

## Evaluation of Triage System in a Dedicated Covid-19 Hospital

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The global health system faces a substantial burden from the Covid-19 pandemic. To prevent Covid-19 transmission an effective triage system is useful in resource-limited countries like Bangladesh. The purpose of the study was to determine the status of the triage system in a dedicated Covid-19 Hospital. This cross-sectional study was conducted among conveniently selected 150 respondents including 63 doctors, 72 nurses and 15 administrative staff. Data were collected through face-to-face interviews using a pretested semi-structured questionnaire and observation checklist. The collected data were processed and analyzed with the help of SPSS (Version 26.0) and Xcel 2019. The study was conducted at Kurmitola General Hospital, Bangladesh from January 2020 to December 2020. Among study participants, 54.0% of the respondents belonged to the (31-40) age group and 74.0% were female. Half 50.7% of the respondents working duration was (0-4) years. Two-thirds 67.0% of the respondents had training on the triage system. All of the respondents mentioned the presence of a triage system in this hospital but there was no tele-triage. Regarding infrastructure facilities like triage room, sitting facilities with 1-meter distance in waiting area, one-way entrance, and exit, separated ticket counter and washroom, proper hand wash facilities, all were present in this hospital. All of the respondents mentioned the presence of available logistic support for the triage system in this dedicated Covid-19 hospital including a sufficient supply of PPE, thermometer, and pulse oximeter. All doctors and nurses wore PPE. Almost four-fifths 87.30% of the respondents mention that there was no training on donning and doffing procedure of PPE. There was a statistically significant association between training on triage with age group and occupation of the respondents ( $p < 0.05$ ). The ideal working time of healthcare providers was not maintained. There had no facilities of isolated accommodation and health checkups for staff. But RT-PCR for Covid-19 test was done for all staff when he/she returns to normal life after duty. Based on study findings it has been concluded that the infrastructure facilities and logistic supports are sufficient. But staff management has to be improved and the authority should pay special attention to an effective triage system.

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**Key words:** Covid-19, Triage, Triage system

### Introduction

Since the beginning of the 20<sup>th</sup> century, the rapid growth of international transportation was responsible for the transmission of infectious diseases. These diseases have repeatedly threatened both population health and health care systems worldwide<sup>1</sup>. In 2020, coronavirus disease (Covid-19) was first reported in Wuhan, China; this virus spread globally through large-scale transmission and continues to create great challenges to medical, public health, and socioeconomic systems worldwide<sup>2</sup>. Bangladesh Government started the preparation to control and contain the pandemic in the country in January 2020 based on National Preparation and Response Plan<sup>3</sup>. Covid-19 cases once diagnosed will be managed preferably in dedicated hospitals either purposefully built or transformed from existing ones<sup>4</sup>. In Bangladesh, disease surveillance alongside response is an important component for prevention and control of the transmission<sup>3</sup>. A

vital strategy in minimizing the risk of infection begins with an effective triage system.

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According to the Bangladesh Society of Medicine, clinical triage for Covid-19 is a system for assessing all patients at admission allowing early recognition of possible Covid-19 patients and immediate isolation of patients with suspected Covid-19 infection in an area separate from other patients<sup>5</sup>. It is necessary to separate the Covid-19 patient's rooms and other rooms into three distinct areas. These three areas are low risk or a safe area, medium risk or semi-infected area, and high risk or infected area. The triage unit should be placed in a crowd-free area and it must have a separate entry and exit. The waiting room of the triage unit must be placed in a safe zone to prevent congestion in the triage unit<sup>6</sup>. The highly contagious nature of Covid-19 makes the use of tele triage particularly advantageous because it avoids the risk of spread by contact<sup>7</sup>. Based on current studies, about 80.0% of confirmed cases of coronavirus disease 2019 (Covid-19) can be treated as outpatients, up to 20.0% need hospitalization and 5.0% require intensive care<sup>8</sup>. The mortality rate for severe patients is around 13.4%. Therefore, risk assessment of patients is extremely important for patient management and medical resource allocation<sup>9</sup>. Rationing of medical resources may be required during the pandemic if healthcare infrastructures are overburdened<sup>10</sup>. According to a published report by World Health Organization published on 22<sup>nd</sup> March 2020 - Algorithm for Covid-19 triage and referral Patient triage and referral for resource-limited settings during community transmission. However, Bangladesh has made its own - Infection prevention and control in healthcare facilities to prevent corona virus protocol according to WHO suggestions. The protocol includes triage briefly following the facilities available. Successful triage of patients with Covid-19 at all levels (Primary, secondary and tertiary) will help the national response planning and case management system cope with the patient influx, direct necessary medical resources to efficiently support the critically ill, and protect the safety of healthcare workers<sup>8</sup>.

### **Methods**

This cross-sectional descriptive study was conducted among health service providers (doctors and nurses) and administrative staff who had to work in Kurmitola General Hospital. We calculate the sample size using an unknown

prevalence of 50.0% with 96.0% CI and precision of 5.0%, we require a total sample size of 384. After considering the non-response of 10.0% the final sample size was 422. But respondents were selected conveniently; as a result, finally, the sample size was 150. The respondent who was ill and not interested to participate we excluded from this study. The study period was January 2020 to December 2020 with the data collection period was the month of September 2020. Data were collected through face-to-face interviews using a pre-tested semi-structured questionnaire and observation checklist by the investigator. Informed written consent was taken from the respondents. The data were checked and cleaned, followed by editing, compiling, coding, and categorizing, analyzed by Statistical Package for Social Sciences (SPSS) statistical software version 26.0. The Chi-square test was applied for statistical significance. Quantitative data were summarized by percentage and qualitative data were summarized by mean and standard deviation. Ethical approval of this research was taken from the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM), Bangladesh.

### **Results**

In order to assess the status of triage system in a dedicated Covid-19 hospital, this cross-sectional study was being carried out among health service providers (doctors and nurses) and administrative staffs of selected Hospital. In this study 48.0% nurse, 42.0% doctors and 10.0% administrative personnel were interviewed. The maximum 54.0% of the respondents belong to (31-40) years and minimum 0.7% was above 50 years. Three-fourth of the respondents were female and rest one-fourth were male. Almost all of the respondents 91.3% were Muslim. Almost half 50.7% of the respondents current working duration was (0- 4 years) and only 2.0% was more than 14 years (Table I). Married was 90.0% and rest 10.0% were unmarried (Figure 1). Two third 67.0% of the respondents having training on Triage system and rest one third 33.0% have no training (Figure 2). Out of 150 respondents, all of respondents mention that presence of triage system, but there were no facilities of tele-triage system in this Covid-19 dedicated hospital. All of respondents mention that presence of separate entry and exit, triage registration desk or ticket counter, hand

wash facilities at entrance, clear sign at entrance, physical barrier (e.g. glass and plastic) between health personnel and patients, separate and well-ventilated waiting room, presence of hand wash facilities in waiting room, enough sitting arrangement in waiting room, at least 1-meter distance was present in purpose of sitting of patient in waiting room in this Covid-19 hospital. Maximum 95.3% respondents mention that triage area and waiting room cleans twice a day. Maximum 93.3% respondents mention that disinfection done by chlorine and alcohol in Covid-19 dedicated hospital. All of respondents mention that presence of dedicated washroom in triage system, presence of hand hygiene facilities in washroom, separated ward for suspected and confirmed patient in this Covid-19 hospital. All of doctors, nurses & ward boy maintain distance in triage area in Covid-19 dedicated hospital. Out of 150, all of the respondents mention that presence of available logistic support for triage system,

sufficient supply of personal protective equipment (PPE) (Like- Gown, Gloves and Goggles, Face shield etc.), sufficient supply of hand hygiene materials (soap, liquid hand wash etc.), Infrared Thermometer, pulse-oximeter, masks (Surgical, N-95, and KN-95) in this Covid-19 dedicated hospital. All of the doctors and nurse wore personal protective equipment (PPE). Regarding training, majority of the respondents 87.3% had not any training on donning and doffing procedure of PPE. Maximum working hour of all staffs in triage area was not 4 hours and there were no facilities of health checkup both physical and mental health. In this hospital, isolated accommodation was not available for all staffs but RT-PCR for Covid-19 test was done for all staffs when he/she return to normal life after duty. 81.3% of the respondents mention that presence of facilities of nutritious diet on Covid-19 dedicated hospital (Table II).

Table I: Socio-demographic characteristics of the respondents

Socio-demographic characteristics	Frequency (n)	Percent (%)
<i>Occupation</i>		
Administrative personnel	15	10.0
Doctor	63	42.0
Nurse	72	48.0
<i>Age of the respondents (years)</i>		
20-30	48	32.0
31-40	81	54.0
41-50	20	13.3
>50	01	00.7
<i>Sex of the respondents</i>		
Male	111	74.0
Female	39	26.0
<i>Religion of the respondents</i>		
Muslim	137	91.3
Hindu	11	07.3
Christian	01	00.6
Buddhist	01	00.6
<i>Current working duration of the respondents (years)</i>		
0-4	76	50.7
5-9	52	34.7
10-14	19	12.7
>14	03	02.0
Total	150	100.0

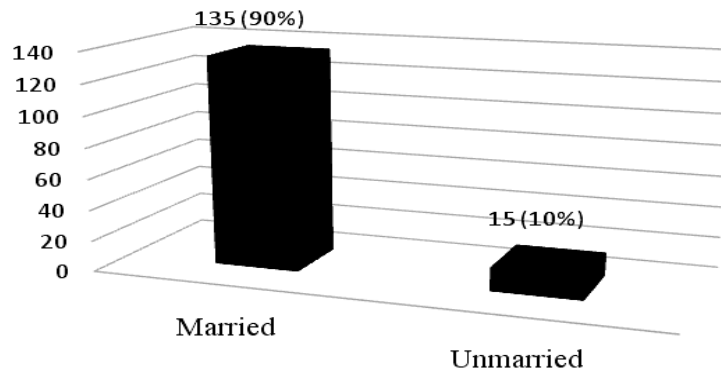


Figure 1: Bar diagram showing distribution of respondent by marital status

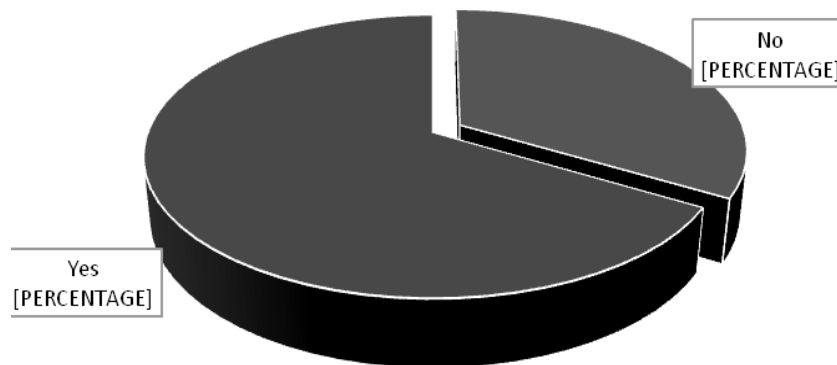


Figure 2: Pie chart showing distribution of respondents by training on triage system

Table III: Information on triage system

Infrastructure facilities of Triage system	Yes	No
	n (%)	n (%)
Presence of triage system	150 (100.0)	00 (00.0)
Presence of tele-triage	00 (00.0)	150 (100.0)
Presence of separate entry and exit	150 (100.0)	00 (00.0)
Presence of separate triage registration desk/ticket counter	150 (100.0)	00 (00.0)
Presence of hand wash facilities at entrance	150 (100.0)	00 (00.0)
Presence of clear sign facilities t entrance	150 (100.0)	00 (00.0)
Presence of physical barrier (e.g. glass and plastic)	150 (100.0)	00 (00.0)
Presence of separate and well-ventilated waiting room	150 (100.0)	00 (00.0)
Hand wash facilities in waiting room	150 (100.0)	00 (00.0)
Presence of enough sitting arrangement in waiting room	150 (100.0)	00 (00.0)
Presence of at least 1-meter distance in purpose of sitting of patient	150 (100.0)	00 (00.0)
Cleaning facilities of triage area and waiting room twice a day	143 (95.3)	07 (04.6)
Disinfection done by chlorine and alcohol	140 (93.3)	10 (08.8)
Dedicated washroom in triage system	150 (100.0)	00 (00.0)
Hand hygiene facilities in washroom	150 (100.0)	00 (00.0)
Presence of separated ward for suspected and confirmed patient	150 (100.0)	00 (00.0)
Maintenance of distance by Doctors, Nurses and Ward boys in triage area	150 (100.0)	00 (00.0)
<i>Information on Logistic support of Triage system</i>		
Presence of available Logistic Support	150 (100.0)	00 (00.0)

*Original Contribution*

Sufficient supply of PPE (gown, gloves, and goggles, face shield)	150 (100.0)	00 (00.0)
Sufficient supply of hand hygiene materials (soap, liquid hand washes etc.)	150 (100.0)	00 (00.0)
Sufficient supply of Infrared Thermometer, pulse-oximeter	150 (100.0)	00 (00.0)
Sufficient supply of Masks (Surgical, N-95, Kn-95)	150 (100.0)	00 (00.0)
PPE worn by doctors	63 (100.0)	00 (00.0)
PPE worn by Nurse	72 (100.0)	00 (00.0)
<i>Information on staff management of triage system</i>		
Training on donning & doffing procedure of PPE	19 (12.7)	131 (87.3)
Maximum working hour in triage area is 4 hours	00 (00.0)	150 (100.0)
Facilities of health checkup (Physical & mental health)	00 (00.0)	150 (100.0)
Isolated accommodation	00 (00.0)	150 (100.0)
Testing of RT-PCR for CpCOVID-19 when he/she return to normal life after duty	150 (100.0)	00 (00.0)

Age and occupation were significantly associated with triage training and training on donning and doffing procedure of PPE (Table III).

Table III: Association of age and occupation of the respondents with training on triage system and training of health care worker on donning and doffing procedure of PPE

Age group (years)	Training on Triage system		Total n (%)	Values
	Yes n (%)	No n (%)		
20-30	08 (16.7)	40 (83.3)	48 (100.0)	p<0.005 $\chi^2 = 11.100$ df = 148
31-40	36 (44.4)	45 (55.6)	81 (100.0)	
41-50	06 (30.0)	14 (70.0)	20 (100.0)	
>50	00 (00.0)	01 (100.0)	01 (100.0)	
Total	50 (33.3)	100 (66.7)	150 (100.0)	
Age group (years)	Training on donning and doffing procedure of PPE		Total n (%)	Values
	Yes n (%)	No n (%)		
20-30	06 (12.5)	42 (87.5)	48 (100.0)	p<0.005 $\chi^2 = 17.663$ df = 3
31-40	38 (46.9)	43 (53.1)	81 (100.0)	
41-50	07 (35.0)	13 (65.0)	20 (100.0)	
>50	01 (100.0)	00 (00.0)	01 (100.0)	
Total	52 (34.7)	98 (65.3)	150 (100.0)	
Occupation	Training on triage system		Total n (%)	Values
	Yes n (%)	No n (%)		
Administrative personnel	04 (26.7)	11 (73.3)	15 (100.0)	p<0.001 $\chi^2 = 24.862$ df = 2
Doctor	35 (55.6)	28 (44.4)	63 (100.0)	
Nurse	11 (15.3)	61 (84.7)	72 (100.0)	
Total	50 (33.3)	100 (66.7)	150 (100.0)	
Occupation	Training on donning & doffing procedure of PPE		Total n (%)	Values
	Yes n (%)	No n (%)		
Administrative personnel	12 (80.0)	03 (20.0)	15 (100.0)	p = <0.001 $\chi^2 = 64.239$ df = 2
Doctor	38 (60.3)	25 (39.7)	63 (100.0)	
Nurse	02 (2.8)	70 (97.2)	72 (100.0)	
Total	52 (34.7)	98 (65.3)	150 (100.0)	

Table IV: Observation checklist of Kurmitola General Hospital - a Covid-19 dedicated hospital according to facilities of triage system

Trait	Kurmitola General Hospital - Covid-19 Dedicated hospital
Triage system in hospital	Present
Tele triage	Absent
Well ventilated separated triage room	Present
Enough sitting facilities in waiting area	Present
Sitting arrangement (1-meter distance) in waiting area	Present
One-way entrance and exit	Present
Separate ticket counter for triage room entry	Present
Receptionist available in ticket booth	Present
Separated dedicated washroom	Present
Proper hand wash facilities in entrance, triage room and washroom	Present
Supply of infrared thermometer and pulse oximeter	Present
Supply of PPE (Gloves, Goggles, face shield, Mask)	Present
Cleanliness of triage room	Present
Assigned doctors and nurses, ward boys and cleaners for triage room	Present

In this Covid-19 dedicated hospital, all of the facilities of triage system including well ventilated separated triage room, enough sitting facilities in waiting area with sitting arrangement (1 meter distance), one way entrance and exit, separate ticket counter for triage room entry with receptionist, separated dedicated washroom, proper hand wash facilities in entrance, triage room & washroom, supply of infrared thermometer & pulse oximeter, of PPE (Gloves, Goggles, face shield, Mask), cleanliness of triage room, assigned doctors and nurses, ward boys & cleaners for triage room for triage room were present except tele-triage (Table IV).

### Discussion

Status of triage system is assessed in a dedicated Covid-19 hospital, Kurmitola General Hospital in this study. The important findings are being discussed here. It has been seen that three-fourths (74.0%) of the respondents were female. Regarding gender distribution, this finding is not similar to a study carried out in Pakistan by Hafeez in 2020<sup>11</sup>. Almost all of the respondents (91.0%) are Muslim. The reason behind that Bangladesh is a Muslim majority nation and it makes up 90.0% of the total population<sup>12</sup>. Most of the respondents (90.0%) were married. Two-thirds (67.0%) of the respondents have the online training on the Triage system. Triage is an important area of the emergency department of any acute hospital<sup>13</sup> but cannot be used during disasters like the Covid-19 pandemic<sup>14</sup>. In this study, all of the study participants mentioned the presence of a triage system in this hospital.

Articles from Iran<sup>6</sup> and Pakistan<sup>11</sup>, suggests telephone triage and audio-visual triage (AVT) respectively. The telephone triages a more effective triage system in the prevention of SARS-CoV-2 infection. In Bangladesh, the Disease Control Division of DGHS, Ministry of Health and Family Welfare also suggest tele-triage<sup>4</sup>. But unfortunately, this teletriage system is absent in this dedicated COVID hospital. In checklist analysis, also revealed that a tele-triage facility is not found in this hospital. By taking simple and cost-effective measures like tele-triage or audio-visual triage (AVT) system, can boost the combating SARS-CoV-2 virus spread. All of the participants mentioned the presence of separate entry and exit in this selected hospital. Patients with suggestive symptoms of Covid-19 should be screened at the entrance of the hospital. Once suspected of Covid-19, the patient should be separated from other people by a distance of at

least 1 meter<sup>8</sup>. All of the respondents mention the presence of a registration desk/ticket counter in this selected hospital. A triage registration desk or ticket counter with staff effectively reduces the infection risk. In Pakistan, a separate Covid-19 Counter was established to carry out triage and limit the mixing of the suspected cases with the routine cases<sup>15</sup>. All of the respondents mention the presence of a separated ward for suspected and confirmed patients and a clear sign at the entrance. Some strategy was mentioned the 'Handbook of Covid-19 Prevention and Treatment' like healthcare facilities of fever clinic should have exclusive one-way passage at the entrance of the hospital with a visible sign; Suspected and confirmed patients should be separated in different ward areas<sup>16</sup>. In this study, all of the participants mentioned the presence of hand washes facilities in the triage area. Handwashing is also one of the key steps of Covid-19 prevention. Ministry of Health and Family Welfare also suggest that hand hygiene facilities should be available in sufficient quantities in Covid-19 Hospital<sup>4</sup>. All of the doctor, nurse and ward boy maintain distance in the triage area. Presence of physical barrier (e.g. glass and plastic) between health personnel and patients. It is essential to maintain a communication distance of 1 to 2 meters to reduce contact with staff<sup>6</sup>. In Pakistan, social distancing was ensured by keeping separation between the patients and health care provider (HCP) by use of a glass wall<sup>15</sup>. Presence of separate and wellventilated waiting room. The presence of enough sitting arrangement and at least 1-meter distance was present in the purpose of the setting of a patient in the waiting room. It is essential for infection prevention and control. Maximum (94.7%) respondents mention that the triage area and waiting room clean twice a day. Due to the presence of the virus on the surfaces, repeated disinfection is required for effective prevention<sup>6</sup>. A dedicated washroom in the triage system is available. People with suspected or confirmed Covid-19 disease should be provided with their flush toilet or latrine that has a door that closes to separate it from the patient's room<sup>4</sup>. All of the respondents mention the presence of available logistic support for the triage system. Triage with the use of thermal guns was also done in Pakistan<sup>15</sup>. All of the doctors & nurses wore personal protective equipment (PPE) but none of the ward boy and cleaner wore. Among healthcare worker, the risk of transmission

can be reduced with appropriate cautions in health settings. For better staff management some guidelines are given in Handbook of Covid-19 Prevention and Treatment (2020), before working in a fever clinic and isolation ward, the staff must undergo strict training and examinations to ensure that they know how to put on and remove personal protective equipment<sup>16</sup>. In this study, (87.3%) respondents had no training on donning and doffing procedure of PPE. It shows significant results with those who had training on the triage system. The front-line staff should have facilities of an isolated accommodation, working hour for each team, not more than 4 hours. But in this hospital triage system failed to fulfill these guidelines. A nutritious diet should be provided to improve the immunity of medical personnel. In this hospital staff getting of facilities of a nutritious diet. In this hospital, all of the HCWs work more than 4 hours without a physical and mental checkup. It might cause physical and emotional health problems due to extreme workload. So periodical examination of HCWs is essential for a better outcome and make sure psychological support for HCWs when requires<sup>4</sup>. RT-PCR for Covid-19 test was done for all staffs when he/she returns to normal life after duty. In response to statistical analysis, some sociodemographic characteristics like age group and occupation of the respondents significantly associated with triage system and training on donning and doffing procedure of PPE. On observation, the triage process of this hospital starts with an entry gate. This hospital triage area is divided into three zones including the green zone, yellow zone, and red zone. Clear sign at the entrance directing patients to the designated ticket counter desk. The patients notify the triage ticket counter desk about symptoms suggestive of Covid-19 as soon as they arrive. After that patients maintain respiratory hygiene i.e. use of masks and handwashing with alcohol rub and wait for the doctor calling in separate wellequipped facilities waiting area. Patients maintain social distance with a 1-meter distance. Doctors investigate the patients in a separated well-ventilated triage room. After history and clinical confirmation, if the Covid-19 positive patient sent to Covid unit of the red zone and suspected patients sent to the yellow zone. Non-Covid individuals left the hospital using the exit gate through the green zone. In checklist analysis, in

this Covid-19 dedicated hospital, almost all of the facilities of triage system are present.

### **Conclusion**

In this study triage system was evaluated by infrastructure facilities, logistic supply, and staff management of this Covid-19 dedicated hospital. Based on respondents response and observation by investigator infrastructure facilities and logistic supply was present in this hospital but some deficiency was revealed in staff management such as isolated accommodation, working hours, absence of regular health checkup. Respondent's response as well as in checklist analysis, the facilities of the tele-triage system were not present. One of the most serious problems related to the Covid-19 pandemic is the spread of the infection to healthcare workers. Effective triage can play a role in the protection of healthcare workers in resource-limited countries like Bangladesh.

### *Recommendation*

Recommendations are i) Tele-triage or audio-visual triage (AVT) system should be recommended for all the hospitals dealing with suspected cases of Corona virus infection, ii) Working hours should be ensured according to guideline for HCWs for better functioning, iii) Regular health checkup including both physical and mental checkup should be recommended and when require necessary support must be provided and iv) Sufficient training on donning and doffing procedure of PPE for staffs and isolated accommodation for doctors and nurse should be recommended.

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