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Original Research Article

Quadmester-wise comparison of disease transmission dynamics of COVID-19 among health care workers in Kannur district, Kerala

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ABSTRACT

Background: Health-care workers (HCWs) may get infected by direct or indirect contact with infected patients or other HCWs or from the community as well, depending on the phase through which pandemic progresses. Knowledge about the disease transmission dynamics as the pandemic advances is a need so that appropriate monitoring, prevention and control measures for HCWs can be implemented at local level. The main objective of this study was quadmester-wise comparison of disease transmission dynamics of COVID-19 among HCWs in Kannur district.
Methods: A cross-sectional study was carried out among HCWs reported positive for SARS-CoV-2 in Kannur district, Kerala. COVID-19 positive HCWs reported in the district were consolidated and contacted over phone and details were collected using a semi-structured questionnaire. Data were entered into microsoft excel and analysed using statistical package for social sciences (SPSS) trial version. Chi-square test was used to compare differences observed in the two groups and binary logistic regression was done to pick out the significant predictors of variability in disease transmission among the two groups.
Results: Total respondents in the first and second quadmester were 243 and 1665, respectively. Factors like gender, clinical features, source of infection, family as source and type of duty taken were found to be statistically significant for the disease transmission dynamics among HCWs.
Conclusions: As the pandemic advances, irrespective of the type of work place, self-reporting and regular testing of HCWs will help to check HCWs from getting infected and spreading the disease.

Keywords: COVID-19, Health-care workers, Kerala, Transmission dynamics

INTRODUCTION

COVID-19 pandemic caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) emerged in China in late 2019.[1] India reported its first case in Kerala, on 30 January 2020. Kannur, a northern district in Kerala reported its first case in March 2020.[2] COVID-19 infection among HCWs in Kannur was first detected in the month of May 2020. HCWs may get infected by direct or indirect contact with infected patients or other HCWs or from the community as well, depending on the phase through which pandemic progresses. Hence risk stratification of HCW exposure is useful only in the epidemic phases with low rates of community transmission. At all other stages HCWs should be considered at high risk for contracting the infection.[3] As the proportion of HCWs who contract infection from outside the hospital increases, more stringent public health measures are also needed in addition to facility-based infection prevention and control (IPC) practices to reduce disease transmission to and from HCWs.

This study aimed to decipher the disease transmission dynamics as the pandemic progresses from one phase to another so that appropriate monitoring, prevention and control measures for HCWs can be implemented at local level. Hence the present study was done with an objective to compare quadmester-wise disease transmission dynamics of COVID-19 among HCWs in Kannur district, Kerala.

METHODS

A cross-sectional study was carried out among HCWs reported positive for SARS-CoV-2 in Kannur district, Kerala. Study duration was from August 2020 to January 2021. COVID-19 positive HCWs line-list from May 2020 to December 2020 were obtained with their contact numbers from district COVID-19 control cell. COVID-19 positive HCWs reported from the month of May to August 2020 were consolidated as first quadmester group and the next four months, September to December 2020 were consolidated as second quadmester group. Since pandemic peak in India was observed on September 4 first quadmester represents phase before COVID-19 peak and second quadmester represents next half of the epidemic curve. Patients were contacted over phone and details were collected using a semi-structured questionnaire. Data were collected regarding demographic profile, symptoms, kind of exposure, type of duty taken and family transmission. Confidentiality and privacy were maintained at every step of the investigation. The present study was the result of HCWs surveillance done as instructed by district medical officer, Kannur. Hence it was exempted from obtaining clearance from institutional ethics committee. Data were entered into microsoft excel and analysed using SPSS trial version. Quantitative variables were summarized using measures of central tendencies and qualitative variables were expressed as proportions. Chi-square test was used to compare differences observed in the two groups and binary logistic regression was done to pick out the significant predictors of variability in disease transmission among the two groups.

RESULTS

A total of 1908 HCWs were reported positive in the district and all responded. First and second quadmesters reported 243 (12.7%) and 1665 (87.2%) positive HCWs respectively. Quadmester-wise frequency of each of the study variables is as shown in (Table 1).

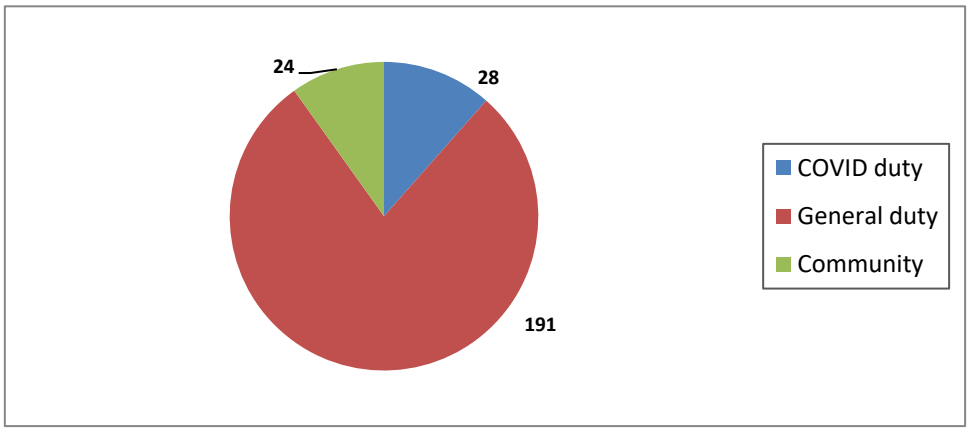

Figure 1: Pie diagram showing proportion of likely exposure in the first quadmester.

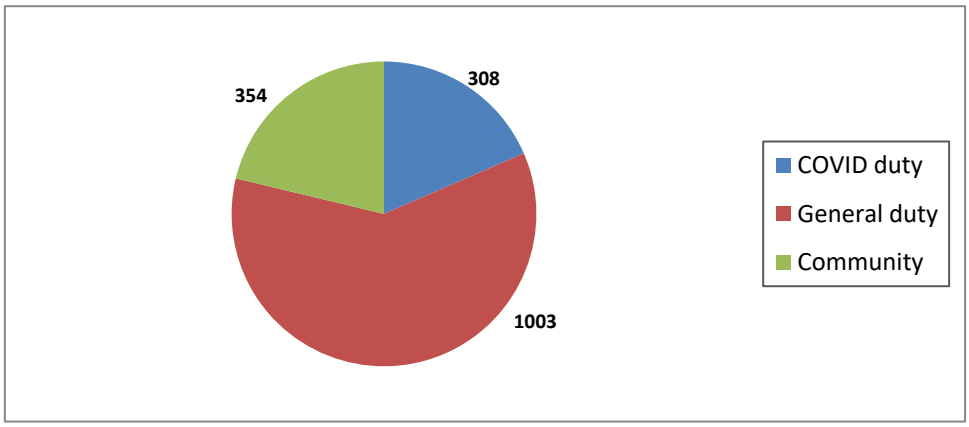

Figure 2: Pie diagram showing proportion of likely exposure in the second quadmester.

Table 1: Quadmester-wise frequency of study variables.

Variables		1st quadmester (n=243) (%)	2nd quadmester (n=1665) (%)
Gender	Female	163 (67)	1240 (74.5)
	Male	80 (32.9)	425 (25.5)
Staff placement	Hospital	226 (93)	1537 (92.3)
	Field	17 (7)	128 (7.7)
Clinical features	Present	163 (67.1)	1290 (77.5)
	Absent	80 (32.9)	375 (22.5)
	Severe*	0	9
	Death	0	1
Source of infection	Hospital	219 (90.1)	1311 (78.7)
	Community	24 (9.9)	354 (21.3)
Transmitted to family	Yes	39 (16)	266 (16)
	No	204 (84)	1399 (84)
Family as source	Yes	5 (2.1)	143 (8.6)
	No	238 (97.8)	1522 (91.4)
Type of exposure#	1. Covid duty with identified source	11 (4.5)	28 (1.7)
	2. Covid duty with unidentified source	10 (4.1)	124 (7.4)
	3. General duty with identified source	174 (71.6)	600 (36)
	4. General duty with unidentified source	17 (7)	403 (24.2)
	5. Non-covid settings while taking covid duty	7 (2.9)	156 (9.4)
	6. Outside hospital setting	24 (9.9)	345 (20.7)
	7. High risk travel (interstate or flight journey)	0	9 (0.5)

*Severe cases were those admitted in ICUs; #the type of exposure were categorised broadly into three based on settings from which likely exposure might have happened; they were COVID duty (1,2 and 5), general duty (3 and 4) and from community (6 and 7).

Table 2: Bi-variable analysis.

Variables		1st quadmester (n=243)	2nd quadmester (n=1665)	OR (95% CI)	P value#
Gender	Male	80 (32.9)	425 (25.5)	1.4 (1.07-1.91)	0.016*
	Female	163 (67.1)	1240 (74.5)		
Clinical features	Absent	80 (32.9)	375 (22.5)	1.68 (1.2-2.2)	0.001*
	Present	163 (67.1)	1290 (77.5)		
Staff placement	Hospital	226 (93)	1537 (92.3)	1.1 (0.65-1.8)	0.796
	Field	17 (7)	128 (7.7)		
Source of infection	Hospital	219 (90.1)	1311 (78.7)	2.4 (1.5-3.8)	<0.001*
	Community	24 (19.9)	354 (21.3)		
Transmitted to family	Nil	204 (84)	1399 (84)	0.99 (0.68-1.4)	1.00
	Yes	39 (16)	266 (16)		
Family as source	Nil	238 (97.9)	1521 (91.4)	4.47 (1.8-11.0)	<0.001*
	Yes	5 (2.1)	143 (8.6)		
Type of duty taken	COVID duty	28 (11.5)	308 (18.5)	0.57 (0.38-0.86)	0.007*
	General duty	215 (88.5)	1357 (81.5)		

Table 3: Multivariable analysis.

Variables	Adjusted OR	95% CI	P value#
Clinical features	1.8	1.3-2.4	<0.001*
Source of infection	2.2	1.3-3.7	0.001*
Family as source	2.5	0.91-6.8	0.07
Type of duty	0.464	0.30-0.70	<0.001*

*p<0.05 is considered significant; #chi-square test.

The variables listed include; (i) gender: quadmester-wise proportion of males and females indicates females were more affected than males in both phases; (ii) staff placement: Hospital staff were more affected than field staff in both quadmesters but as the pandemic progressed a slight increase in proportion was noticed among field staff; (iii) clinical features: More than two-third had symptoms in both phase but the proportion of symptomatics were high in the second quadmester, number of severe cases as indicated by the number of intensive care unit (ICU) admissions and one death reported in the second quadmester; (iv) source of infection: the respondents tried to identify a link as their probable source of infection either from the hospital setting itself or from the community. Compared to first, second quadmester saw a rise in proportion of cases linked to community. Other than contact with a COVID-19 positive family member or neighbour or friend community link include occasions such as attending marriages or funeral or public functions, using public transportation facilities like bus or train; (v) disease transmission to family: it shows the proportion of COVID-19 positive HCWs had transmitted disease to their own family members; (vi) family as a source: HCWs can contract the disease not only from the work place but also from the family members. In the second quadmester when the community transmission was higher, more HCWs got infected from their own family members. (vii) Type of exposure: the proportion of type of exposures in the two quadmesters are depicted in Figure 1 and 2. In second quadmester, maximum cases were observed from being exposed to community which is 14 times more compared to first quadmester whereas high risk duty exposure contributed 11 times and general duty exposure contributed 5 times growth in cases. Bivariable analysis showed factors such as gender, clinical features, source of infection, family as source and type of duty taken as statistically significant for the dynamics in disease transmission. Bivariable analysis done is as shown in Table 2. The predictors of difference in disease transmission was found using binary logistic regression. Backward conditional regression was employed discarding non-significant exposure variables. Maximum value of Nagelkerke R square with minimum number of variables and significance of the model in the chi-square table were the criteria used for finalising the model. The model was found to be significant with a p value of <0.001 and could explain 5.1% (Nagelkerke R square=0.051) of the variability seen in transmission dynamics. The model variables include clinical features, source of infection, family as source and type of duty. The multivariable regression done is as shown in Table 3.

DISCUSSION

The proportion of female HCWs outnumbered that of male HCWs in both quadmesters. It may be due to higher number of females working in Kerala health sector.[5] As the pandemic progressed the chance of getting infected was more for females compared to their counterpart. The case fatality and severity among HCWs were very low in the district (CFR=0.05%, severity rate=0.4%) compared to one multi-centric study which reported CFR of 0.4% and severity rate of 16.6%.[6] There is no difference observed in the percentage of cases reported and staff placement location among the two groups. Family being a source of infection has a strong association and compared to first quadmester, the number got increased 30 times in the second quadmester. In a study of COVID-19 infection in HCWs found that contact history with a diagnosed case of family members showed higher relative risk than contact with a diagnosed or suspected patient.[7] As pandemic advances, community transmission happens and as a result the chance of getting infected from household increases since no protective gears are usually wore inside home. The proportion of HCWs diagnosed with COVID-19 transmitted to their families remained same in both quadmesters. In a study, 98.5% of HCWs are in constant fear of transmitting disease to their families.[8] The presence of HCW as a family member poses a constant risk for getting infection from them since within one's home the possible interactions were almost similar irrespective of the pandemic phases. With respect to first quadmester, in second quadmester symptomatic HCWs were more in number. This may be because of the increased awareness of COVID-19 symptoms prompting many of them to undergo testing. Or else, it can be because of reduced testing among asymptomatics which may in effect worsen the control measures. Testing of asymptomatic HCWs is warranted especially in institutional outbreaks which can markedly reduce the staff work days lost due to self-isolation.[9] Outside-hospital or community was the source of infection as communicated by respondents which increased almost 15 times in second quadmester compared to first quadmester. This clearly points towards reduced relevance in risk stratification of HCWs based on workplace exposures. But for continuing the best practices testing of HCWs as a priority, providing personal protective equipments (PPE) especially for those working in high transmission areas, self-monitoring, social isolation and quarantine has to be ensured despite the stage through which the pandemic progresses.[10] Majority of cases spurt in the non-COVID settings especially in the first quadmester. This may be due to the occurrence of institutional clusters in the district which originated from the non-COVID settings which were then studied and recommended to follow universal precautions at all points of patient care irrespective of type of setting. Following which, there was a significant reduction in cases in the second quadmester emerged from the general settings. Hence irrespective of type of workplace self-reporting, rapid and regular testing of HCWs will help to check HCWs from getting infected and spreading the disease.

Limitation

Chances of recall bias is more because of retrospective nature. The case control type of analysis done to compare

the observed difference in the disease transmission dynamics in the two groups as well is a limitation of this study.

CONCLUSION

Risk stratification of HCWs has little role as the pandemic progresses and active monitoring of HCWs for symptoms is not feasible, so the need for increasing testing among asymptomatic HCWs as well on a regular basis should be considered. However, being a new disease, further studies on epidemiology of COVID-19 is needed and considering the changing epidemiology of the pandemic, health delivery system also should adapt optimal methods accordingly to safeguard HCWs.

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