

## RATIONAL USE OF PERSONAL PROTECTIVE EQUIPMENT - COVID 19 PANDEMIC

Beenish Abbas, Abdul Rehman\*, Sana Abbas\*\*, Faisal Nawaz Khan\*\*\*

Fauji Foundation Hospital, Rawalpindi Pakistan, \*Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, \*\*Armed Forces Institute of Ophthalmology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, \*\*\*Combined Military Hospital Peshawar/National University of Medical Sciences (NUMS) Pakistan

### ABSTRACT

**Objective:** To evaluate coherence with reasonable and judicious use of personal protective equipment.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Tertiary Care Hospital, from Feb 2020 to May 2020.

**Methodology:** Methodology constituted of a paper-based and web-based questionnaire based on relevant studies and World Health Organization (WHO) Guidelines. A pilot study carried out at 15-20 participants for questionnaire validation and reviewed by independent experts for face validity, a final questionnaire comprised of 13 multiple-choice questions in addition to information on demographic profile and professional overview. The minimum sample size required for the study was 573, where the prevalence of knowledge of use of personal protective equipment by doctors was considered to be 31.5%.

**Results:** A total of 640 participants enrolled in the study and data extracted from their responses. Age range 24-61 years of sample was with mean age was  $36.66 \pm 9.0$  years. One hundred and sixty (25%) participants were males whereas 480 (75%) were females. Three hundred and four (47.5%) had adequate knowledge about disease transmission and 592 (92.5%) were aware of preventive measures. Five hundred and forty four (65%) declared that N95 to be used in routine patient care, therefore, exhibiting injudicious use. Only 56 (8.8%) were compliant with the length of duration of Respirator use.

**Conclusion:** Due to global mismatch and disruption in the supply chain of Personal Protective Equipment an intricate balance between the safety of healthcare workers, prevention of disease transmission and economic burden to be maintained with adherence to World Health Organization PPE use guidelines.

**Keywords:** COVID-19, N95 Respirator, PPE.

---

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

---

## INTRODUCTION

December 2019 China reported the World Health Organization pneumonia caused by a newer organism in their province Wuhan. It was declared as Public Health Emergency of International Concern on 30<sup>th</sup> January 2020. On 11<sup>th</sup> February 2020, this newer bug was named as COVID-19 where CO stands for Corona, VI- stands for Virus and D - for the disease. Since the first case was reported in December 2019, there-fore, suffix 19 was added. On 11<sup>th</sup> Mar World Health Organization Chief doctor Tedros Adhanom Ghebreyesus announced COVID-19 to be a pandemic involving multiple countries. On 26<sup>th</sup> February first case of COVID-19 was reported in Pakistan<sup>1</sup>.

This ongoing pandemic is a type of rare and

extreme crisis scenario, generating morbidity, mortality, and stress globally. In addition to its physical infliction, the general population of all age groups, from all over the world is impacted by the storm of social stigma of fear, insecurities, and superstitious convictions. Due to severe pulmonary disease, imposing a greater risk to front line healthcare facilitator and law enforcement personnel, fear and stigma are prevailing due to enormous misinformation and subsequent unfounded rumours. Solidarity is the need of hour in changing behavior against this stigma. Administrative authorities have to play an epic role to lessen prevailing fear and discrimination<sup>2</sup>.

The mainstay of prevention of this widespread disease is being controlled by involving isolation, quarantine and social distancing. Almost all of the affected global area is in lockdown of entire states. Cancellation of transports,

---

**Correspondence:** Dr Faisal Nawaz Khan, Consultant Dental Surgeon, Combined Military Hospital Peshawar Pakistan  
Received: 07 May 2020; revised received: 01 Jun 2020; accepted: 02 Jun 2020

being locked up in a home, timely opening of canteen stores, empty wandering roads, uncertainty regarding disease pathogenesis, safety aspects of already chronically ill patients and widespread prevalence of conspiracy theories on social media has put humans in severe anxiety state that world health organization director of global infectious hazard preparedness Sylvie Briand said "fear and stigma go together and when people fear, they tend to stigmatize other groups and what we try to do is to reduce this fear"<sup>3</sup>.

This state of lockdown and torment has disrupted global chains of supply of assorted items in addition to personal protective equipment (PPE). Furthermore economy also submerged into a financial crisis. German foreign minister is alleged to have committed suicide. It was then later disclosed by his close friend that he was scared of an economic crisis to an extent to end up his life by himself<sup>4</sup>.

COVID-19 although closed book but given available evidence it is not an airborne infection, spreads through contact. Most vulnerable congregation are those who are caregivers and healthcare workers managing COVID-19 patients. Preventive measures suggested are incessant hand hygiene with alcohol-based hand rub and washing with soap and water, social distance maintenance of at least 01 meter, following respiratory hygiene by coughing or sneezing on elbow or tissue, and immediate relinquishments of contaminated. Wearing medical mask advocated only with respiratory symptoms<sup>5</sup>.

World Health Organization program "Save Lives - Clean Your Hands" with proper technique, use of gloves can not deny the importance of adequate hand hygiene illustrated as under (figure).

Entry points to be arrayed with infrared thermometers and thermal imaging cameras, additionally, phase I sorting with sketchy history and examination ensuring a safe distance of 1 meter at the minimum to have adhered. Intend prohibition of self-contamination. Pronouncements for healthcare workers are to protect them-

selves and avert transmission with the intricate balance between appropriate use and overuse of PPE, therefore, putting a stop to depletion of storage and supplies of PPE. This calls for inescapable training of hospital staff for the rational use of PPE. Contamination is to be prevented from inanimate objects, facilities to be ensured with spatial distance of 1 meter, well ventilated set up and adequate isolation rooms<sup>7</sup>.

Globally there is a shortage of PPE due to lockdown, inappropriate use, lack of information, stocking, and state of panic among masses. Equilibrium loss in production and inflation of consumption has created shortages thus deleterious for healthcare bodies. World Health Organization to reduce subjection of public and healthcare workers suggested the establishment of telemedicine and online portals for minor ailments. Use of transparent windows and barriers at reception desk, triage zones, pharmacy etc. Restricted movement in isolation wards and adoption of multitasking strategy. As per WHO guidelines, PPE use vary according to situation, circumstances, and setting. Healthcare workers nearby of COVID-19 infected patients and involved in direct care should use gloves, gown along with medical masks and eye protection in the form of goggles & face shield. However if involved in performing aerosol-generating procedures such as endotracheal intubation, cardiopulmonary resuscitation, etc. should use respirators instead of medical masks along with splash-proof aprons<sup>8</sup>.

Perceptive use of respirators (e.g. N95, FFP2 or equivalent standard) in utmost advantageous manner is essential, as evidence gained from past respiratory outbreaks, respirators can be employed for extended duration up to 04 hours. In community, individuals providing first-hand care to infected and evidence of active symptoms use a medical mask (MM) however, general public neither having active symptoms nor immediate contact with infected one should not ply any genre of mask<sup>9</sup>.

Sanitary workers make use of medical mask, gown, resistant gloves, protective eye equipment,

closed work shoes for the COVID isolation ward. Only social distance of 01 meter sufficient in Triage or primary segregation area, no personal protective equipment is required however if the client is symptomatic use a medical mask. Use medical mask, gown, gloves is reasonable for laboratory staff, eye protection passable only with risk of splash. There is isn't any pre requisition of protective equipment for administrative healthcare staff<sup>10</sup>.

Our study based on the assumption that was there is a meagerness of acquiescence, comprehension, and proficiency to the rational use of personal protective equipment (PPE) in light of World Health organization Guidelines issued pertinent to COVID-19 pandemic. This paucity of facts is attributable to the financial burden and problems of PPE availability encountered by professionals.

**METHODOLOGY**

This cross-sectional study was carried out from February 2020 to May 2020, at Tertiary Care Hospital, approval was taken from the ethical research committee of the Institute (ERC number -09/ERC).

Methodology constituted of a paper-based and web-based questionnaire based on relevant studies and World Health Organization (WHO)

a final questionnaire comprised of 13 multiple-choice questions in addition to information on demographic profile and professional overview.

Our questionnaire covered three sections demographic profile, Knowledge about COVID-19, and compliance with PPE guidelines. We inquired about high-risk groups, preventive measures in community, precautions which can minimize the requirement of PPE. The third section analyzed knowledge about essential equipment required in various scenarios such as direct care of patients, aerosol-generating procedures, individuals with or without symptoms. We also asked participants about their understanding of respirators use. We also assessed practices followed during administrative work, Triage area, and during patient transport<sup>11,12</sup>.

The minimum sample size required for this cross-sectional study was 573, calculated by using formula (open epi calculator  $-n = [deff * np(1-p)] / [(d2/z21-\alpha/2*(n-1)+p*(1-p)]$ ) with hypothesized % frequency of outcome factor in the population (p) as 31.5% ± 5, Confidence limits as % of 100 (absolute ±%) (d) (5%) and (99%) confidence levels where the prevalence of knowledge of the use of personal protective equipment by doctors was considered to be 31.5% as reported by Archana *et al*<sup>13</sup>. A non-probability convenience

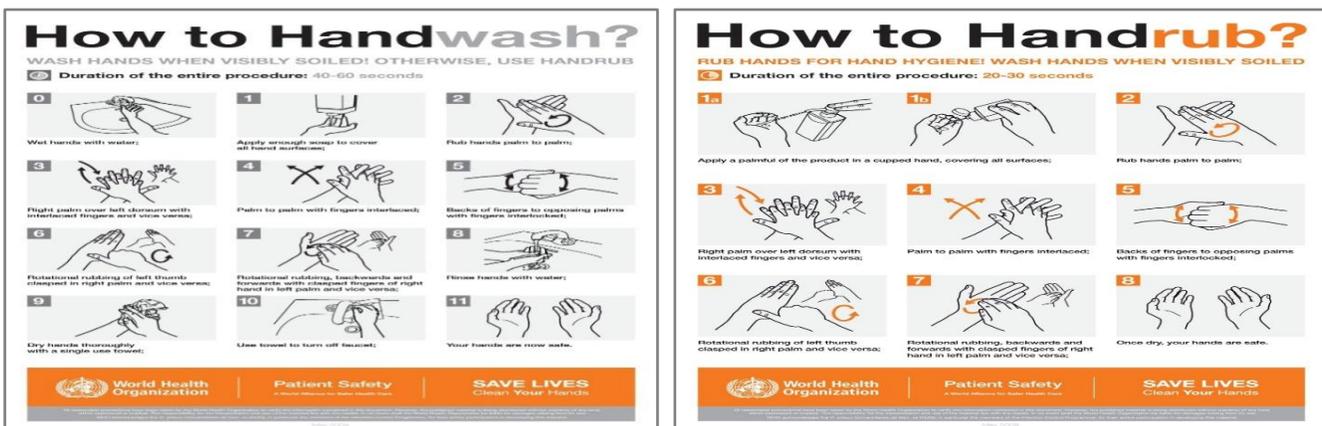


Figure 1: Hand Hygiene Steps<sup>6</sup>.

Guidelines. A pilot study carried out at 15-20 participants for questionnaire validation and reviewed by independent experts for face validity,

sampling methodology was employed and the questionnaire was distributed among (n=640) participants.

Data was entered and analysed by using data management software IBM SPSS (version 23.0). The descriptive statistics of continuous variables were presented as mean and standard deviation, while categorical data frequencies and

exact test as applicable. A *p*-value of  $\leq 0.05$  was considered to be statistically significant.

## RESULTS

A total of 640 participants enrolled in the study and data extracted from their responses.

**Table-I: Knowledge assessment.**

		Frequencies, n (%)
Knowledge about COVID-19	Transmission between close contact & droplets	280 (43.8)
	Close contacts of COVID-19 are at risk	56 (8.8)
	All of the above	304 (47.8)

**Table-II: Preventive Measures**

		Frequencies, n (%)
Community-based preventive measures	Hand hygiene	16 (2.5)
	Respiratory Hygiene	8 (1.3)
	Wearing MM	8 (1.3)
	Avoid touching eyes, nose & mouth	8 (1.3)
	Social distance	8 (1.3)
	All of the above	592 (92.5)
Minimize requirements of PPE	Telemedicine	152 (23.6)
	Physical barriers	80 (12.5)
	Bundling activities	16 (2.6)
	All of the above	296 (46.3)
	Unsure	96 (15)

**Table-III: PPE rational use.**

		Frequencies, n (%)
Direct Patient Care	Gown, gloves, MM and eye protection	224 (35)
	Gown, gloves, N-95 and eye protection	416 (65)
Aerosol Generating procedure	Gown, gloves, MM and eye protection	72 (11.3)
	Gown, gloves, N-95 and eye protection	544 (85)
	Unsure	24 (3.8)
Duration of Respirators Use	02 hours	24 (3.3)
	04 hours	56 (8.8)
	06 hours	288 (45)
	Unsure	272 (42.5)
Individual with Symptoms	Medical masks	96 (15)
	Respirators(e.g. N95, FFP2)	512 (80)
	Unsure	32 (5)
Individuals without Symptoms	Medical masks	456 (71.3)
	Respirators(e.g. N95, FFP2)	112 (17.5)
	Unsure	8 (1.3)
	Don't use masks	64 (10)
Triage Area	No PPE required	24 (3.8)
	Medical masks	112 (17.5)
	Respirators (e.g. N95, FFP2)	304 (47.5)
	Unsure	200 (31.3)

percentages were used. Categorical grouped data was analyzed by either Chi-square or Fischer-

Age range 24-61 years of sample was with mean age was  $36.66 \pm 9.00$  years. Age group distri-

bution was 72(11.3%) <25 years, 552 (86.3%) 25-50 years and 16(2.5%) >50 years. 160 (25%) participants were males whereas 480 (75%) were females. 232 (36.3%), 5-10 years 272 (42.5%) and 10-20 years 120 (18.8%). 304 (47.5%) had adequate knowledge about disease transmission and 592

**Table-IV: PPE Recommendations.**

		Frequencies; n(%)
Laboratory Staff/ Sample Handling	Gown, gloves, MM and eye protection	224 (35)
	Gown, gloves, N-95 and eye protection	400 (62.5)
	Unsure	16 (2.5)
Ambulance/Patient Transport	Gown, gloves, MM and eye protection	136 (21.3)
	Gown, gloves, N-95 and eye protection	496 (77.5)
	Unsure	8 (1.3)
Cleaners/Sanitary workers	MM, Gown, Heavy-duty gloves, Eye protection	88 (13.8)
	MM, Gown, Heavy-duty gloves, Eye protection, closed shoes	280 (40)
	N-95, Gown, Heavy-duty gloves, Eye protection, closed shoes	280 (43.8)
	Unsure	16 (2.5)
Administrative Area	No PPE required	32 (5)
	Medical masks	448 (70)
	Respirators (e.g. N95, FFP2)	104 (16.3)
	Unsure	56 (8.8)

**Table V: Summary.**

Profession / Administrative Area		Administrative Area				p-value
		No PPE	MM	N-95	Unsure	
Profession	Dentist	24	416	88	48	0.001*
	Medical	8	32	16	8	
Total		32	448	104	56	
Profession / Aerosol Generating Procedures		Aerosol Generating Procedures			p-value	
		Medical Mask	Respirator	Unsure		
Profession	Dentist	64	488	24	0.27	
	Student	8	56	0		
Total		72	544	24		
Profession / Respirators Duration		Respirators Duration				p-value
		02 hrs	04 hrs	06 hrs	Unsure	
Profession	Dentist	24	48	280	224	<0.001*
	Student	0	8	8	48	
Total		24	56	288	272	
Profession / Patient Transport		Patient Transport			p-value	
		MM	N-95	unsure		
Profession	Dentist	112	456	8	0.006*	
	Student	24	40	0		
Total		136	496	8		

\*significant p-value; p-value was calculated by applying Fischer-exact test

les. 576 (90%) participants were practising dentists whereas 64 (10%) were dental students. Working experience of respondents was <5 years (92.5%) were aware of preventive measures (table-I). 544 (65%) declared that N95 to be used in routine patient care, therefore, exhibiting inju-

icious use (table-III). Only 56 (8.8%) were compliant with a length of duration of Respirator use i.e. 04 hours. Only 328 (51.2%) were sure that respirators can be used again, 256 (40%) said it can't be used and 56 (8.8%) were unsure. Summary of significant co-relations illustrated in (table-V).

## DISCUSSION

Results proved that there was a meagerness of acquiescence, comprehension, and proficiency to the rational use of personal protective equipment (PPE) in light of World Health organization Guidelines issued pertinent to COVID-19 pandemic. Although participants are appropriately equipped with knowledge (47.8%) and competently about preventive measures (92.5%).

Archana *et al* conducted a study on PPE use among 1060 health care workers. Out of which 412 (38.9%) were doctors, 550 (51.9%) nurses and 98 (9.2%) technicians. Only 156 (18.1%) practitioners appropriately used PPE out of which Operation theatre staff was more proficient (100%). Adherence to guidelines for removal of PPE was observed only in 116 (12.1%) doctors and nurses. (78%) and (11%) stated a lack of availability and lack of knowledge respectively, reason for non-adherence with guidelines. This supports our rationale as we hypothesized that injudicious consumption will lead to early burn out of stocks<sup>13</sup>.

Schwartz *et al* evaluated healthcare workers knowledge and confidence in PPE in the course of H1N1 Pandemic via validated questionnaire dispersed across (617) participants in (21) hospitals and (40) basic medical facilities. (61%) had a well-judged approach for utilization of PPE stating whereas (48%) did not have. However in our case only (35%) has adequate knowledge in direct patient care<sup>14</sup>.

Hussain *et al* prosecuted a cross-sectional study during the influenza pandemic across Pakistan with a questionnaire as an analysis tool. 181 (75%) Medical students declared that medical masks should be used for symptoms whereas in or case (80%) stated N-95 respirator exhibiting an exaggerated approach on COVID-19<sup>15</sup>.

Waheed *et al* interviewed 100 healthcare workers and 100 patients across 10 hospitals dedicated to the management of drug-resistant tuberculosis in Pakistan. Reasons for the limited use of surgical masks in order of precedence were no availability (50), lack of patient cooperation (24), training deficit (8), and overburdened (5). In the case of respirators, respondents gave justifications as non-availability (54), intolerable (53), the dearth of training (11), and hunch of suffocation (6)<sup>16</sup>.

Javed *et al* gauged practices through questionnaire, participants included doctors, nurses and non-medical staff in tertiary care hospitals. (25%) used PPE for suspected TB cases and (56%) for confirmed cases, therefore, in the Triage area where cases are only segregated PPE is not overtly exhausted. (47.5%) of our participants stated respirators to be used in the Triage area which demonstrates the dissipation of expensive commodities<sup>17</sup>.

Nasim *et al* conducted a cross-sectional study including (1782) laboratory staff and inquired them about the use of PPE (coats, gloves, face masks, eye shield). (31.9%) said that they don't use any PPE however gloves and coats are most frequently used. However in our case only (35%) responded regarding the correct combination of PPE use for laboratory staff during the COVID-19 pandemic. 18

Chughtai *et al* prosecuted a cross-sectional survey via questionnaire across 55 Secondary and Tertiary hospitals in the course of Influenza, severe acute respiratory syndrome (SARS), and Tuberculosis (TB). They evaluated the use of various types of masks and respirators. Results interpreted that Medical masks are considered standard. Whereas (65%) of our respondents preferred respirators for direct patient care which is not recommended by WHO COVID-19 PPE guidelines<sup>19</sup>.

Khan *et al* conducted evaluated protective use of gloves, face masks and eye shields to prevent infectious diseases. (200) dentists were enrolled in the study from Tertiary care dental

hospitals. (94%), (68%) and (35%) used gloves, masks and eye shields respectively. (85%) of our participants were compliant with the use of eyeshields<sup>20</sup>.

Beckman *et al* surveyed respiratory protection programs and practices in the course of H1N1 influenza pandemic. (95.5%) respondents stated the use of N95 respirator or higher level of barrier for direct patient care and (65%) of our participants exhibited similar responses therefore relatively enhanced grip on the guidelines. (42.3%) reused an N95 respirator due to “standard practice” and “shortage.” (51.2%) of our participants declared that respirators can be reused or for prolonged period however when asked about recommended allowed duration only (8.8%) stated 04 hours<sup>21</sup>.

Therefore because of enlightenment attained by research analysis of our study it is relative studies conducted on outbreaks that spanned globally in past it is strongly recommended to cohere with guidelines and indoctrination is mandatory as the perpetuity of illumination and education is the core of medical meadow. We are among third world countries with constraints of resources hence the stupendous magnitude of rationality is anticipated out of our healthcare workers to conserve resources and finances.

## CONCLUSION

Due to global mismatch and disruption in the supply chain of Personal Protective Equipment, an intricate balance between safeties of healthcare workers, prevention of disease transmission and economic burden to be maintained with adherence to World Health Organization PPE use guidelines.

## CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

## REFERENCES

- World Health Organisation. Coronavirus disease 2019. (2020). [online] Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- Coronavirus pandemic in Pakistan [Internet]. Wikipedia. Wikimedia Foundation; 2020. Available from: [https://en.wikipedia.org/wiki/2020\\_coronavirus\\_pandemic\\_in\\_Pakistan](https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Pakistan)
- Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19. [online] Available at: <https://www.ecdc.europa.eu/en/publications-data/guidance-wearing-and-removing-personal-protective-equipment-healthcare-settings>
- Al Jazeera. German state minister kills himself as coronavirus hits the economy [Internet]. Germany News | Al Jazeera. Al Jazeera; 2020. Available from: <https://www.aljazeera.com/news/2020/03/german-state-minister-kills-coronavirus-hits-economy-200329165242615.html>
- Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19) & interim guidance, 2020. Available at: <https://apps.who.int/iris/handle/10665/331498>
- Modi PD, Kumar P, Solanki R, Modi J, Chandramani S, Gill N. Hand hygiene practices among indian medical undergraduates: a questionnaire-based survey. *Cureus* 2017; 9(7): 1463.
- Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19) - Interim guidance (19 March 2020) - World | Relief Web. [online] Available at: <https://reliefweb.int/report/world/rational-use-personal-protective-equipment-ppe-coronavirus-disease-covid-19-interim>
- Guidelines for use of personal protective equipment (PPE) during the COVID-19 pandemic when demand exceeds supply. *Am Veterinary Med Assoc* 2020. Available at: <https://www.avma.org/resources-tools/animal-health-and-welfare/covid-19/guidelines-ppe-covid-19-pandemic-demand-exceeds>
- Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth. Geneva: World Health Organization; 2009 (Global Observatory for eHealth Series).
- Radonovich LJ, Cheng J, Shenal BV, Hodgson M, Bender BS. Respirator tolerance in health care workers. *J Am Med Assoc* 2009; 301(1): 36-38.
- Personal protective equipment (PPE) for clinicians & ICM Anaesthesia COVID-19. Available at: <https://icmanaesthescovid-19.org/personal-protective-equipment-ppe-for-clinicians>
- COVID-19: personal protective equipment use for non-aerosol generating procedures - GOV.UK. Available at: <https://www.gov.uk/government/publications/covid-19-personal-protective-equipment-use-for-non-aerosol-generating-procedures>
- Archana A, Gladius H, Meriton A, Christina P. A study on personal protective equipment use among health care providers, Tamil Nadu. *Intl J Community Med Pub Health* 2018; 10: 18203.
- Schwartz D, Shapira S, Bar-Dayan Y. Health care workers' knowledge and confidence in personal protective equipment during the H1N1 pandemic in Israel. *Disaster Med Pub Health Preparedness* 2014; 8(2): 150-57.
- Hussain ZA, Hussain SA, Hussain FA. Medical students' knowledge, perceptions, and behavioural intentions towards the H1N1 influenza, swine flu, in Pakistan: A brief report. *Am J Infect Control* 2012; 40(3): e11-3.
- Waheed Y, Khan MA, Fatima R, Yaqoob A, Mirza A, Qadeer E, et al. Infection control in hospitals managing drug-resistant tuberculosis in Pakistan: how are we doing? *Pub Health Action* 2017; 7(1): 26-31.
- Javed S, Zaboli M, Zehra A, Shah N. Assessment of the protective measures taken in preventing nosocomial transmission of pulmonary tuberculosis among health-care workers. *East J Med* 2012; 17(1): 115-18.

18. Nasim S, Shahid A, Mustufa MA, Arain GM, Ali G, Taseer IU, et al. Biosafety perspective of clinical laboratory workers: a profile of Pakistan. *J Infect Dev Ctries* 2012; 6(1): 611-19.
  19. Chughtai AA, MacIntyre CR, Ashraf MO, Zheng Y, Yang P, Wang Q, et al. Practices around the use of masks and respirators among hospital health care workers in 3 diverse populations. *Am J Infect Cont* 2015; 43(10): 1116-18.
  20. Khan AA, Javed O, Khan M, Mehboob B, Baig S. Cross infection control. *Pak Oral Dent J* 2012; 32(1): 444.
  21. Beckman S, Materna B, Goldmacher S, Zipprich J, D'Alessandro M, Novak D, et al. Evaluation of respiratory protection programs and practices in California hospitals during the 2009-2010 H1N1 influenza pandemic. *Am J Infect Control* 2013; 41(11): 1024-31.
- .....