SC
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5 134 was to guide and endorse the overall study based on the WISN strategy and its implementation.
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8 135 2. **Technical Taskforce (TT):** TT was responsible for guiding the implementation of the WISN
9
10 136 process. Researchers from implementing research institution (the school of public health of a
11
12 137 Bangladeshi university, BRAC University); and experts from WHO Bangladesh Country
13
14 138 Office; an international non-governmental organization (NGO), Save the Children; and
15
16 139 another university, Bangladesh University of Health Sciences served in the Taskforce.
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18

19 140 3. **Expert Working Groups (EWG):** There were multiple EWGs, one for each of the following
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21 141 professional groups: General Physicians (Medical Officer [MO], Emergency Medical Officer
22
23 142 [EMO], Residential Medical Officer [RMO]), and Nursing Staff (Senior Staff Nurse, Nursing
24
25 143 Supervisor). The respective EWG defined the workload components and set activity standard
26
27 144 for the specific staff category.
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30
31 145 The qualitative part of this research involved document reviews, key informant interviews (KII)
32
33 146 with policy level persons related to HRH issues in Bangladesh (mostly from among SC and EWG
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35 147 members), in-depth interviews (IDI) with individual service providers (e.g., physicians, nurses,
36
37 148 etc. working in UpHCs under this study), and observations. The quantitative component involved
38
39 149 time-motion survey which is a work measurement technique for recording the times and rates of
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41 150 working for the elements of a specific job though observing a subject continuously or in a certain
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43 151 period of time¹⁷. Time motion data served as a guide to determine the activity standard for WISN
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45 152 analyses.
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154 **Study duration, setting and population**

155 The research continued from July to November 2017 and was carried out in two pre-selected
156 Districts of Bangladesh (Figure 3):

- 157 • Jhenaidah, located in south-western part of Bangladesh, under Khulna Division
- 158 • Moulvibazar, located in north-eastern part of Bangladesh, under Sylhet Division

159
160 The selection of the districts was made by the Human Resources Unit, Ministry of Health and
161 Family Welfare **in collaboration with the development partners (Save the Children and WHO**
162 **Bangladesh) in a workshop nationally organized in November 2016. Later the selection of**
163 **the UpHCs was made in consultation with the SC, taking into consideration some**
164 **performance indicators such as** number of beds, number of total deliveries, number of live births,
165 bed occupancy rates as well as patient load including the number of outpatient visits. **From each**
166 **district, two highest performing UpHCs were included in the study**¹⁸. Thus, Shailkupa and
167 Kotchandpur UpHCs were selected from Jhenaidah District and Kulaura and Sreemangal from the
168 Moulvibazar. Because future applications need to be based on optimum quality standards, the
169 highest performing UpHCs were selected to serve as a model for other health facilities. From each
170 of these four UpHCs, physicians (Medical Officers and Residential Medical Officers) and nurses
171 (Senior Staff Nurse and Nursing Supervisor) were included for workload analysis. A total of 24
172 health facilities from the two districts were studied. This included two district hospitals, four
173 UpHCs, two Maternal and Child Welfare Centers, eight Union Sub Centers, eight Union Health
174 and Family Welfare Centers, and eight Community Clinics. This manuscript reported findings
175 from all the four UpHCs under this study, as UpHCs are the nucleus of the primary health care
176 delivery in Bangladesh, serving the rural population.

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56 178 **Sampling strategy**
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89 179 **Qualitative part**
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12 180 Documents for review were selected based on the suggestions from the experts (members of SC,
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14 181 TT, and EWG), supplemented by reference tracking of government reports and published literature
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16 182 on HRH of Bangladesh. Key Informants were selected on the principles of purposive sampling¹⁹,
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18 183 supplemented by snowball sampling (i.e., based on the reference or suggestion from the key
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20 184 informants). IDI respondents were selected through purposive sampling, based on the respondent's
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22 185 seniority and designation (e.g., Residential Medical Officer, Nursing Supervisors, etc.). These
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24 186 respondents were practicing individuals and had more than 10 years of experience and played a
25
26 187 supervisory role in their respective health facilities.
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3233 189 **Quantitative part**
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36 190 For time-motion study, time sampling was done for each consenting staff available during the data
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38 191 collection period. Field Data Collectors (FDCs) observed each staff twice for 45-minutes duration,
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40 192 once during the first half of their service duration and again during the second half. This was done
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42 193 to minimize the bias in the time data due to the patient load (assuming higher patient load in the
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44 194 first half and lower in the second).
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196 **Tool development, pretest, training of data collectors, agreement test**

197 For qualitative data collection, semi-structured guidelines, including that for document reviews,
198 KIIs, IDIs, and observation, were developed. For the time-motion study, structured observation
199 tool was designed. The structured observation tools contained three sections:

- 200 1. Background information of observation setting and the person under observation
- 201 2. Time-motion data sheet (containing three columns: type of activity, time spent in minutes,
202 and remarks)
- 203 3. Example of the activities (health service activities, support activities, and additional
204 activities)

205
206 Health service activities, according to WISN manual, are performed by all members of the staff
207 category and regular service statistics are available for them for example, obstetrical service,
208 emergency service, outpatient service, etc. Support activities are also performed by all members
209 of the staff category, but regular service statistics are not available for them for example, record
210 keeping and reporting, attending meetings, instrument sterilization, etc. Additional activities are
211 performed by only certain members of the staff category (e.g., the supervisor or a senior member),
212 and regular service statistics are not available for them for example, duty roster preparation,
213 preparing staff evaluation reports, supervision of cleanliness, etc.¹⁷.

214
215 The examples of health service activities were primarily drawn from the list of the activities
216 mentioned in the Essential Services Package (ESP)²⁰ for respective health facility type. Since
217 service statistics were not available according the ESP activity list, it was adjusted for the local
218 context with inputs from the respondents (through KII, followed by IDI), in alignment with the

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3 219 availability of service statistics. An ‘hourglass’ approach was adopted for defining the workload
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5 220 components based on the ESP (Figure 4). Tools were pre-tested in a UpHC near Dhaka, before
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7 221 applying for actual data collection. Qualitative tools were also pre-tested through mock IDIs and
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9 222 KIIs. The pre-testing exercise was followed by the training of the Field Supervisors (FSs) and
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11 223 Field Data Collectors (FDCs).
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18 225 **Data collection and quality control**

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21 226 At first, FSs were sent to respective districts to orient the personnel on the project, seek support,
22
23 227 and assess the availability of the service statistics. The FSs spent one week in each district and
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25 228 conducted qualitative observation of the service provision at the UpHCs, to gain a firsthand
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27 229 understanding of the context.
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32 231 In the second step, we conducted five KIIs to define workload components, in light of the ESP
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34 232 document’s standard of services by facility level²⁰. The workload components were further refined
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36 233 based on IDIs with a total of eight physicians and eight nurses.
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41 235 In the third step, the FDCs, under the supervision of FSs, conducted time-motion study, using a
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43 236 mobile device (SurveyCTO software). During the time FDCs were collecting time-motion data,
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45 237 the FS, in addition to supervising the FDCs, conducted additional IDIs and collected data on
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47 238 available working time; time required for health service, support, and additional activities; and
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49 239 service statistics.
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241 The next step was data validation and set activity standards. Primary data validation was done
 242 through phone calls made to the services providers, and health facility statisticians. Secondly, these
 243 were shared with the SC and TT members. Finally, interviews were conducted with the EWG
 244 members to finalize the activity standards (Table 1).

246 **Table 1 Number of interviewees representing EWG of staff categories**

EWG representing staff category	Number
Physicians: MO, EMO, RMO	2
Nurses: Nursing Supervisor, Senior Staff Nurse	7
Total	9

247
 248 We presented the time-motion findings to the EWG members and requested them to be as realistic
 249 as possible in suggesting activity standards. We also requested them to account for the variability
 250 of patient load due to factors such as seasonality, timing of day, facility catchment population, etc.
 251 Finally, through multiple meetings, debates and deliberations, the activity standard was finalized,
 252 taking into account the information from the IDIs and KIIs, and inputs from the EWG members
 253 (Table 2).

254
 255 **Table 2 Service standard for Physicians and Nurses in UpHCs, Bangladesh, 2017**

Activities	Service standard		Unit
	Physician	Nurse	

Obstetrical Service (Caesarean Section) ^a	90	90	min/patient
Obstetrical Service (Normal Delivery)	60	120	min/patient
Newborn Management	15	15	min/inpatient day
Emergency Service	15	Not applicable	min/patient
IMCI/ Nutritional Service	15	15	min/patient
OPD Service (including NCD management)	10	Not applicable	min/patient
First ANC	20	20	min/patient
Follow-up ANC	10	10	min/patient
PNC	15	15	min/patient
Indoor Services (Round, including minor bedside procedures) ^b	25.65	34	min/inpatient day
Bedside patient care	Not applicable	17	min/inpatient day
Patient admission and discharge	Not applicable	20	min/inpatient day
Death certification and associated arrangements	20	30	min/patient

256 **Note:** ^aFor Nurses: Assist Obstetrical Service (Caesarean Section); ^bFor Nurses: Indoor Services
 257 (Round with Physician)

258 # IMCI: Integrated Management of Childhood Illness; OPD: Out Patient Department; NCD: Non-
 259 communicable Diseases; ANC: Antenatal Care; PNC: Postnatal Care.

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7 261 In order to ensure the quality of data, the Principal Expert (lead author of this article), Co-experts
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9 262 (two co-experts – one was leading data collection and the other was leading data quality check and
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11 263 reporting), WHO team consisting of national and international technical experts, and officials from
12
13 264 the Human Resource Branch of Ministry of Health and Family Welfare (MoHFW) conducted field
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15
16 265 visits to each study District and the health facilities therein. During the time-motion data collection
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18 266 period, the Co-experts monitored the data and their geographic location in real-time. They also
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21 267 regularly checked the consistency of the data. Our field based data collection team saved contact
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23 268 information of all the respondents; so, in case of any confusion or need for clarification, the Co-
24
25 269 experts called the respondents over phone.

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31 **Data management and analysis**

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34 272 The first analytic step was to estimate available working time of the staffs. This is the time a health
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36 273 worker has available in one year to do his or her work, taking into account authorized and
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38 274 unauthorized absences¹⁷. For all categories of staff, a uniform number of weeks per year (52
39
40 275 weeks), working days in one week (six days), possible working days in one year ($52 * 6 = 312$
41
42 276 days) were estimated. Next, absent days, such as public holidays (20 days), earned leave (average
43
44 277 for each staff category, based on Health Management Information System data), and casual leave
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46 278 (20 days) were deducted to obtain the annual working time in days. Multiplying this with daily
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48 279 working hours (six hours per day), we obtained annual working time in hours.

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3 281 Workload components were defined through the inputs from the key informants; activity standards
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5 282 were also set through the interviews with the EWG members. An activity standard is the time
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7 283 necessary for a well-trained, skilled and motivated worker to perform an activity to professional
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9 284 standards in the local circumstances¹⁷. Both service standards (for health service activities),
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11 285 category allowance standards (for support activities), and individual allowance standards (for
12
13 286 additional activities) were determined in the same way.
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17 287 The next analytic step was to establish standard workload, which was done by dividing the annual
18
19 288 working time by unit time of health service activities. A standard workload is the amount of work
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21 289 within a health services workload component that one health service provider can do in a year
22
23 290 hypothetically¹⁷. Then category allowance factor and individual allowance factors were calculated
24
25 291 using the following formula, respectively:
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27
28 292 Category allowance factor = $1 / \{1 - (\text{Total category allowance standard} / 100)\}$
29

30
31 293 Individual allowance factor = $\text{Total individual allowance standard} / \text{Available working time in}$
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33 294 hours
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38 296 Next, exact number of required staff was calculated by the following formula:
39

40 297 Total required number of staff = $(\text{Staff needed for health service activity} * \text{Category allowance}$
41
42 298 $\text{factor}) + \text{Individual allowance factor}$
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44
45 299 The fractional results were rounded up or down, following the guideline provided in the WISN
46
47 300 manual¹⁷:
48

49 301 • 1.0 – 1.1 is rounded down to 1 and >1.1 – 1.9 is rounded up to 2

50
51 302 • 2.0 – 2.2 is rounded down to 2 and >2.2 – 2.9 is rounded up to 3

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53 303 • 3.0 – 3.3 is rounded down to 3 and >3.3 – 3.9 is rounded up to 4
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- 304 • 4.0 – 4.4 is rounded down to 4 and >4.4 – 4.9 is rounded up to 5
- 305 • 5.0 – 5.5 is rounded down to 5 and >5.5 – 5.9 is rounded up to 6

307 Finally, based on the existing number of staff in the respective health facilities, we calculated both
308 the difference (current number of staff – required number of staff by WISN), and the ratio (current
309 number of staff / required number of staff by WISN). The WISN difference indicates whether the
310 health facilities are relatively understaffed (i.e., when the WISN difference is negative),
311 overstaffed (i.e., when the WISN difference is positive), or balanced (i.e., when the WISN
312 difference is zero). The WISN Ratio indicates whether the staffs are experiencing high workload
313 (i.e., when the WISN Ratio is lower than one), low workload (i.e., when the WISN Ratio is higher
314 than one), or normal workload (i.e., when the WISN Ratio is equal to one). For this calculation,
315 we used the de-facto number of current staff, i.e., the number of staff that we actually found
316 working in the health facilities during our data collection period; not the number shown in the
317 office records or statistics.

319 **Ethical considerations**

320 Ethical approval for this study was obtained from the Ethical Review Committee (ERC) of BRAC
321 James P Grant School of Public Health, BRAC University. All ethical principles were strictly
322 adhered to. We obtained a support letter from the Ministry of Health and Family Welfare and also
323 obtained written informed consent form from each person we engaged in data collection. Identity
324 of respondents was kept confidential.

326 Results

327 General WISN findings across levels

328 For descriptive purposes, we have categorized the workload pressure as Extremely High (WISN
 329 Ratio between 0.10 and 0.29), Very High (WISN Ratio between 0.30 and 0.49), High (WISN Ratio
 330 between 0.50 and 0.69), Moderately High (WISN Ratio between 0.70 and 0.89), Normal (WISN
 331 Ratio between 0.90 and 1.19), and Low (WISN Ratio greater than or equal to 1.20). Based on this
 332 categorization, at an aggregate level (i.e., considering the average required number and WISN
 333 Ratio across the same types of health facilities), physicians are found to have a Very High (WISN
 334 Ratio 0.43) and nurses High (WISN Ratio 0.69) workload pressure. To cope with the workload,
 335 on an average 11 physicians (on average 4.50 were available during data collection) and 19 nurses
 336 (On average 12.75 were available during data collection) are needed in each UpHC (Table 3). This
 337 means, there was an average deficit of six members in each staff categories.

338

339 **Table 3 Analysis of WISN results at aggregate level (average required number and WISN**
 340 **Ratio across same types of health facilities)**

Staff category	Required staff to cope with the demand	Average number of existing staff	Deficit of staff	Average WISN Ratio	Workload pressure
Physician	10.59	4.50	6.09	0.43	Very high
Nurse	18.86	12.75	6.11	0.69	High

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342 Tabulating the total percentage of time spent on all support activities (i.e., category allowance
 343 standards) by different staff categories, we found that, 50% of nurses' time are occupied with
 344 support activities (Table 4).

346 **Table 4 Comparison of Support Activities across staff categories**

Staff category	Total % of support activities
Physician	24%
Nurse	50%

347

348 **WISN results disaggregated by UpHCs**

349 The required number of staff ranges from eight to 12 among Physicians, and 16 to 23 among
 350 Nurses. Highest shortage is observed in Nurses of Sreemangal UpHC (-8.46), followed by
 351 Physicians of Kulaura UpHC (-8.28). Workload pressure is the highest among Physicians of
 352 Kotchandpur UpHC (WISN Ratio 0.28) and lowest among Nurses of Shailkupa (WISN Ratio 0.87)
 353 (Table 5).

355 **Table 5 Analysis of WISN results of Upazila level health staff**

Health facility	Current number of staff	Required number, based on WISN	Shortage or excess	WISN Ratio	Workload pressure
Staff category: Physician					

Shailkupa UpHC	4	8.14	-4.14	0.49	Very High
Kotchandpur UpHC	3	10.71	-7.71	0.28	Extremely High
Kulaura UpHC	4	12.28	-8.28	0.33	Very High
Sreemangal UpHC	7	11.23	-4.23	0.62	High
Staff category: Nurse					
Shailkupa UpHC	14	16.08	-2.08	0.87	Moderately High
Kotchandpur UpHC	15	22.80	-7.8	0.66	High
Kulaura UpHC	10	16.08	-6.08	0.62	High
Sreemangal UpHC	12	20.46	-8.46	0.59	High

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357 **Change of workload if vacancies are filled**

358 If the vacant posts are filled, understandably, the workload is reduced. In most of the cases,
 359 sanctioned number of Physicians and Nurses is more than what is actually needed to tackle the
 360 workload. However, only filling up the vacant posts are not enough in case of some of the staff
 361 categories, such as the Nurses at Kotchandpur and Physicians at Sreemangal (Table 6).

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363 **Table 6 Change of workload if vacancies in Physician and Nursing posts are filled**

Health facility	Staff category	Current number of staff	Required number, based on WISN	WISN Ratio	Sanctioned number of staff	WISN Ratio as per sanctioned number of staff
Shailkupa UpHC	Physician	4	8.14	0.49	10	1.25
	Nurse	14	16.08	0.87	21	1.31
Kotchandpur UpHC	Physician	3	10.71	0.28	20	1.82
	Nurse	15	22.80	0.66	20	0.87
Kulaura UpHC	Physician	4	12.28	0.33	20	1.67
	Nurse	10	16.08	0.62	26	1.62
Sreemangal UpHC	Physician	7	11.23	0.62	10	0.91
	Nurse	12	20.46	0.59	22	1.10

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365 **Discussion and recommendations**366 **Discussion**

367 Findings from this WISN study clearly indicates that the public-sector healthcare providers in
 368 Bangladesh are suffering from a very high workload pressure. Nurses are predominantly occupied
 369 with support activities rather than actual nursing care. There is unequal workload across UpHCs,
 370 indicating potential for workforce re-distribution. The unequal workload mainly stems from

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3 371 differing patient load, due to geographic location, number of catchment population, and
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5 372 epidemiological characteristics, at different UpHCs. Inappropriate number of sanctioned posts
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7 373 indicate the necessity of WISN-based workforce planning.
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12 375 High workload pressure may arise from absolute or relative shortage of health workforce. Absolute
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14 376 shortage appears when there is inadequate production of a particular staff category while relative
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16 377 shortage appears when health workforce is not distributed evenly between the urban and rural areas
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18 378 throughout the country for various reasons. For example, absolute shortage in HRH production is
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20 379 revealed by the fact that there are only 4.90 registered physicians and 2.90 registered nurses per
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22 380 10,000 populations¹⁸, rendering the country to be one of the 57 critical workforce shortage
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24 381 countries in the world⁶. On top of this absolute shortage, Bangladesh also suffers from relative
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26 382 shortage, as evidenced from the fact that physician to population ratio in urban areas is 1:1,500,
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28 383 but in rural areas it is 1:15,000²¹. Workload pressure has some serious consequences as well,
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30 384 namely, fatigue and burnout of service providers, lack of motivation, and compromised quality of
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32 385 care²². High workload is, however, not unique to Bangladesh. WISN studies in Low- and Middle-
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34 386 Income Countries (LMICs) like Namibia²³, Uganda²⁴, Kenya²⁵, Burkina Faso²⁶, and Iran²⁷ also
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36 387 identified high workload pressure among their HRH.
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45 389 It is expected that the nurses would spend most of their service times beside the patients, providing
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47 390 nursing care. Unfortunately, this is not the case in Bangladesh as well as in some other comparable
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49 391 settings. A qualitative study in Bangladesh showed, nurses' maximum time is spent on
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51 392 administrative and paperwork tasks²⁸. Excessive support activities of nurses is reported in studies
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53 393 conducted in Iran²⁷, and Uganda²⁴ as well. A recent WISN study conducted in Iran showed, nurses
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3 394 are overburdened; and support activities account for 31% of their workload²⁷. Nurses' excessive
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5 395 engagement in paperwork or other support activities may result from deficient human resource
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7 396 planning and management.
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12 398 Despite the fact that most of the staff are already overworked, staffs in some health facilities may
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14 399 be more so, compared to a neighboring one. Presence of different number of staffs causes
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16 400 fluctuation in the amount of workload at different health facilities. In places where workload of a
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18 401 staff category is 'Extremely High', some supports from nearby health facilities with lower
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20 402 workload should be sought. Or, in places where workload of a staff category is 'Normal' or 'Low',
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22 403 some support may be transferred to health facilities with higher workload. For example, in
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24 404 Sreemangal UpHC, there are seven physicians, with a High workload pressure. However,
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26 405 workload pressure in nearby Kulaura UpHC is Very High, with only four physicians (Table 5). At
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28 406 least one physician from Sreemangal can be reallocated to Kulaura to tackle the high workload.
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31 407 Similar action may be taken regarding the Nurses by transferring some from Shailkupa
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33 408 (Moderately High workload) to Kotchandpur (High workload). This is just an example how WISN
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35 409 can help in decision-making regarding allocation of human resources. Similar situation was
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37 410 identified in Namibia, where researchers suggested redistribution of health workers from one area
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39 411 to the other²³.
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49 413 We found that many posts remained vacant in different health facilities. Some staffs were not
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51 414 present at their service locations for various reasons, such as training, deputation to another health
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53 415 facility, etc. Even if the existing posts are filled-up, a large portion of the workload would be
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55 416 curbed. For example, according to the Standard Setup document of the Ministry of Public
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3 417 Administration, 18 physician posts (10 Junior Consultants, one Residential Medical Officer, seven
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5 418 Assistant Surgeons) have been proposed for a 50 bed hospital²⁹. We have found 4.5 Physicians on
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7 419 an average in each UpHC. The average required number is 11 (Table 3). Our proposition is that,
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9 420 even if it is not possible to reach the ideal workforce setup for a health facility, filling-up at least
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11 421 the vacant positions, and ensuring regular presence of all staffs would reduce the workload.
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13 422 Supportive supervision and monitoring of the staff is essential to ensure the presence of posted
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15 423 staff. Researchers in Namibia came up with the similar finding and proposed a similar solution for
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17 424 the problem²³. WISN was used over standard staffing schedule in HIV Clinics in Kenya as well to
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19 425 resolve a similar crisis²⁵.
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27 427 **Recommendations**

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29 428 Based on the findings and its in-depth analysis, we propose few short-term and long-term
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31 429 recommendations. The short-term recommendations require administrative or management
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33 430 decisions, relatively easier to implement and tackle the immediate crisis. On the other hand, the
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35 431 long-term recommendations demand radical policy amendments following careful examination.
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41 433 Short-term recommendations include: reallocation of staff from low workload areas to high
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43 434 workload areas, fill-up existing vacant positions and strengthen supervision and monitoring.
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45 435 Nurses are the most needed staff, the most overloaded, and are short in supply. On top of all these,
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47 436 they are burdened with support activities. If some of their support and additional activities can be
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49 437 shifted to other staff, nurses can devote their time better in nursing care.
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3 439 The study yields some long-term recommendations as well, for the policy-makers. For example,
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5 440 in order to increase the availability of workforce, especially Nurses, and decrease their workload,
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7 441 their number needs to increase. Hence, long term policy response is needed to increase the intake
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9 442 of nursing students, train them with quality education, and deploy them in larger numbers in a
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11 443 secure and gender-friendly work environment. In the same vein, incentives should be given to
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13 444 increase the number of nurses in both public and private sector educational institutions.
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15 445 Regulations should be developed and implemented so that medical colleges can be established
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17 446 only when a nursing school is established alongside. Otherwise, the skill-mix imbalance between
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19 447 physicians and nurses would jeopardize the quality of care. Quality and quantity of physicians
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21 448 should also increase.

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26 449 Secondly, since the Nurses are found to be predominantly engaged in support activities at the
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28 450 expense of actual patient care, a separate staff category for administrative/ support activities is
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30 451 greatly warranted. This will free up the valuable yet scarce clinical time of the service providers.

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33 452 Thirdly, instead of the existing approach of deploying a fixed number of workforce at all health
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35 453 facilities, a flexible recruitment and HRH planning is needed, based on patient load and disease
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37 454 burden. This can be supported by determination of optimal requirements of HRH under given
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39 455 limited resources or constrains in those health facilities by using the WHO methodology on
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41 456 workload indicators of staffing need. It is important to recognize that, decisions in health sector
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43 457 are very much contingent on the local context, especially the patient load, demographic drivers
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45 458 (e.g., age structure of the population, gender ratio, etc.), and epidemiologic profile. Therefore, the
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47 459 government should adopt flexible health workforce planning and recruitment policy in place to
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49 460 keep up with the local patient load and disease burden. The culture of bottom-up decision-making
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51 461 should be adopted eventually.
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7 463 **Strengths and limitations**

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9 464 This study had a number of strengths. First, we conducted time-motion study, which helped the
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11 465 research team gain a better understanding of the service context of the staffs. Secondly, when the
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13 466 key informants or experts suggested an unrealistic activity standard, we presented them the time-
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15 467 motion findings and helped them suggest a more context sensitive standards. Thirdly, the research
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17 468 team used both qualitative and quantitative methods for primary data collection, which
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19 469 complement each other for bringing data accuracy. Fourthly, WHO technical officers, who had
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21 470 expertise in WISN application in other countries, and the Ministry of Health officials were directly
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23 471 involved in the field level data quality checks.
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30 473 However, despite careful planning and painstaking implementation of the research, we faced some
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32 474 challenges during different stages of the WISN process. First, some service statistics data, which
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34 475 were essential for establishing standard workloads, were not readily available due to poor record
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36 476 keeping systems at some health facilities. Secondly, the research did not take into account the
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38 477 patients' opinion or stakeholders' stance. Notwithstanding the fact that these perspectives are
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40 478 gaining momentum in health workforce decision-making, we could not take advantage of them in
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42 479 the interest of adhering to the highly structured nature of the WISN methodology. Thirdly, the
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44 480 official number of existing staffs often did not match with the number of staffs we observed
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46 481 providing services.
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53 483 **Conclusions**

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3 484 Human resource management is a big challenge, especially in a resource-poor setting like
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5 485 Bangladesh. With a vision of becoming a middle-income country by 2021, Bangladesh needs to
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7 486 strive for optimizing its existing resources, including human resources. This type of study can aid
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9 487 the decision-making in this direction, using the WISN as a planning tool for the managers.
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11 488 Implementation research is needed regarding how this workload-based staffing decisions can be
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13 489 integrated into the health systems in the most effective way. We expect that, these types of studies
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15 490 would pave the way for evidence-based HRH decision-making in the context of health system of
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17 491 Bangladesh.
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23 24 493 **List of abbreviations**

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26
27 494 ANC: Antenatal Care;
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29 495 EMO: Emergency Medical Officer;
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31 496 ERC: Ethical Review Committee;
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33 497 ESP: Essential Services Package;
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35 498 EWG: Expert Working Groups;
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37 499 FDCs: Field Data Collectors;
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39 500 FSs: Field Supervisors;
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41 501 GoB: Government of Bangladesh;
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43 502 HRH: Human Resources for Health;
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45 503 IDI: In-depth Interviews;
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47 504 IMCI: Integrated Management of Childhood Illness;
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49 505 KII: Key Informant Interviews;
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51 506 LMICs: Low- and Middle-Income Countries;
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3 507 MO: Medical Officer;
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5 508 MoHFW: Ministry of Health and Family Welfare;
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7 509 NCD: Non-communicable Diseases;
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10 510 OPD: Out Patient Department;
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12 511 PNC: Postnatal Care;
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14 512 RMO: Residential Medical Officer;
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16 513 SC: Steering Committee;
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18 514 TT: Technical Taskforce;
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20 515 UHC: Universal Health Coverage;
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22 516 UpHCs: Upazila Health Complexes;
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24 517 WISN: Workload Indicators of Staffing Need
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32 **Declarations**

33 ***Consent for publication***

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39 521 During the data collection process, while the ethical consents were obtained from the respondents,
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41 522 they were informed that their data might be used for publication in future. They were also informed
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43 523 that their identity will remain anonymous. Institutional consents for publication were obtained as
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46 524 well.

47 ***Availability of data and materials***

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51 526 All research data have been submitted to the World Health Organization Country Office for
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53 527 Bangladesh, as per the agreement with the research organization, BRAC James P Grant School of
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56 528 Public Health, BRAC University. This manuscript only used the data pertaining to the Physicians
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3 529 and Nurses working at the two study Upazila (sub-district) Health Complexes. Unpublished data
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5 530 include: Consultants, General Physicians, and Nurses at the District Hospital level; Physicians,
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7 531 and Family Welfare Visitors at Maternal and Child Welfare Center level; Sub-Assistant
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9 532 Community Medical Officers at the Upazila Health Complex level; Sub-Assistant Community
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11 533 Medical Officers at Union Sub-Centers level, Sub-Assistant Community Medical Officers, and
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13 534 Family Welfare Visitors at Union Health and Family Welfare Centers level; and Community
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15 535 Health Care Providers, and Family Welfare Assistants at the Community Clinic/ Outreach level.
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17 536 Data may be obtained from the World Health Organization Country Office for Bangladesh upon
18
19 537 reasonable request (Focal Point: Mr. Md Nuruzzaman- nuruzzamanm@who.int).
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27 ***Competing interests***

28
29
30 540 The authors declared that they do not have any competing interests.
31
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33 541

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36
37
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39
40 544 researchers at BRAC James P Grant School of Public Health, BRAC University.
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45 ***Authors' contributions***

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47
48 547 TJ conceived and designed the study. TJ and SNBKT carried out the data analyses and drafted the
49
50 548 manuscript. MN, SA, VOC, and TZ thoroughly reviewed the manuscript and contributed
51
52 549 substantially with necessary revision. TJ and SNBKT again reviewed the manuscript and prepared
53
54 550 for final submission. All authors approved the final manuscript.
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12
13
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15
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17
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19
20
21 558 inputs at different stages of the project. Finally, we would like to extend our sincere gratitude to
22
23 559 the Field Supervisors and Data Collectors for their contribution throughout the qualitative and
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25 560 quantitative data collection.

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30 562 **Patient and Public Involvement statement:** No patient involved

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4 642 **Figure Legends**
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6 643 Figure 1: The ways WISN can help in human resource decision-making
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8 644 Figure 2: Methods applied in each WISN step
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10 645 Figure 3: Map of Jhenaidah and Moulvibazar Districts with study Upazilas identified
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12 646 Figure 4: Approach of integration of ESP components in defining workload components of
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Figure 1

Comparative analysis of WISN Ratio across different geographical areas (and health facilities therein)

- can help decision-making on recruitment of new staff and transfer of existing staff

Comparative analysis of WISN Ratio across comparable staff categories

- can help decision-making on allocating new functions on certain staff categories or removing their functions to other staff

Comparative analysis of current professional standards with the activity standards (developed for the WISN study)

- can help evaluating current professional performance and decision-making on additional staff requirement for performance improvement

Analysis of projected workload

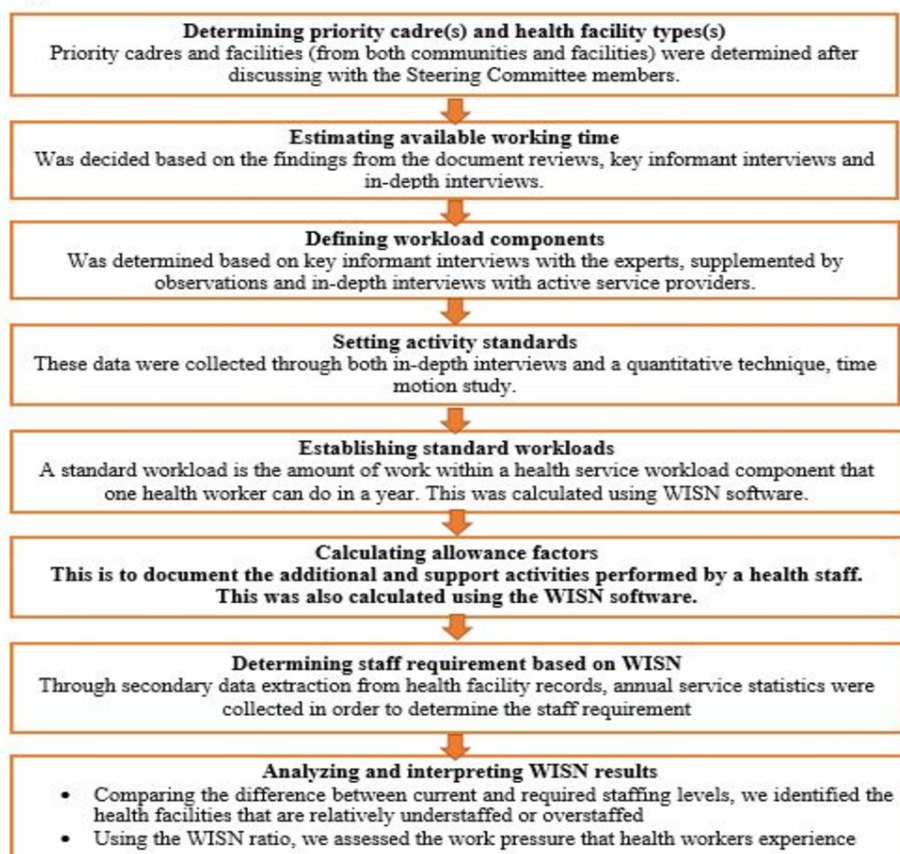
- can help decision-making on future staffing of health facilities

Alternative scenario based WISN analysis (e.g., changing length of working week, changing leave days, changing training policies, etc.)

- can help examining the impact of different conditions on staff requirement

Figure 1. The ways WISN can help in human resource decision-making

The ways WISN can help in human resource decision-making

Figure 2**Figure 2 Methods applied in each WISN step**

Methods applied in each WISN step

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Figure 3

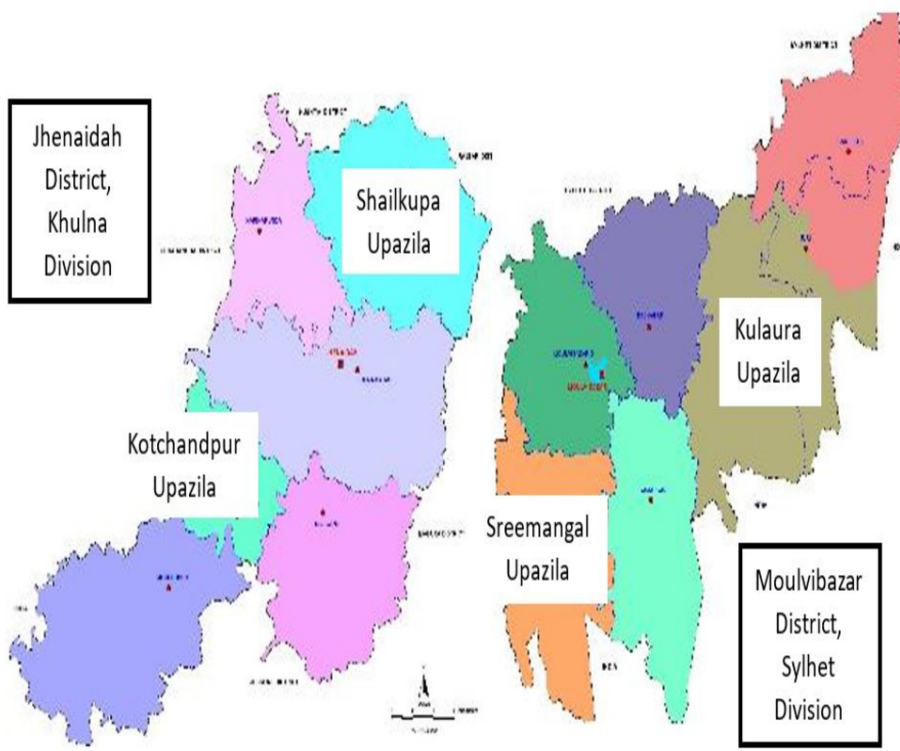


Figure 3 Map of Jhenaidah and Moulvibazar Districts with study Upazilas identified

Map of Jhenaidah and Moulvibazar Districts with study Upazilas identified

Figure 4

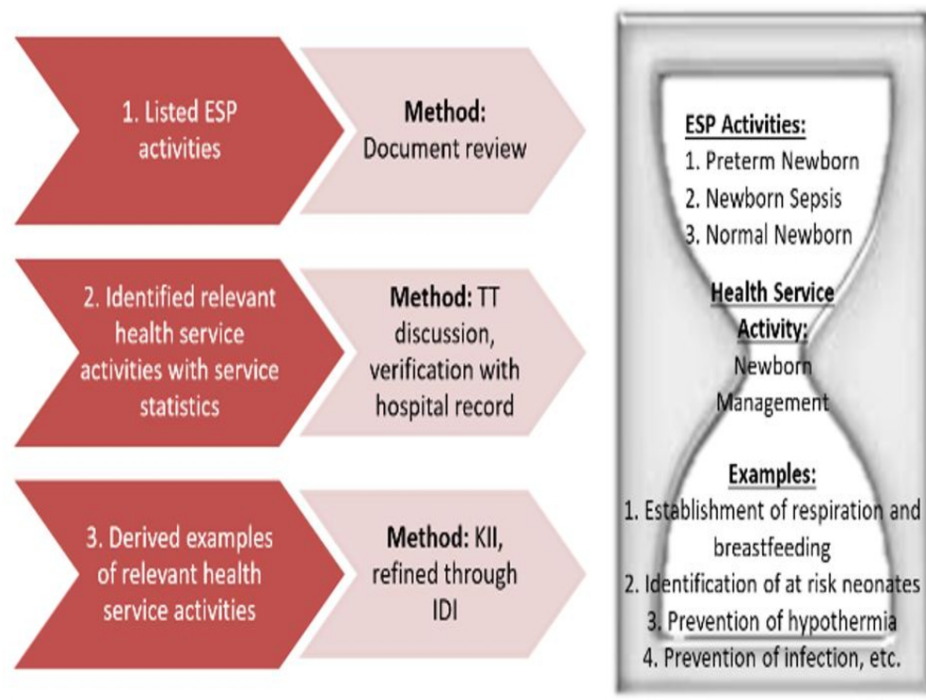


Figure 4 Approach of integration of ESP components in defining workload components of health service activity

Approach of integration of ESP components in defining workload components of health service activity

BMJ Open

An assessment of staffing needs for physicians and nurses at Upazila Health Complexes in Bangladesh using WHO workload indicators of staffing need (WISN) method

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1 ****Title page**

2 **An assessment of staffing needs for physicians and nurses at Upazila Health**
3 **Complexes in Bangladesh using WHO workload indicators of staffing need**
4 **(WISN) method**

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23 **Abstract**

24 **Objective** This study aimed to assess the current workload and staffing need of Physicians and
25 Nurses for delivering optimum health care services at the Upazila Health Complexes (UpHCs) in
26 Bangladesh.

27 **Design** Mixed-methods, combining qualitative (e.g., document reviews, key informant interviews,
28 in-depth interviews, observations) and quantitative methods (time-motion survey)

29 **Setting** Study was conducted in 24 health facilities of Bangladesh. However, UpHCs being the
30 nucleus of primary health care in Bangladesh, this manuscript limits itself to reporting the findings
31 from the providers at four UpHCs under this project.

32 **Participants** 18 Physicians and 51 Nurses, males and females.

33 **Primary outcome measures** Workload components were defined based on inputs from five
34 experts, refined by nine service providers. Using WHO WISN software, standard workload,
35 category allowance factor, individual allowance factor, total required number of staff, WISN
36 Difference, and WISN Ratio were calculated.

37 **Results:** Physicians have Very High (WISN Ratio 0.43) and Nurse High (WISN Ratio 0.69)
38 workload pressure. 50% of Nurses' time are occupied with support activities, instead of nursing
39 care. There are different workloads among the same staff category in different health facilities. If
40 only the vacant posts are filled, the workload is reduced. In fact, sanctioned number of Physicians
41 and Nurses is more than actual need.

42 **Conclusions:** It is evident that high workload pressures prevail for Physicians and Nurses at the
43 UpHCs. This reveals high demand for these health workforces in the respective sub-districts.
44 WISN method can aid the policy-makers in optimizing utilization of existing human resources.
45 Therefore, the government should adopt flexible health workforce planning and recruitment policy

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3 46 to manage the patient load and disease burden. WISN should thus be incorporated as a planning
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5 47 tool for health managers. There should be a regular review of health workforce management
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7 48 decisions, and these should be amended based on periodic reviews.
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12 13 50 **Strengths and limitations**

- 15 51 • Time-motion findings helped the experts suggest a more context sensitive activity
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17 52 standards.
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20 53 • Using both qualitative and quantitative methods for primary data collection complemented
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22 54 each other for bringing data accuracy.
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25 55 • Technical inputs from the WHO technical experts in WISN application in other countries,
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27 56 and officials of the Ministry of Health improved the data quality as they were directly
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29 57 involved in quality checks at the field level.
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32 58 • One limitation was that some service statistics data, essential for establishing standard
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34 59 workloads, were unavailable.
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36 60 • Due to lack of scope in WISN methodology, patient engagement was minimal.
- 37
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39 61 **Keywords**

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42 62 Human Resources for Health, Workforce Management, Workload Indicators of Staffing Need,
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44 63 Bangladesh, Upazila Health Complex, Health Systems
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65 **Background**

66 Shortage of Human Resources for Health (HRH) has been one of the major challenges faced by the
67 health system and globally, more than 90 countries are haunted by this crisis. According to
68 International Labor Organization (ILO), there are on average 34.5 health workers per 10,000
69 population and about one third of the world's population lack access to health care because of
70 shortage of health workforce¹. According to the Global strategy on human resources for health:
71 workforce 2030, the estimated global shortage of skilled health workers will be around 18 million
72 by 2030². This problem has reached a critical stage in three (Bangladesh, Myanmar and Bhutan)
73 South-East Asia Region countries with <23 health workers (doctors, nurses and midwives)
74 per 10,000 population, limiting access to health services³.

76 Improving health workers' performance and productivity is vital for better health service provision
77 in the country. Poor performance of the health workers has been reported in the literature resulting
78 from too few staff, or staff not providing care according to standards⁴⁻⁶. The extent of the shortage
79 is reflected in health worker density rates and workforce vacancy rates, and its impact in health
80 system performance indicators. Factors that contribute to poor performance of health workers
81 include limited employment opportunities and low salaries; poor working conditions, weak
82 support and supervision, and limited opportunities for professional development⁷.

84 Bangladesh's health workforce scenario is characterized by "shortage, inappropriate skill mix and
85 inequitable distribution"^{8,9}. Equitable access to skilled and motivated health worker in a functional
86 health system is essential for achieving Universal Health Coverage (UHC) and the Sustainable
87 Development Goals¹⁰. In 2015, Government of Bangladesh (GoB) approved the Bangladesh

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3 88 Health Workforce Strategy which affirms government's vision of equitable availability of skilled,
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5 89 motivated and responsive health workforce in adequate numbers across the country¹¹. However,
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7 90 there is lack of comprehensive, nationally representative data on HRH workload and optimum staff
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9 91 need in health care facilities in Bangladesh. A small scale qualitative study found overwhelming
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11 92 workload as one of the critical components that hinders retention of doctors and nurses at rural
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13 93 healthcare facilities in Bangladesh¹². Another policy analysis on retention of HRH (physicians and
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15 94 nurses) also found that deficiency of adequate workforce and consequent high workload acted as
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17 95 a deterrent against rural retention¹³.

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24 97 Workload management is very important for any country or institution to deliver quality services,
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26 98 retain staffs and reduce turnover¹⁴. Even the seminal document on HRH, "Global strategy on
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28 99 human resources for health: Workforce 2030", emphasized on developing country level workforce
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30 100 strategies, drawing on workload analysis studies². Such studies can provide detailed insight into
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32 101 the current state of workload in a system, coping strategies of the staff for regular extra work
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34 102 pressure, causes behind the excessive workloads, and ways to deal with it. This study aimed to fill-
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36 103 in this knowledge gap with respect to workload and optimum staff need for physicians and nurses
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38 104 at the Upazila or Sub-district level (i.e., at Upazila Health Complex [UpHC]). It is expected that
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40 105 this workload analysis will contribute in improving performance, ensuring quality of services, and
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42 106 facilitating uninterrupted service delivery through efficient management of staff.
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50 108 **Workload Indicator of Staffing Need (WISN) overview**

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53 109 WHO developed the Workload Indicator of Staffing Need (WISN) method in 1998, which was
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55 110 later updated based on learning from implementation in different countries. This method is simple,
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3 111 useful and time-saving, which was borrowed from the industrial sector for use in the health sector
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5 112 by Peter Shipp in 1984. The result is expressed in terms of differences and ratios, the former
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7 113 indicating worker shortage or surplus, and the latter workload pressure experienced by the staff¹⁵.
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12 115 WISN results help in human resource decision-making in several ways (Figure 1). For example,
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14 116 recruitment and transfer of HRH can be based on geographic comparison of WISN ratios, staffing
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16 117 of health facilities can be informed by WISN-based workload projection, etc.

19 118 **Methods**

23 119 **Study design**

25 120 We followed the updated WISN manual¹⁵, but contextualized it for Bangladeshi setting. The WISN
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27 121 steps have been summarized in Figure 2. The research project was developed based on close
28
29 122 collaboration among and mutual insights from three types of committees:

- 32 123 1. **Steering Committee (SC):** The SC was consisting 13 members, established by the Ministry
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35 124 of Health and Family Welfare (MOHFW) with membership from senior government officials
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37 125 (seven): WHO official (one); professional organization of the physicians, Bangladesh Medical
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39 126 Association (one); and relevant academia (four) such as BRAC University (two persons),
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41 127 Bangladesh University of Health Sciences, and Center for Medical Education. All seven senior
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43 128 government officials were directly involved in decision making regarding daily management
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45 129 of the health workforce in their respective departments. WHO officer was there to respond to
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47 130 WISN related technical issues and application. All four academicians were part of the
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49 131 committee because they had expertise in their respective areas (i.e. education, policy making,
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51 132 curriculum development and performance assessment) of the health workforce. They were also
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3 133 well known in the community of scientific writing and academic teaching. The role of the SC
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5 134 was to guide and endorse the overall study based on the WISN strategy and its implementation.
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8 135 2. **Technical Taskforce (TT):** TT was responsible for guiding the implementation of the WISN
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10 136 process. Researchers from implementing research institution (the school of public health of a
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12 137 Bangladeshi university, BRAC University); and experts from WHO Bangladesh Country
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14 138 Office; an international non-governmental organization (NGO), Save the Children; and
15
16 139 another university, Bangladesh University of Health Sciences served in the Taskforce.
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19 140 3. **Expert Working Groups (EWG):** There were multiple EWGs, one for each of the following
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21 141 professional groups: General Physicians (Medical Officer [MO], Emergency Medical Officer
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23 142 [EMO], Residential Medical Officer [RMO]), and Nursing Staff (Senior Staff Nurse, Nursing
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25 143 Supervisor). The respective EWG defined the workload components and set activity standard
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27 144 for the specific staff category.
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31 145 The qualitative part of this research involved document reviews, key informant interviews (KII)
32
33 146 with policy level persons related to HRH issues in Bangladesh (mostly from among SC and EWG
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35 147 members), in-depth interviews (IDI) with individual service providers (e.g., physicians, nurses,
36
37 148 etc. working in UpHCs under this study), and observations. The quantitative component involved
38
39 149 time-motion survey which is a work measurement technique for recording the times and rates of
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41 150 working for the elements of a specific job though observing a subject continuously or in a certain
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43 151 period of time¹⁶. Time motion data served as a guide to determine the activity standard for WISN
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45 152 analyses.
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154 **Study duration, setting and population**

155 The research continued from July to November 2017 and was carried out in two pre-selected
156 Districts of Bangladesh (Figure 3):

- 157 • Jhenaidah, located in south-western part of Bangladesh, under Khulna Division
- 158 • Moulvibazar, located in north-eastern part of Bangladesh, under Sylhet Division

159
160 The selection of the districts was made by the Human Resources Unit, Ministry of Health and
161 Family Welfare **in collaboration with the development partners (Save the Children and WHO**
162 **Bangladesh) in a workshop nationally organized in November 2016. Later the selection of**
163 **the UpHCs was made in consultation with the SC, taking into consideration some**
164 **performance indicators such as** number of beds, number of total deliveries, number of live births,
165 bed occupancy rates as well as patient load including the number of outpatient visits. **From each**
166 **district, two highest performing UpHCs were included in the study**¹⁷. Thus, Shailkupa and
167 Kotchandpur UpHCs were selected from Jhenaidah District and Kulaura and Sreemangal from the
168 Moulvibazar. Because future applications need to be based on optimum quality standards, the
169 highest performing UpHCs were selected to serve as a model for other health facilities. From each
170 of these four UpHCs, physicians (Medical Officers and Residential Medical Officers) and nurses
171 (Senior Staff Nurse and Nursing Supervisor) were included for workload analysis. A total of 24
172 health facilities from the two districts were studied. This included two district hospitals, four
173 UpHCs, two Maternal and Child Welfare Centers, eight Union Sub Centers, eight Union Health
174 and Family Welfare Centers, and eight Community Clinics. This manuscript reported findings
175 from all the four UpHCs under this study, as UpHCs are the nucleus of the primary health care
176 delivery in Bangladesh, serving the rural population.

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56 178 **Sampling strategy**7
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9 179 **Qualitative part**

10 180 Documents for review were selected based on the suggestions from the experts (members of SC,
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12 181 TT, and EWG), supplemented by reference tracking of government reports and published literature
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14 182 on HRH of Bangladesh. Key Informants were selected on the principles of purposive sampling¹⁸,
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16 183 supplemented by snowball sampling (i.e., based on the reference or suggestion from the key
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18 184 informants). IDI respondents were selected through purposive sampling, based on the respondent's
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20 185 seniority and designation (e.g., Residential Medical Officer, Nursing Supervisors, etc.). These
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22 186 respondents were practicing individuals and had more than 10 years of experience and played a
23
24 187 supervisory role in their respective health facilities.
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33 189 **Quantitative part**

34 190 For time-motion study, time sampling was done for each consenting staff available during the data
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36 191 collection period. Field Data Collectors (FDCs) observed each staff twice for 45-minutes duration,
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38 192 once during the first half of their service duration and again during the second half. This was done
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40 193 to minimize the bias in the time data due to the patient load (assuming higher patient load in the
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196 **Tool development, pretest, training of data collectors, agreement test**

197 For qualitative data collection, semi-structured guidelines, including that for document reviews,
198 KIIs, IDIs, and observation, were developed. For the time-motion study, structured observation
199 tool was designed. The structured observation tools contained three sections:

- 200 1. Background information of observation setting and the person under observation
- 201 2. Time-motion data sheet (containing three columns: type of activity, time spent in minutes,
202 and remarks)
- 203 3. Example of the activities (health service activities, support activities, and additional
204 activities)

205
206 Health service activities, according to WISN manual, are performed by all members of the staff
207 category and regular service statistics are available for them for example, obstetrical service,
208 emergency service, outpatient service, etc. Support activities are also performed by all members
209 of the staff category, but regular service statistics are not available for them for example, record
210 keeping and reporting, attending meetings, instrument sterilization, etc. Additional activities are
211 performed by only certain members of the staff category (e.g., the supervisor or a senior member),
212 and regular service statistics are not available for them for example, duty roster preparation,
213 preparing staff evaluation reports, supervision of cleanliness, etc.¹⁵.

214
215 The examples of health service activities were primarily drawn from the list of the activities
216 mentioned in the Essential Services Package (ESP)¹⁹ for respective health facility type. Since
217 service statistics were not available according the ESP activity list, it was adjusted for the local
218 context with inputs from the respondents (through KII, followed by IDI), in alignment with the

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3 219 availability of service statistics. An ‘hourglass’ approach was adopted for defining the workload
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5 220 components based on the ESP (Figure 4). Tools were pre-tested in a UpHC near Dhaka, before
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7 221 applying for actual data collection. Qualitative tools were also pre-tested through mock IDIs and
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9 222 KIIs. The pre-testing exercise was followed by the training of the Field Supervisors (FSs) and
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11 223 Field Data Collectors (FDCs).
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18 225 **Data collection and quality control**

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21 226 At first, FSs were sent to respective districts to orient the personnel on the project, seek support,
22
23 227 and assess the availability of the service statistics. The FSs spent one week in each district and
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25 228 conducted qualitative observation of the service provision at the UpHCs, to gain a firsthand
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27 229 understanding of the context.
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32 231 In the second step, we conducted five KIIs to define workload components, in light of the ESP
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34 232 document’s standard of services by facility level¹⁹. The workload components were further refined
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36 233 based on IDIs with a total of eight physicians and eight nurses.
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41 235 In the third step, the FDCs, under the supervision of FSs, conducted time-motion study, using a
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43 236 mobile device (SurveyCTO software). During the time FDCs were collecting time-motion data,
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45 237 the FS, in addition to supervising the FDCs, conducted additional IDIs and collected data on
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47 238 available working time; time required for health service, support, and additional activities; and
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49 239 service statistics.
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241 The next step was data validation and set activity standards. Primary data validation was done
 242 through phone calls made to the services providers, and health facility statisticians. Secondly, these
 243 were shared with the SC and TT members. Finally, interviews were conducted with the EWG
 244 members to finalize the activity standards (Table 1).

246 **Table 1 Number of interviewees representing EWG of staff categories**

EWG representing staff category	Number
Physicians: MO, EMO, RMO	2
Nurses: Nursing Supervisor, Senior Staff Nurse	7
Total	9

247
 248 We presented the time-motion findings to the EWG members and requested them to be as realistic
 249 as possible in suggesting activity standards. We also requested them to account for the variability
 250 of patient load due to factors such as seasonality, timing of day, facility catchment population, etc.
 251 Finally, through multiple meetings, debates and deliberations, the activity standard was finalized,
 252 taking into account the information from the IDIs and KIIs, and inputs from the EWG members
 253 (Table 2).

254
 255 **Table 2 Service standard for Physicians and Nurses in UpHCs, Bangladesh, 2017**

Activities	Service standard		Unit
	Physician	Nurse	

Obstetrical Service (Caesarean Section) ^a	90	90	min/patient
Obstetrical Service (Normal Delivery)	60	120	min/patient
Newborn Management	15	15	min/inpatient day
Emergency Service	15	Not applicable	min/patient
IMCI/ Nutritional Service	15	15	min/patient
OPD Service (including NCD management)	10	Not applicable	min/patient
First ANC	20	20	min/patient
Follow-up ANC	10	10	min/patient
PNC	15	15	min/patient
Indoor Services (Round, including minor bedside procedures) ^b	25.65	34	min/inpatient day
Bedside patient care	Not applicable	17	min/inpatient day
Patient admission and discharge	Not applicable	20	min/inpatient day
Death certification and associated arrangements	20	30	min/patient

256 **Note:** ^aFor Nurses: Assist Obstetrical Service (Caesarean Section); ^bFor Nurses: Indoor Services
 257 (Round with Physician)

258 # IMCI: Integrated Management of Childhood Illness; OPD: Out Patient Department; NCD: Non-
 259 communicable Diseases; ANC: Antenatal Care; PNC: Postnatal Care.

260

261 In order to ensure the quality of data, the Principal Expert (lead author of this article), Co-experts
262 (two co-experts – one was leading data collection and the other was leading data quality check and
263 reporting), WHO team consisting of national and international technical experts, and officials from
264 the Human Resource Branch of Ministry of Health and Family Welfare (MoHFW) conducted field
265 visits to each study District and the health facilities therein. During the time-motion data collection
266 period, the Co-experts monitored the data and their geographic location in real-time. They also
267 regularly checked the consistency of the data. Our field based data collection team saved contact
268 information of all the respondents; so, in case of any confusion or need for clarification, the Co-
269 experts called the respondents over phone.

270

271 **Data management and analysis**

272 The first analytic step was to estimate available working time of the staffs. This is the time a health
273 worker has available in one year to do his or her work, taking into account authorized and
274 unauthorized absences¹⁵. For all categories of staff, a uniform number of weeks per year (52
275 weeks), working days in one week (six days), possible working days in one year ($52 * 6 = 312$
276 days) were estimated. Next, absent days, such as public holidays (20 days), earned leave (average
277 for each staff category, based on Health Management Information System data), and casual leave
278 (20 days) were deducted to obtain the annual working time in days. Multiplying this with daily
279 working hours (six hours per day), we obtained annual working time in hours.

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3 281 Workload components were defined through the inputs from the key informants; activity standards
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5 282 were also set through the interviews with the EWG members. An activity standard is the time
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7 283 necessary for a well-trained, skilled and motivated worker to perform an activity to professional
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9 284 standards in the local circumstances¹⁵. Both service standards (for health service activities),
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11 285 category allowance standards (for support activities), and individual allowance standards (for
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13 286 additional activities) were determined in the same way.

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17 287 The next analytic step was to establish standard workload, which was done by dividing the annual
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19 288 working time by unit time of health service activities. A standard workload is the amount of work
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21 289 within a health services workload component that one health service provider can do in a year
22
23 290 hypothetically¹⁵. Then category allowance factor and individual allowance factors were calculated
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25 291 using the following formula, respectively:

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27
28 292 $\text{Category allowance factor} = 1 / \{1 - (\text{Total category allowance standard} / 100)\}$

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31 293 $\text{Individual allowance factor} = \text{Total individual allowance standard} / \text{Available working time in}$
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33 294 hours

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38 296 Next, exact number of required staff was calculated by the following formula:

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40 297 $\text{Total required number of staff} = (\text{Staff needed for health service activity} * \text{Category allowance}$
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42 298 $\text{factor}) + \text{Individual allowance factor}$

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45 299 The fractional results were rounded up or down, following the guideline provided in the WISN
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47 300 manual¹⁵:

- 48
49 301 • 1.0 – 1.1 is rounded down to 1 and >1.1 – 1.9 is rounded up to 2
50
51 302 • 2.0 – 2.2 is rounded down to 2 and >2.2 – 2.9 is rounded up to 3
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54 303 • 3.0 – 3.3 is rounded down to 3 and >3.3 – 3.9 is rounded up to 4
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- 304 • 4.0 – 4.4 is rounded down to 4 and >4.4 – 4.9 is rounded up to 5
- 305 • 5.0 – 5.5 is rounded down to 5 and >5.5 – 5.9 is rounded up to 6

307 Finally, based on the existing number of staff in the respective health facilities, we calculated both
308 the difference (current number of staff – required number of staff by WISN), and the ratio (current
309 number of staff / required number of staff by WISN). The WISN difference indicates whether the
310 health facilities are relatively understaffed (i.e., when the WISN difference is negative),
311 overstaffed (i.e., when the WISN difference is positive), or balanced (i.e., when the WISN
312 difference is zero). The WISN Ratio indicates whether the staffs are experiencing high workload
313 (i.e., when the WISN Ratio is lower than one), low workload (i.e., when the WISN Ratio is higher
314 than one), or normal workload (i.e., when the WISN Ratio is equal to one). For this calculation,
315 we used the de-facto number of current staff, i.e., the number of staff that we actually found
316 working in the health facilities during our data collection period; not the number shown in the
317 office records or statistics.

319 **Ethical considerations**

320 Ethical approval for this study was obtained from the Ethical Review Committee (ERC) of BRAC
321 James P Grant School of Public Health, BRAC University. All ethical principles were strictly
322 adhered to. We obtained a support letter from the Ministry of Health and Family Welfare and also
323 obtained written informed consent form from each person we engaged in data collection. Identity
324 of respondents was kept confidential.

326 Results

327 General WISN findings across levels

328 For descriptive purposes, we have categorized the workload pressure as Extremely High (WISN
 329 Ratio between 0.10 and 0.29), Very High (WISN Ratio between 0.30 and 0.49), High (WISN Ratio
 330 between 0.50 and 0.69), Moderately High (WISN Ratio between 0.70 and 0.89), Normal (WISN
 331 Ratio between 0.90 and 1.19), and Low (WISN Ratio greater than or equal to 1.20). Based on this
 332 categorization, at an aggregate level (i.e., considering the average required number and WISN
 333 Ratio across the same types of health facilities), physicians are found to have a Very High (WISN
 334 Ratio 0.43) and nurses High (WISN Ratio 0.69) workload pressure. To cope with the workload,
 335 on an average 11 physicians (on average 4.50 were available during data collection) and 19 nurses
 336 (On average 12.75 were available during data collection) are needed in each UpHC (Table 3). This
 337 means, there was an average deficit of six members in each staff categories.

338
 339 **Table 3 Analysis of WISN results at aggregate level (average required number and WISN**
 340 **Ratio across same types of health facilities)**

Staff category	Required staff to cope with the demand	Average number of existing staff	Deficit of staff	Average WISN Ratio	Workload pressure
Physician	10.59	4.50	6.09	0.43	Very high
Nurse	18.86	12.75	6.11	0.69	High

341

342 Tabulating the total percentage of time spent on all support activities (i.e., category allowance
 343 standards) by different staff categories, we found that, 50% of nurses' time are occupied with
 344 support activities (Table 4).

346 **Table 4 Comparison of Support Activities across staff categories**

Staff category	Total % of support activities
Physician	24%
Nurse	50%

347

348 **WISN results disaggregated by UpHCs**

349 The required number of staff ranges from eight to 12 among Physicians, and 16 to 23 among
 350 Nurses. Highest shortage is observed in Nurses of Sreemangal UpHC (-8.46), followed by
 351 Physicians of Kulaura UpHC (-8.28). Workload pressure is the highest among Physicians of
 352 Kotchandpur UpHC (WISN Ratio 0.28) and lowest among Nurses of Shailkupa (WISN Ratio 0.87)
 353 (Table 5).

355 **Table 5 Analysis of WISN results of Upazila level health staff**

Health facility	Current number of staff	Required number, based on WISN	Shortage or excess	WISN Ratio	Workload pressure
Staff category: Physician					

Shailkupa UpHC	4	8.14	-4.14	0.49	Very High
Kotchandpur UpHC	3	10.71	-7.71	0.28	Extremely High
Kulaura UpHC	4	12.28	-8.28	0.33	Very High
Sreemangal UpHC	7	11.23	-4.23	0.62	High
Staff category: Nurse					
Shailkupa UpHC	14	16.08	-2.08	0.87	Moderately High
Kotchandpur UpHC	15	22.80	-7.8	0.66	High
Kulaura UpHC	10	16.08	-6.08	0.62	High
Sreemangal UpHC	12	20.46	-8.46	0.59	High

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357 **Change of workload if vacancies are filled**

358 If the vacant posts are filled, understandably, the workload is reduced. In most of the cases,
 359 sanctioned number of Physicians and Nurses is more than what is actually needed to tackle the
 360 workload. However, only filling up the vacant posts are not enough in case of some of the staff
 361 categories, such as the Nurses at Kotchandpur and Physicians at Sreemangal (Table 6).

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363 **Table 6 Change of workload if vacancies in Physician and Nursing posts are filled**

Health facility	Staff category	Current number of staff	Required number, based on WISN	WISN Ratio	Sanctioned number of staff	WISN Ratio as per sanctioned number of staff
Shailkupa UpHC	Physician	4	8.14	0.49	10	1.25
	Nurse	14	16.08	0.87	21	1.31
Kotchandpur UpHC	Physician	3	10.71	0.28	20	1.82
	Nurse	15	22.80	0.66	20	0.87
Kulaura UpHC	Physician	4	12.28	0.33	20	1.67
	Nurse	10	16.08	0.62	26	1.62
Sreemangal UpHC	Physician	7	11.23	0.62	10	0.91
	Nurse	12	20.46	0.59	22	1.10

364

365 **Discussion and recommendations**366 **Discussion**

367 Findings from this WISN study clearly indicates that the public-sector healthcare providers in
 368 Bangladesh are suffering from a very high workload pressure. Nurses are predominantly occupied
 369 with support activities rather than actual nursing care. There is unequal workload across UpHCs,
 370 indicating potential for workforce re-distribution. The unequal workload mainly stems from

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3 371 differing patient load, due to geographic location, number of catchment population, and
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5 372 epidemiological characteristics, at different UpHCs. Inappropriate number of sanctioned posts
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8 373 indicate the necessity of WISN-based workforce planning.
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12 375 High workload pressure may arise from absolute or relative shortage of health workforce. Absolute
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14 376 shortage appears when there is inadequate production of a particular staff category while relative
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16 377 shortage appears when health workforce is not distributed evenly between the urban and rural areas
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18 378 throughout the country for various reasons. For example, absolute shortage in HRH production is
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20 379 revealed by the fact that there are only 4.90 registered physicians and 2.90 registered nurses per
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22 380 10,000 populations¹⁷, rendering the country to be one of the 57 critical workforce shortage
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24 381 countries in the world⁶. On top of this absolute shortage, Bangladesh also suffers from relative
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26 382 shortage, as evidenced from the fact that physician to population ratio in urban areas is 1:1,500,
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28 383 but in rural areas it is 1:15,000²⁰. Workload pressure has some serious consequences as well,
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30 384 namely, fatigue and burnout of service providers, lack of motivation, and compromised quality of
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32 385 care²¹. High workload is, however, not unique to Bangladesh. WISN studies in Low- and Middle-
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34 386 Income Countries (LMICs) like Namibia²², Uganda²³, Kenya²⁴, Burkina Faso²⁵, and Iran²⁶ also
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36 387 identified high workload pressure among their HRH.
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45 389 It is expected that the nurses would spend most of their service times beside the patients, providing
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47 390 nursing care. Unfortunately, this is not the case in Bangladesh as well as in some other comparable
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49 391 settings. A qualitative study in Bangladesh showed, nurses' maximum time is spent on
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51 392 administrative and paperwork tasks²⁷. Excessive support activities of nurses is reported in studies
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53 393 conducted in Iran²⁶, and Uganda²³ as well. A recent WISN study conducted in Iran showed, nurses
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3 394 are overburdened; and support activities account for 31% of their workload²⁶. Nurses' excessive
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5 395 engagement in paperwork or other support activities may result from deficient human resource
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8 396 planning and management.
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12 398 Despite the fact that most of the staff are already overworked, staffs in some health facilities may
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14 399 be more so, compared to a neighboring one. Presence of different number of staffs causes
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16 400 fluctuation in the amount of workload at different health facilities. In places where workload of a
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18 401 staff category is 'Extremely High', some supports from nearby health facilities with lower
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20 402 workload should be sought. Or, in places where workload of a staff category is 'Normal' or 'Low',
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22 403 some support may be transferred to health facilities with higher workload. For example, in
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24 404 Sreemangal UpHC, there are seven physicians, with a High workload pressure. However,
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26 405 workload pressure in nearby Kulaura UpHC is Very High, with only four physicians (Table 5). At
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28 406 least one physician from Sreemangal can be reallocated to Kulaura to tackle the high workload.
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31 407 Similar action may be taken regarding the Nurses by transferring some from Shailkupa
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33 408 (Moderately High workload) to Kotchandpur (High workload). This is just an example how WISN
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35 409 can help in decision-making regarding allocation of human resources. Similar situation was
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37 410 identified in Namibia, where researchers suggested redistribution of health workers from one area
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39 411 to the other²².
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47 413 We found that many posts remained vacant in different health facilities. Some staffs were not
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49 414 present at their service locations for various reasons, such as training, deputation to another health
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51 415 facility, etc. Even if the existing posts are filled-up, a large portion of the workload would be
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54 416 curbed. For example, according to the Standard Setup document of the Ministry of Public
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3 417 Administration, 18 physician posts (10 Junior Consultants, one Residential Medical Officer, seven
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5 418 Assistant Surgeons) have been proposed for a 50 bed hospital²⁸. We have found 4.5 Physicians on
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7 419 an average in each UpHC. The average required number is 11 (Table 3). Our proposition is that,
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9 420 even if it is not possible to reach the ideal workforce setup for a health facility, filling-up at least
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11 421 the vacant positions, and ensuring regular presence of all staffs would reduce the workload.
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13 422 Supportive supervision and monitoring of the staff is essential to ensure the presence of posted
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15 423 staff. Researchers in Namibia came up with the similar finding and proposed a similar solution for
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17 424 the problem²². WISN was used over standard staffing schedule in HIV Clinics in Kenya as well to
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19 425 resolve a similar crisis²⁴.
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27 427 **Recommendations**

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29 428 Based on the findings and its in-depth analysis, we propose few short-term and long-term
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31 429 recommendations. The short-term recommendations require administrative or management
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33 430 decisions, relatively easier to implement and tackle the immediate crisis. On the other hand, the
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35 431 long-term recommendations demand radical policy amendments following careful examination.
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41 433 Short-term recommendations include: reallocation of staff from low workload areas to high
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43 434 workload areas, fill-up existing vacant positions and strengthen supervision and monitoring.
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45 435 Nurses are the most needed staff, the most overloaded, and are short in supply. On top of all these,
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47 436 they are burdened with support activities. If some of their support and additional activities can be
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49 437 shifted to other staff, nurses can devote their time better in nursing care.
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3 439 The study yields some long-term recommendations as well, for the policy-makers. For example,
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5 440 in order to increase the availability of workforce, especially Nurses, and decrease their workload,
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7 441 their number needs to increase. Hence, long term policy response is needed to increase the intake
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9 442 of nursing students, train them with quality education, and deploy them in larger numbers in a
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11 443 secure and gender-friendly work environment. In the same vein, incentives should be given to
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13 444 increase the number of nurses in both public and private sector educational institutions.
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15 445 Regulations should be developed and implemented so that medical colleges can be established
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17 446 only when a nursing school is established alongside. Otherwise, the skill-mix imbalance between
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19 447 physicians and nurses would jeopardize the quality of care. Quality and quantity of physicians
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21 448 should also increase.

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26 449 Secondly, since the Nurses are found to be predominantly engaged in support activities at the
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28 450 expense of actual patient care, a separate staff category for administrative/ support activities is
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30 451 greatly warranted. This will free up the valuable yet scarce clinical time of the service providers.

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33 452 Thirdly, instead of the existing approach of deploying a fixed number of workforce at all health
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35 453 facilities, a flexible recruitment and HRH planning is needed, based on patient load and disease
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37 454 burden. This can be supported by determination of optimal requirements of HRH under given
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39 455 limited resources or constraints in those health facilities²⁹⁻³² by using the WHO methodology on
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41 456 workload indicators of staffing need. It is important to recognize that, decisions in health sector
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43 457 are very much contingent on the local context, especially the patient load, demographic drivers
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45 458 (e.g., age structure of the population, gender ratio, etc.), and epidemiologic profile. Therefore, the
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47 459 government should adopt flexible health workforce planning and recruitment policy in place to
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49 460 keep up with the local patient load and disease burden. The culture of bottom-up decision-making
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51 461 should be adopted eventually.
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7 463 **Strengths and limitations**

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9 464 This study had a number of strengths. First, we conducted time-motion study, which helped the
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11 465 research team gain a better understanding of the service context of the staffs. Secondly, when the
12
13 466 key informants or experts suggested an unrealistic activity standard, we presented them the time-
14
15 467 motion findings and helped them suggest a more context sensitive standards. Thirdly, the research
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17 468 team used both qualitative and quantitative methods for primary data collection, which
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19 469 complement each other for bringing data accuracy. Fourthly, WHO technical officers, who had
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21 470 expertise in WISN application in other countries, and the Ministry of Health officials were directly
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23 471 involved in the field level data quality checks.
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30 473 However, despite careful planning and painstaking implementation of the research, we faced some
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32 474 challenges during different stages of the WISN process. First, some service statistics data, which
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34 475 were essential for establishing standard workloads, were not readily available due to poor record
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36 476 keeping systems at some health facilities. Secondly, the research did not take into account the
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38 477 patients' opinion or stakeholders' stance. Notwithstanding the fact that these perspectives are
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40 478 gaining momentum in health workforce decision-making, we could not take advantage of them in
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42 479 the interest of adhering to the highly structured nature of the WISN methodology. Thirdly, the
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44 480 official number of existing staffs often did not match with the number of staffs we observed
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46 481 providing services.
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53 483 **Conclusions**

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3 484 Human resource management is a big challenge, especially in a resource-poor setting like
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5 485 Bangladesh. With a vision of becoming a middle-income country by 2021, Bangladesh needs to
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7 486 strive for optimizing its existing resources, including human resources. This type of study can aid
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9 487 the decision-making in this direction, using the WISN as a planning tool for the managers.
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11 488 Implementation research is needed regarding how this workload-based staffing decisions can be
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13 489 integrated into the health systems in the most effective way. We expect that, these types of studies
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15 490 would pave the way for evidence-based HRH decision-making in the context of health system of
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17 491 Bangladesh.
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23 24 493 **List of abbreviations**

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26
27 494 ANC: Antenatal Care;
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29 495 EMO: Emergency Medical Officer;
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31 496 ERC: Ethical Review Committee;
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33 497 ESP: Essential Services Package;
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35 498 EWG: Expert Working Groups;
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37 499 FDCs: Field Data Collectors;
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39 500 FSs: Field Supervisors;
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41 501 GoB: Government of Bangladesh;
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43 502 HRH: Human Resources for Health;
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45 503 IDI: In-depth Interviews;
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47 504 IMCI: Integrated Management of Childhood Illness;
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49 505 KII: Key Informant Interviews;
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51 506 LMICs: Low- and Middle-Income Countries;
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3 507 MO: Medical Officer;
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5 508 MoHFW: Ministry of Health and Family Welfare;
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7 509 NCD: Non-communicable Diseases;
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10 510 OPD: Out Patient Department;
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12 511 PNC: Postnatal Care;
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14 512 RMO: Residential Medical Officer;
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16 513 SC: Steering Committee;
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18 514 TT: Technical Taskforce;
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20 515 UHC: Universal Health Coverage;
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22 516 UpHCs: Upazila Health Complexes;
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24 517 WISN: Workload Indicators of Staffing Need
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32 **Declarations**

33 ***Consent for publication***

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39 521 During the data collection process, while the ethical consents were obtained from the respondents,
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41 522 they were informed that their data might be used for publication in future. They were also informed
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43 523 that their identity will remain anonymous. Institutional consents for publication were obtained as
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46 524 well.
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48 ***Availability of data and materials***

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51 526 All research data have been submitted to the World Health Organization Country Office for
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53 527 Bangladesh, as per the agreement with the research organization, BRAC James P Grant School of
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56 528 Public Health, BRAC University. This manuscript only used the data pertaining to the Physicians
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3 529 and Nurses working at the two study Upazila (sub-district) Health Complexes. Unpublished data
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5 530 include: Consultants, General Physicians, and Nurses at the District Hospital level; Physicians,
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7 531 and Family Welfare Visitors at Maternal and Child Welfare Center level; Sub-Assistant
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9 532 Community Medical Officers at the Upazila Health Complex level; Sub-Assistant Community
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11 533 Medical Officers at Union Sub-Centers level, Sub-Assistant Community Medical Officers, and
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13 534 Family Welfare Visitors at Union Health and Family Welfare Centers level; and Community
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15 535 Health Care Providers, and Family Welfare Assistants at the Community Clinic/ Outreach level.
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17 536 Data may be obtained from the World Health Organization Country Office for Bangladesh upon
18
19 537 reasonable request (Focal Point: Mr. Md Nuruzzaman- nuruzzamanm@who.int).
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27 539 *Competing interests*

30 540 The authors declared that they do not have any competing interests.
31
32
33 541

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39
40 544 researchers at BRAC James P Grant School of Public Health, BRAC University.
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46 546 *Authors' contributions*

48 547 TJ conceived and designed the study. TJ and SNBKT carried out the data analyses and drafted the
49
50 548 manuscript. MN, SA, VOC, and TZ thoroughly reviewed the manuscript and contributed
51
52 549 substantially with necessary revision. TJ and SNBKT again reviewed the manuscript and prepared
53
54 550 for final submission. All authors approved the final manuscript.
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8
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12
13
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15
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17
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19
20
21 558 inputs at different stages of the project. Finally, we would like to extend our sincere gratitude to
22
23 559 the Field Supervisors and Data Collectors for their contribution throughout the qualitative and
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25 560 quantitative data collection.

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30 562 **Patient and Public Involvement statement:** No patient involved31
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648 **Figure Legends**

649 Figure 1: The ways WISN can help in human resource decision-making

650 Figure 2: Methods applied in each WISN step

651 Figure 3: Map of Jhenaidah and Moulvibazar Districts with study Upazilas identified

652 Figure 4: Approach of integration of ESP components in defining workload components of
653 health service activity

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Figure 1

Comparative analysis of WISN Ratio across different geographical areas (and health facilities therein)

- can help decision-making on recruitment of new staff and transfer of existing staff

Comparative analysis of WISN Ratio across comparable staff categories

- can help decision-making on allocating new functions on certain staff categories or removing their functions to other staff

Comparative analysis of current professional standards with the activity standards (developed for the WISN study)

- can help evaluating current professional performance and decision-making on additional staff requirement for performance improvement

Analysis of projected workload

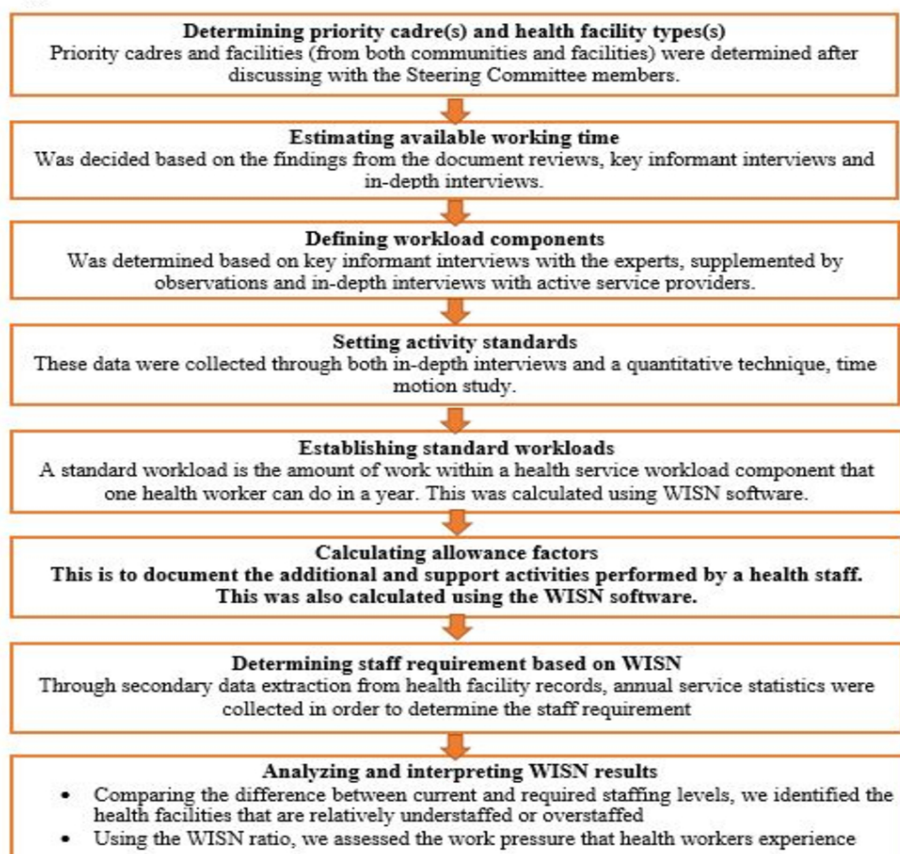
- can help decision-making on future staffing of health facilities

Alternative scenario based WISN analysis (e.g., changing length of working week, changing leave days, changing training policies, etc.)

- can help examining the impact of different conditions on staff requirement

Figure 1. The ways WISN can help in human resource decision-making

The ways WISN can help in human resource decision-making

Figure 2**Figure 2 Methods applied in each WISN step**

Methods applied in each WISN step

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Figure 3

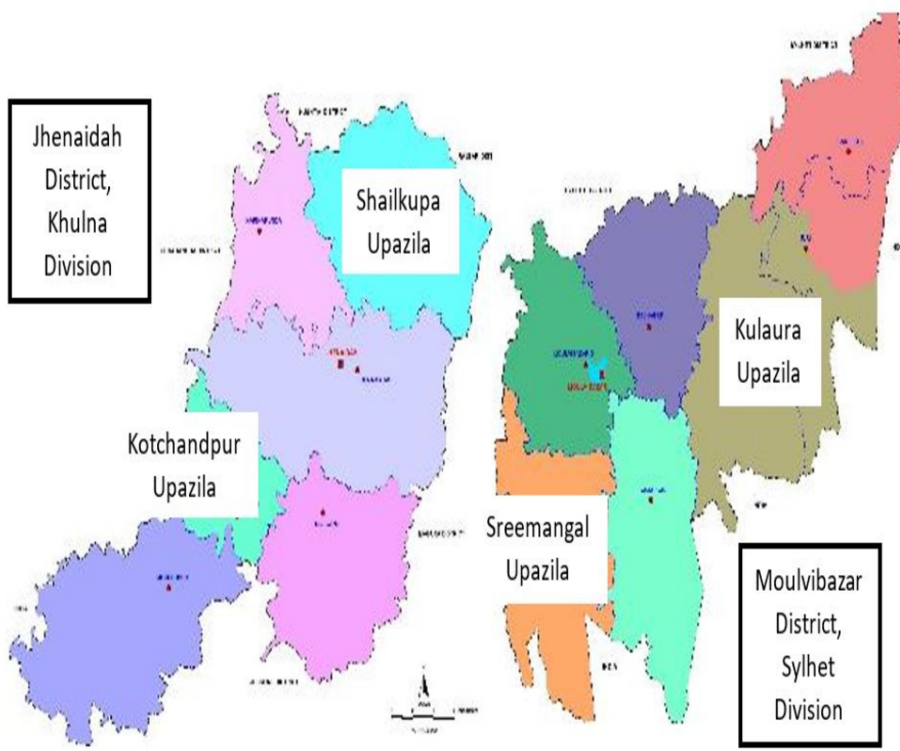


Figure 3 Map of Jhenaidah and Moulvibazar Districts with study Upazilas identified

Map of Jhenaidah and Moulvibazar Districts with study Upazilas identified

Figure 4

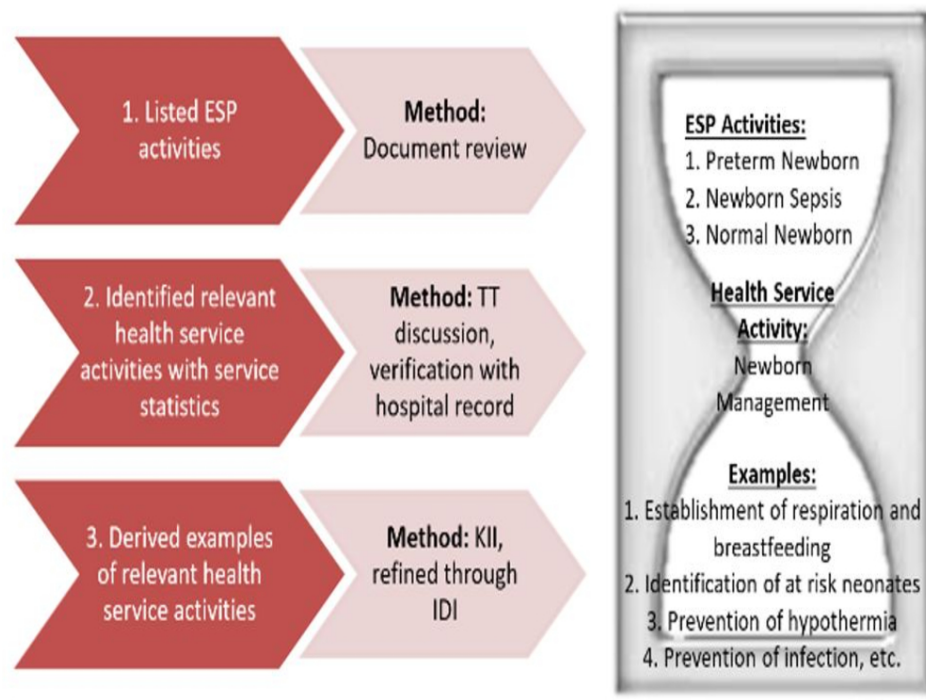


Figure 4 Approach of integration of ESP components in defining workload components of health service activity

Approach of integration of ESP components in defining workload components of health service activity