

Using A 'Brick' System of Staffing and Duty Rotation for Optimal Utilization of Manpower and Reducing Attrition of Health Care Workers in An Isolation Ward During the Covid19 Pandemic

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Abstract

Introduction: *The COVID19 pandemic has affected nearly 80 million people globally, tremendously increasing the burden on healthcare resources worldwide, especially in developing countries like India. The requirement of separate isolation wards for suspected and confirmed cases, continuous use of uncomfortable personal protective equipment (PPE), need for a 2 week quarantine after a period of duty in the COVID19 wards and a high risk of infection lead to an increased requirement of health care workers (HCW) for hospitals in the scenario of such an infectious pandemic compared to routine working. We have devised a 'brick' system of staffing for nursing staff to more optimally utilize the precious resource of HCWs and reduce their attrition due to infection while continuing to provide them periods of rest and recuperation.*

Materials and methods: *We utilized a 'brick' system of 4 nursing staff per 50 patients working for 6 hours shifts followed by 12 hours of rest for 14 days. After 14 days of continuous duty, all nursing staff were given a rest for 2 weeks followed by 2 more weeks of duty and so forth. At the end of 08 weeks all nursing staff who had worked under the new system were subjected to a 10 question survey to see their satisfaction and acceptance of it.*

Results: *Though the majority of nursing staff preferred the older system of duty rotation, they were willing to accept the merit of using the new 'brick' system in the scenario of the pandemic and were willing to recommend it for use in COVID19 wards.*

Conclusion: *The 'brick' system of nurse staffing can allow optimal utilization of HCWs in the present pandemic especially in resource constrained countries like India. The system can be exhausting and tiring but is acceptable to most HCWs.*

Keywords: *COVID19, health care worker, duty rotation*

INTRODUCTION

The World Health Organization (WHO) declared the COVID19 or Coronavirus disease (SARS nCov2) outbreak as a pandemic on 12 March 2020.¹ By 29 December 2020, there are nearly 80 million confirmed cases and 1.7 million deaths attributable to this disease globally. Over 10 million of these cases have been diagnosed in India.²

India has a heterogeneous healthcare system with a complex combination of public and private sector entities with an available hospital bed ratio of 0.7 per 1000 population which is just about a fourth of the world statistic of 2.7.³ In the present scenario of a pandemic of a highly infectious disease such as COVID19, the healthcare system has come under severe stress with a high risk of getting overwhelmed rapidly at both the institutional and national level.

To prepare hospitals for the exponential rise of COVID19 cases, several guidelines have been continuously developed by the Indian Council of Medical Research (ICMR) and disseminated by the Ministry of Health & Family Welfare, India.⁴ Our institute is a 800 bedded multi-speciality tertiary care hospital. As part of the COVID19 readiness, a fever screening clinic, a 100 bedded COVID19 Triage & isolation ward and an 12 bedded isolation ICU and 6 Bedded Triage ICU were established.

Due to the highly contagious nature of the SARS nCov-2 (R_0 between 2.24 to 3.58),⁵ health care workers (HCW) are at high risk of contracting the virus, especially in areas where there is a large number of positive patients. The possibility of virus transmission can be significantly reduced by implementation of rigorous infection prevention practices⁶ like use of appropriate personal protective equipment (PPE), regular hand hygiene by HCWs and patients, maintenance of social distancing norms within the ward and reducing the rate and duration of direct interaction between HCWs and an infected patient. However, despite these measures, the risk of infection of HCWs is possible and may lead to attrition of HCWs working in COVID19 positive areas of hospitals for own treatment or quarantine. Thus, regular staffing norms for HCWs may be inadequate and have to be either augmented or modified in such a setting.

Our aim in this study is to calculate the manpower requirement of HCWs for an isolation ward in the scenario of the present COVID19 pandemic using a 'brick' system of staffing. In our opinion, the 'brick' system would allow us to utilize the same number of HCWs per 100 hospital beds even in the setting of an infectious pandemic. We have also attempted to take the opinion and satisfaction levels of the HCWs using this new system of staffing by means of a 10 point questionnaire.

MATERIALS AND METHODS: DEVELOPING THE NEW STAFFING SYSTEM

Routine working scenario

As per the Indian Nursing Council Norms,⁷ 01 nurse is recommended for every 6 patient beds in a regular ward. For a normal, 100 bedded ward, under routine circumstances, the recommended number of nursing staff is between 45 to 48.^{7,8}

Under normal circumstances, the nursing staff at our centre follow a 6-6-12 schedule. A mandatory weekly off ensures the physical, mental and emotional well being of the staff while keeping the average working hours per week below the mandatory limit of 48 Hrs (see table 1

– normal scenario). This enables a minimum staff availability of 14 per shift for 100 beds or 7 for 50 beds.

Figure 1: **STAFFING SCENARIO 1 : ROUTINE**

	0800h to 1400h	1400h to 2000h	2000h to 0800h	
Day 1	A	B	C	
Day 2	A	B	C	
Day 3	A	B	C	
Day 4	A	B	C	
Day 5	A	B	C	
Day 6	A	B	C	
Day 7	A	B	C	
Day 8	A	B	C	
Day 9	A	B	C	
Day 10	A	B	C	
Day 11	B	C	A	
Day 12	B	C	A	
Day 13	B	C	A	
Day 14	B	C	A	
Day 15	B	C	A	
Day 16	B	C	A	
Day 17	B	C	A	
Day 18	B	C	A	
Day 19	B	C	A	
Day 20	B	C	A	
Day 21	C	A	B	
Day 22	C	A	B	
Day 23	C	A	B	
Day 24	C	A	B	
Day 25	C	A	B	

Day 26	C	A	B	
Day 27	C	A	B	
Day 28	C	A	B	
Day 29	C	A	B	
Day 30	C	A	B	

A = (10 shifts x 6hrs) + (20 shifts x 6 hrs) = 210 hrs - 4 days off = 186, Hence, avghrs/week = 46.5

B = (10 shifts x 6hrs) + (20 shifts x 6 hrs) = 210 hrs - 4 days off = 186 Hence, avghrs/week = 46.5

C = (10 shifts x 6hrs) + (20 shifts x 6 hrs) = 210 hrs - 4 days off = 186 Hence, avghrs/week = 46.5

Total hours 01 nurse can work per month = 48 x 4 = 192 hrs

Special circumstances during a pandemic

In the scenario of a pandemic like COVID19, an isolation ward is required for housing laboratory positive patients of COVID19, to protect other patients within the hospital from contracting the infection. Certain peculiarities pertaining to functioning and requirement of such a ward that will affect the manpower requirements are as follows:

- (a) All HCWs need to be wearing a full complement of PPE at all times within the ward. This includes cap, N95 mask, safety goggles/face shield, gloves, coveralls and shoe covers and can be significantly uncomfortable
- (b) Use of central air conditioners is advised against unless there is availability of HEPA filters
- (c) Both the above points contribute to making the process of carrying out duty in the isolation ward difficult for long periods of time
- (d) The ward needs to be divided into 2 separate cohorts of 'suspected' and 'confirmed' cases of 50 beds each.^{9,10}
- (e) For the duration of their duties, the HCWs working in isolation ward cannot meet or mix with patients and HCWs from other parts of the hospital
- (f) It is preferable for HCWs to not go home for the duration of their duties in isolation ward to prevent chances of infecting their families
- (g) A two week quarantine or (commensurate with the disease's incubation period) "cooling off" period is recommended¹¹ after completing duties in the isolation ward for the HCWs during which they are home quarantined
- (h) Duties in the isolation ward can be associated with certain degree of anxiety and apprehension amongst the HCWs
- (i) Many (70-80%) asymptomatic or mildly symptomatic patients^{12,13,14} who would not merit admission in normal scenarios would also be admitted to the isolation ward to prevent spread of disease in the community. Such patients may require only minimal nursing care

- (j) Critically ill patients would require ventilator support and would be shifted to the isolation ICU
- (k) Even if 01 HCWs gets infected, he/she has a high likelihood of infecting other HCWs in living quarters before they become symptomatic and get tested. Hence, an entire complement of reserve HCWs need to be available at short notice.
- (l) Principles of infection prevention include a conscious attempt to reduce both the number and duration of close and direct interaction of HCWs with infected patients to bare minimum.

If we follow the routine scenario shift policy, even during the pandemic, the following difficulties may be faced:

- (a) The night staff doing 12 hour duties would have to spend an extremely long time wearing the uncomfortable and awkward PPE.
- (b) After working for 01 month in the high intensity zone, the staff will require a break for at least 14 days. To replace them, 50% additional manpower will be required escalating cost and other resource consumption.
- (c) In the scenario of any of the HCWs becoming positive, the entire shift of HCWs staying in common quarters will need to be quarantined.

Proposed staffing roster

With the consideration of these above factors, and ensuring the most optimal utilization of the limited manpower resources, we formulated a ‘brick’ system of duty rotation plan for HCWs in our 100 bedded isolation ward.

The 100 bedded ward would function as 2 separate wards of 50 beds each (confirmed positive ward and suspected cases ward). The patients and HCWs of the two wards will not mix or mingle.

The available manpower of 48 nurses would be divided and will work into 12 “bricks” of 4 HCWs each.

A working day of 24 hours would be divided into four shifts of six hours each in a day starting from 0800 hrs and finishing at 0800 hrs the next morning.

In every shift, each ward would be manned by one brick each. Considering 80% of the patients (40) are likely to be asymptomatic or mildly symptomatic and the critically ill patients will be shifted to the isolation ICU, this number should suffice in delivering optimal care.

After working for one shift, each brick would get a break of 12 hours before their next shift. During working and resting hours, each brick will maintain social distancing from members of other bricks and will avoid close interaction without PPE outside of their brick.

For the period of 14 days, 3 bricks each (total 6) will be active in both wards. The remaining 6 bricks will be kept in reserve.

After a working period of 14 days, the first 6 bricks will go into a period of home quarantine for 14 days, while the second set of 6 bricks will start their rotation of duties for the next 14 days. The cycle can continue with the 2 sets of 6 bricks each replacing each other every 2 weeks.

In case of any of the HCWs becoming symptomatic or testing positive for COVID19, only their brick of 04 needs to be quarantined and replaced.

Advantages

- Allows the patient care in isolation ward during a pandemic to be delivered without increasing consumption of manpower resources of HCW.
- Reduces the continuous time spent by HCWs wearing PPE in vicinity of positive patients
- By reducing the working complement to 4 per 50 beds, the PPE consumption is also reduced
- In case of any of the HCWs becoming COVID19 positive, only a small group of 4 would be quarantined and be unavailable for duties, thus, reducing attrition
- Caters for a 14 day “cooling off” period for all HCWs within the available manpower resources.

Disadvantages

- Using only 4 nursing staff and with 6 hours duties repeating every 12 hours can be mentally and physically challenging for the HCWs
- The average working hours per week increases to 57 during the working weeks though it is followed by 2 weeks of break from duties.

Figure 2 :STAFFING SCENARIO 2 : INFECTIOUS PANDEMIC

	0800h to 1400h	1400h to 2000h	2000h to 0200h	0200h to 0800h
Day 1	A	B	C	A
Day 2	B	C	A	B
Day 3	C	A	B	C
Day 4	A	B	C	A
Day 5	B	C	A	B
Day 6	C	A	B	C
Day 7	A	B	C	A
Day 8	B	C	A	B
Day 9	C	A	B	C
Day 10	A	B	C	A
Day 11	B	C	A	B
Day 12	C	A	B	C
Day 13	A	B	C	A

Day 14	B	C	A	B
Day 15	D	E	F	D
Day 16	E	F	D	E
Day 17	F	D	E	F
Day 18	D	E	F	D
Day 19	E	F	D	E
Day 20	F	D	E	F
Day 21	D	E	F	D
Day 22	E	F	D	E
Day 23	F	D	E	F
Day 24	D	E	F	D
Day 25	E	F	D	E
Day 26	F	D	E	F
Day 27	D	E	F	D
Day 28	E	F	D	E
Day 29	RESTART ROTATION			
Day 30	RESTART ROTATION			

A = 19 shifts x 6 hrs = 114 hrs per month ; 57 hrs per week during working week
 B= 19 shifts x 6 hrs = 114 hrs per month ; 57 hrs per week during working week
 C = 19 shifts x 6 hrs = 114 hrs per month ; 57 hrs per week during working week
 Total hours 01 nurse can work per month = 48hrs x 4 = 192 hrs

RESULTS: Survey of the Health Care Workers

The two 50-bedded isolation wards of our hospital were activated with the new staffing protocol on 25 March 2020. By 25 December 2020, the 'brick' system of staffing had been in use for 9 months. A 10-question survey about the new staffing system was circulated amongst the 50 nursing staff who had been following it. The questionnaire and the response percentages are shown in table 1.

A total of 3850 Covid 19 positive patients were admitted in our Isolation & Triage wards in the last 9 months. No healthcare workers contracted the infection while working in these wards during this period. This can be attributed to strict adherence to infection prevention practices.

Table 1: 10 point questionnaire about satisfaction levels with ‘brick’ system

DEMOGRAPHIC DETAILS :				
(a)	Age	20 - 25 years	25 - 30 years	30 - 40 years
		36%	44%	20%
(b)	Sex	Male	Female	
		50%	50%	
(c)	Years of experience as HCW	< 5 years	5 - 10 years	> 10 years
		60%	30%	10%
(d)	Number of weeks spent working in COVID19 isolation ward	< 1 Month	1-6 months	>6 months
		20%	50%	30%
10 - POINT QUESTIONNAIRE :				
Q 1.	Is the ‘brick’ system of staff rotation more hectic/tiring than the routine rotations?	Yes	No	Can't say
		76%	14%	10%
Q 2.	How many hours can you work comfortably while wearing PPE?	6 hours	8 hours	10 hours
		80%	16%	4%
Q 3.	How many days' duty rotation at a stretch would you prefer in the COVID19 ward?	7 days	14 days	21 days
		54%	42%	4%
Q 4.	Do you think you are working more hours overall under the ‘brick’ system than the routine system?	Yes	No	Can't say
		14%	66%	20%
Q 5.	While following the ‘brick’ system are you able to continue delivering the same quality of nursing care as before?	Yes	No	Can't say
		70%	14%	16%
		Yes	No	Can't say

Q 6.	Do you think the ‘brick’ system reduces the chances of HCWs infection / attrition during the COVID19 Pandemic?	54%	20%	26%
Q 7.	Which staff rotation system do you prefer, routine or ‘brick’ system?	<i>Routine</i>	<i>Brick</i>	<i>Both equally</i>
		30%	60%	10%
Q 8.	Would you volunteer to work in the COVID19 wards again?	<i>Yes</i>	<i>No</i>	<i>Can’t say</i>
		50%	30%	20%
Q 9.	While working in COVID19 areas of the hospital, would you prefer to go back home after duties or stay within the hospital away from your families?	<i>Home</i>	<i>Away</i>	<i>Can’t say</i>
		30%	50%	20%
Q 10.	In the current pandemic, would you recommend the ‘brick’ system of staff rotation over the routine system in COVID19 wards?	<i>Yes</i>	<i>No</i>	<i>Can’t say</i>
		70%	20%	10%

DISCUSSION

In terms of demographics, our cohort of nursing workers were divided equally between males and females. The majority of them (80%) were less than 30 years of age with no nursing staff above the age of 40 years. The younger aged workers were selectively detailed for working in the COVID19 wards mainly because of the lesser likelihood that they will suffer from the severe forms of COVID19 compared to the older population and also because the younger individuals were more likely to be single and staying independently, reducing risk of exposure to young children and elderly family members. This also meant that only 10% of the study cohort had work experience of more than 10 years and 40% with more than 5 years respectively. After a nine month run, 20% of the workers had worked in the COVID19 isolation ward for less than 1 month, 50% had worked for 1 to 6 months and 30% had worked for more than 6 months.

The difficulty and level of discomfort in working while wearing the full PPE was obviously brought out by the fact that the majority (80%) of HCWs felt that they could not work for more than 6 hours wearing the PPE. A small number (16%) were willing to work up to 8 hours and very few (4%) for 10 hours. Even WHO recommends that using an N95 respirator for more than 4 hours can become uncomfortable and should be avoided.¹⁵ Studies have shown that the tolerance for wearing the respirators continuously peaks at less than 8 hours.¹⁶ The discomfort is further added to by the presence of the fluid-proof, synthetic overalls or jumpsuits that can cause heat stress to the HCWs even when worn for durations as short as 1 hour in tropical regions.^{17, 18}

As expected, the large majority (76%) of HCWs felt that working in the new “brick” system of staffing was more tiring than the routine rotation system. This was because the nursing staff had to work a shift of 6 hours after a break of every 12 hours which allowed very minimal time for personal activities after sleeping and eating. Also, only 4 staff were available for caring for 50 patients compared to the normal figure of 7 to 8. The tiredness would also have been contributed by performance of duties while wearing the uncomfortable PPEs as described above. However, in the long run (3-6 months) the majority of nursing staff did not feel that the number of hours they had to work in the brick system was more than before. This is likely because they were getting a break period of 2 weeks after 2 weeks of duty. It appears that the 2 weeks break was enough to motivate the HCWs to go through the difficult and intensive 2 weeks of duty. It also helps them to recuperate and recover mentally, physically and emotionally for a second rotation of duties. The 14 day on and 14 day off model has also been utilized by other institutes though with differing hours of shifts.¹⁹ Though most HCWs (54%) still opined that they would prefer the duty rotation in the COVID19 ward to be only one week, a significant minority (42%) thought that the 2 weeks of duty was acceptable with very few willing for 3 weeks of the ‘brick’ system of rotation in the COVID19 wards. There was also no surprise then, that the majority of the cohort said that they preferred working in the old rotation system rather than the new one.

Despite the increased pressure and difficulty of workload, the significant majority (76%) of nursing staff felt they were able to deliver the same quality of care to the patients with the new system as before. This hints towards the fact that the majority of patients required minimal nursing care as had been estimated by the authors. More than half the study cohort felt that use of the ‘brick’ system of staffing reduced the chances of HCW infection while working in the COVID19 wards. At least half of them were also of the view that during their duties in the COVID19 wards, they would prefer to stay within the hospital complex and away from their families to reduce the risk of spread of infection.

The majority (60%) of the surveyed HCWs opined that they preferred the new ‘brick’ system of staffing over the routine system. More than two-thirds (70%) of them were convinced that during the COVID19 pandemic or other similar infectious disease scenarios, the ‘brick’ system was overall more advantageous for the institute as well as the individual workers and recommended it for the wards dealing with COVID19 patients. Finally, despite the risks and the hardships, 50% of the HCWs were willing to continue to volunteer to work in the COVID19 wards.

CONCLUSION

The ‘brick’ system of staff rotation is an efficient way of utilizing health care worker resources during the COVID19 pandemic especially under resource constrained environment. Though it can be more difficult and tiring than the routine system, it is acceptable to most HCWs during the pandemic and may help in reducing infection and attrition rates amongst them.

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