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The Effects of Migration in the Transmission Dynamics of COVID-19 in Kerala, India

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Abstract

Nowadays, the new narrative is the transformation of a zoonotic virus into an international predicament called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection which is affecting millions. In this pandemic situation, universal migration has had an adverse impact on the world healthcare scenario. As Kerala is a source destination for international migration and destination for internal and return migration, this paper aims to investigate the transmission dynamics of Corona Virus Disease 2019 (COVID-19) in Kerala in the light of migration. The study was conducted after creating a crowd-sourced dashboard on the details of the COVID-19 outbreak in Kerala which is available in the public domain (https://doi.org/10.5281/zenodo.3818096). The data of the COVID-19 situation in Kerala, which is crowdsourced, curated, and scientifically presented using the open data standards, formed the basis of this study. The study demonstrates that, even before community spread, return and internal migration has increased the spread of the infection in Kerala, particularly in the second phase of the disease outbreak. The largest number of COVID-19 positive cases in Kerala have been reported among migrants from the Middle East countries. The study shows an exponential growth in positive cases from July 2020, when flights continued to come in to Kerala with returning migrants. This study draws attention of the authorities and policy makers to the consequences of migration to healthcare systems, transit areas and destination areas in health emergencies.

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Introduction

COVID-19 infection caused by the SARS-CoV-2 virus was reported for the first time in the metropolitan city of Wuhan in China. Eventually, the outbreak spread to other cities across China (Xu et al., 2020) and the entire world. India reported its first case in January 2020, when a 20-year-old student from Kerala returned from Wuhan. As of 20 August 2020, the State had recorded a total of 52,199 cases with 18,126 active cases and 191 deaths. While COVID-19 cases have surpassed 10,000 in Kerala, import cases have ceased to rise as much (Ulahannan et al., 2020a). While considering the increase in the number of positive cases in Kerala and the number of imported cases from different parts of the world, it is clear that the return of people from different parts of the world impacted the infection spread (Ulahannan et al., 2020a).

Migration is an age-old phenomenon arising primarily from the tendency to seek better lives outside the usual place of domicile. It contributes significantly to social development worldwide, but often creates a broader impact on the socio-political domain. The outflow usually starts from developing economies to the developed, and hence the foremost destinations for transnational migration include the USA, Russia, France, Saudi Arabia, and the UAE (Acosta et al., 2020). International migrants have increased in the last five decades. The estimated number of international migrants in 1970 was slightly over two per cent of the total world population. It grew to 272 million in 2019, which is over three per cent (Kerala State Planning Board, 2020). The USA is the primary destination of international migration which amounts to 18.6 per cent of all transnational migrants (Kerala State Planning Board, 2020).

The *World Migration Report* states that India is the largest source of migrants with 17.5 million people, followed by Mexico (11.8 million) and China (10.7 million) (Acosta et al., 2020). This estimate includes Non-Resident Indians (NRIs), (12.49 million) and People of Indian Origin (15.59 million) (Gottschlich, 2014). India, China, and Mexico are the top three recipients in terms of remittances by emigrants (Acosta et al., 2020).

Migration: The Kerala Scenario

Kerala has been a source of internal and international migration due to socio-cultural reasons. Kerala is 'exposed to the outside world' mainly

through trade and missionary activity (Madore et al., 2018) and, at present, as a source for quality workforce. Migration has had an immense impact on the Kerala economy, predominantly in household status which is reflected in their income, consumption pattern and quality of living (Zachariah et al., 2001). The Kerala Migration Survey (KMS) reported that in Kerala, one out of every five households has a migrant (Philip, 2014). When considering the number of emigrants from Kerala during the period between 1961 and 1981, the migrants mostly moved within India. But the boom in the oil sector in the Gulf region has wholly altered the patterns of migration (Rajan and Zachariah, 2018).

The motivation for the migration among Keralites is predominantly better employment. Thereby they can meet household expenditure, accumulate savings, repay debts, manage the expenses of marriage and education of dependents, purchase land and construct houses (Saikia, 2015). The presence of four international airports in this small State shows the significance of international migration, and thereby remittances to Kerala (Rajan, 2020).

In Kerala, the socio-economic growth is induced by remittances from abroad. Due to increased migration, approximately 2.1 million migrants remit about INR 850.92 billion, which was about INR 711.42 billion in 2014 (Rajan and Zachariah, 2018). KMS indicates that the outflow from Kerala is rising as the State faces underemployment among educated youths (Philip, 2014). The number of Kerala emigrants almost doubled in the period from 1998 (1.36 million) to 2014 (2.36 million) (Philip, 2014). Among districts, Malappuram stands first with 444,100 emigrants (18.8%), followed by Kannur (12.4%), Thiruvananthapurma and Thrissur. Wayanad and Idukki districts occupy the last positions (Philip, 2014).

Internal Migration to Kerala

Internal migration is associated with the movement within the political boundaries of a country by changing the usual places of domicile. The number of internal migrants in India was 457 million in 2011 (37.8% of the total population) compared to 220.7 million during 1991 (27.1%) (Census of India, 2011). For Kerala, out-migration is largely rural centric, while in-migration is urban-centric.

Kerala has become a haven for migrant workers as the average daily wage is about double that of the national average (*The News Minute*, 2015).

Agricultural work such as ploughing and tilling pays an average daily wage of INR 713 in Kerala, while it is INR 515 in Tamil Nadu and INR 200 in North Indian States. Similarly, non-agricultural workers earn much higher wages in the State (*The News Minute*, 2015). The other significant reasons for internal migration to Kerala are the availability of work, better working conditions, accumulation of savings and repayment of debts, and acquaintances and relatives working in Kerala (Saikia, 2015).

In-migration to Kerala has been on the rise, and it was estimated to be 2.5 million in 2013, and 3.4 million in 2017, which nearly equals the quantum of international and internal migrants from Kerala giving rise to the phenomenon of 'Replacement Migration' (Narayana et al., 2013). Inter-state migrants in Kerala are increasing gradually, with migrants from West Bengal (41%), Assam (14%) and Odisha (11%) accounting for a significant portion of the total migrants. Ernakulam district has the highest proportion (21%) of migrant workers, followed by Kozhikode, Thrissur, and Thiruvananthapuram. The annual transfer of funds from Kerala by migrant workers is about INR 175 billion, which is about four per cent of its GDP (Ravindranath, 2015).

Return Migration

Despite increased migration, the rate of return of emigrants has increased in Kerala due to economic, social and political reasons. The long history of emigration to the Gulf countries from Kerala is declining and has reached the last phase (Kerala State Planning Board, 2020). The number of returning emigrants has increased from 1.15 million (2011) to 1.25 million (2014), which is about 52 per cent of the total number of emigrants (Philip, 2014).

Migrants' figures showed a negative growth of 11.6 per cent in the five years between 2013 and 2018 (Rajan and Zachariah, 2018). It is reported that there was a drop of 0.3 million emigrants which accounted for one-tenth of the emigrant numbers in 2013. This paradigm shift is due to a decline in the growth rate of the population in the 19-25 age bracket, stagnation in wages structure in the Gulf region, implementation of policies such as Nitaqat (Saudization, to increase employment of nationals) and family taxes in Saudi Arabia, and migration to the developed economies in the West. Above all, the slashes in the oil price since 2010, have created a broader impact on the Gulf economy, making it a non-conducive

environment for prospective migrants. The estimated number of returning emigrants in 2018 is 1.3 million, approximately 60 per cent of the total number of emigrants (Kerala State Planning Board, 2019). Thiruvananthapuram, Kannur, Malappuram, Wayanad and Palakkad districts favour return migration (Philip, 2014) (Table 1).

Table 1: Population of overseas Indians

Districts	1998		2003		2008		2011	
	EMI	REM (% change)	EMI	REM (% change)	EMI	REM (% change)	EMI	REM (% change)
Thiruvananthapuram	130705	118878 (16.1%)	68046	103059 (11.5%)	08481	215280 (18.6%)	29732	196101 (17%)
Kollam	10297	74106 (10%)	48457	69314 (7.8%)	07516	124066 (10.7%)	67446	116927 (10.2%)
Pathanamthitta	97505	54537 (7.4%)	33720	83502 (9.3%)	20990	60544 (5.2%)	91381	15297 (1.3%)
Alappuzha	62870	34572 (4.7%)	75036	43109 (4.8%)	31719	51024 (4.4%)	44386	54688 (4.8%)
Kottayam	35494	18164 (2.5%)	06569	28368 (3.2%)	89351	26448 (2.2%)	17460	11846 (1%)
Idukki	7390	5017 (0.7%)	7880	3766 (0.4%)	5792	3213 (0.3%)	7690	6738 (0.6%)
Ernakulam	103750	45028 (6.1%)	21237	74435 (8.3%)	20979	68860 (5.9%)	36113	62312 (5.4%)
Thrissur	161102	116788 (15.8%)	78867	86029 (9.6%)	84068	174655 (15.1%)	98368	149132 (13%)
Palakkad	116026	39238 (5.3%)	77876	55008 (6.2%)	89815	85318 (7.4%)	42020	83388 (7.2%)
Malappuram	296710	123750 (17.7%)	71787	141537 (15.8%)	34572	219736 (19%)	08884	154122 (13.4%)
Kozhikode	116026	60910 (8.2%)	67436	109101 (12.2%)	99163	72405 (6.3%)	06719	114424 (9.9%)
Wayanad	4552	3327 (0.4%)	7704	3852 (0.4%)	13996	1930 (0.2%)	26874	14489 (1.3%)
Kannur	88065	28263 (3.8)	02414	45394 (5.2%)	19119	26416 (2.3%)	83045	125303 (10.9%)
Kasaragod	38747	16667 (2.3%)	71449	47468 (5.3%)	57851	27222 (2.4%)	20425	45580 (4%)
Total	1361919	739245	38478	893942	93412	1157127	80543	1150347

Source: Philip, 2014.

Effects of Migration on Health

Migration alters the dynamics of population and the patterns of epidemic outspread. The impact of migration on global epidemics has generated much public interest (Fokunang et al., 2015). It creates repercussions in public health, and these migration effects becomes significant when, according to the World Migration Report, more than 289 million of the total world population are migrants (Acosta et al., 2020). The growing trends of migration have created gaps in indicators of health (Fokunang et al., 2015).

Migration can be a key risk factor for contagious and chronic diseases and works through complicated pathways (Acosta et al., 2020; Fokunang et al., 2015). Further, if any epidemic infection treatment is delayed, then the chances of onward transmission of infections will increase (Acosta et al., 2020). The challenges further extend to health care providers in terms of cultural and language barriers at the time of service delivery. Also, the incongruity between professional ethics and domestic laws limits health care access for the migrants in the form of delayed care and denied care (Acosta et al., 2020). The migrant population has inadequate access to hospitals, diagnostics services, medical insurance availability, health promotion programmes, as well as therapeutic interventions (Acosta et al., 2020; Fokunang et al., 2015).

Conversely, there are arguments like the "healthy migrant hypothesis" (Ginsburg et al., 2018). Moreover, there is a dearth of information on the migration dynamics of COVID-19, even though studies of the migration effects on the previous epidemic outbreaks are available. Further, in the Kerala context, no curated data is available to give an overview of the disease. This paper intends to fill this gap in knowledge using the crowd sourced data which has been made available in the public domain (Ulahannan et al., 2020a). Hence the objective of this study is to identify the effect of migration on the transmission dynamics of COVID-19 in Kerala. Further, this paper highlights renewed concerns about the management of infectious diseases and potential risks for the native population. This study is important since Kerala is a unique State with a large number of expatriates and a destination for internal migration, and perhaps is the first comprehensive study on the SARS-CoV-2 outspread and migratory effect in Kerala. These results will be useful for policymakers, the healthcare industry and academia for planning various programmes to be adopted and implemented at various stages of the migratory process.

Methods

The data was collected through a citizen-led data sourcing and a curation collective named CODD-K (Ulahannan et al., 2020a, 2020b). From the sourced data, real-time analysis and daily updates of COVID-19 cases in Kerala was provided through a user-friendly bilingual dashboard (https://covid19kerala.info/) for non-specialists. To ensure longevity and reusability, the dataset was deposited in an open-access public repository for future analysis. It provides outbreak trends and demographic characteristics of the individuals affected with COVID-19 in Kerala during the outbreak. Data collection started from the first day of reporting the COVID-19 positive cases in Kerala in January 2020. The data is accessible in the open data format on Zenodo (Ulahannan et al., 2020a). The data used for this study includes the COVID-19 positive cases from January to August 2020. The curated data is available in CSV format and geographical data in GeoJSON formats. This is the only database about the COVID-19 situation in Kerala that is crowdsourced, curated, and scientifically presented using the open data standards. The 1- star data that is collected from various sources is curated and released in the 3-star format. The data is analysed using tools in Python.

Results and Discussion

The outbreak of COVID-19 triggered large scale reverse migration in Kerala and it created a panic in its initial phase.

Table 2 indicates that migrants from the Middle East countries have reported the largest number of COVID-19 cases in Kerala, where UAE with 2,475 cases, Saudi Arabia with 1,662 cases, and Kuwait with 1,138 cases occupy the first three positions. Within a few days of the pandemic outbreak, approximately 60,000 people moved from urban to rural, affecting more than 40 million internal migrants (Pandey, 2020). Many migrants in the Gulf countries returned to Kerala due to the lockdown and the loss of jobs (Mitra et al., 2020). The results are consistent with the findings of a previous study (Ranjan and Bisht, 2020) that among the emigrants, people living in Gulf Cooperation (GCC) nations are more vulnerable to the epidemic outspread, taking into consideration short-term employment, tough working and living conditions and limited access to preventive mechanisms and healthcare.

Table 2: COVID -19 cases reported in Kerala: Source destinations from abroad

Country	Number of Patients
Africa	65
Australasia	7
Europe	35
Bahrain	136
China	3
Kazakhstan	12
Kuwait	1138
Kyrgyzstan	13
Maldives	26
Moldova	9
Oman	430
Qatar	555
Russia	41
Saudi Arabia	1662
Singapore	5
Tajikistan	28
UAE	2475
UK	25
USA	14
Other Middle Eastern countries	29
Other Asian Countries	11

As seen in Table 3, migrants returning from the neighbouring States of Karnataka (1,304) and Tamil Nadu (1,255) take the first two places in the inflow of COVID-19 cases in Kerala. A total of 933 migrants from Maharashtra were diagnosed as positive for the disease after they arrived in Kerala. The CMID (Centre for Migration and Inclusive Development), Kerala, reported that migrants from 25 Indian States work in Kerala, mainly from West Bengal, Assam, Odisha, Bihar, Jharkhand, Uttar Pradesh, Tamil

Nadu, and Karnataka, and these migrant linkages escalated a speedy local transmission rate (Mitra et al., 2020). Considering the influx of migrant workers, West Bengal, Jharkhand, Bihar, Assam and Odisha have witnessed massive spikes in positive cases when compared to the other States in India (Mullick, 2020; Panda and Biswal, 2020). According to the official COVID-19 dashboard of Odisha, it had received 513,103 internal migrants by June 21, 2020 (Panda and Biswal, 2020).

Table 3: COVID-19 cases, inflow from the Indian States

State	Number of Patients
Andaman and Nicobar Islands	9
Andhra Pradesh	105
Arunachal Pradesh	10
Assam	28
Bihar	59
Chandigarh	2
Chhattisgarh	14
Daman & Diu	2
Delhi	452
Goa	11
Gujarat	91
Haryana	26
Himachal Pradesh	3
Jammu and Kashmir	71
Jharkhand	34
Karnataka	1304
Ladakh	12
Lakshadweep	9
Madhya Pradesh	29
Maharashtra	933
Manipur	5
Meghalaya	2

Nagaland	13
Odisha	19
Puducherry	5
Punjab	52
Rajasthan	57
Sikkim	4
Tamil Nadu	1255
Telangana	197
Tripura	11
Uttarakhand	10
Uttar Pradesh	84

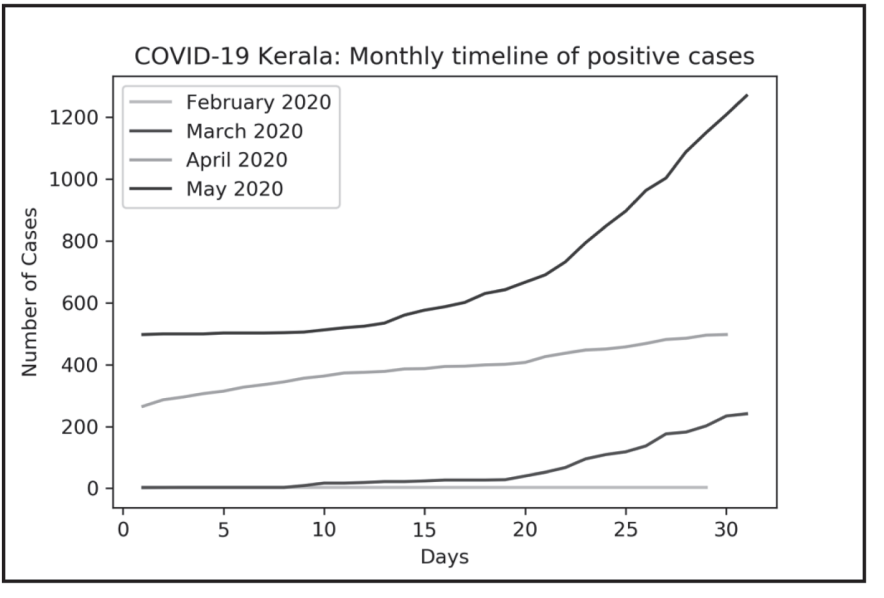
As seen in Table 4, Palakkad stands first with 1,703 cases due to internal and return migration, followed by Malappuram with 1,650 cases and Alappuzha with 1,181 cases. Data shows that Malappuram ranks as the highest return migration (Rajan and Zachariah, 2018). According to KMS (Philip, 2014), Palakkad, Malappuram, Kannur are favouring return migrants.

Table 4: Imported COVID-19 cases by district

Districts	Total Imported Cases	Cases from Abroad	Cases from the Other States
Alappuzha	1181	653	528
Ernakulam	704	302	402
Idukki	626	151	475
Kannur	1139	433	706
Kasaragod	825	482	343
Kollam	741	528	213
Kottayam	591	304	287
Kozhikode	889	505	384
Malappuram	1650	1215	435
Palakkad	1703	984	719
Pathanamthitta	1100	641	459
Thiruvananthapuram	503	309	194
Thrissur	978	515	463
Wayanad	364	117	247
Total	12994	7139	5855

States with an influx of migrants will have higher levels of increase in COVID-19 cases and thus fatality rates (Panda and Biswal, 2020). India's massive repatriation mission called the Vande Bharat Mission started from May 7, 2020 onwards. Figure 1 shows the increasing pattern of positive cases from mid-May, following which, Kerala witnessed a steady increase in June and July (Panda and Biswal, 2020). Flights arrived in Kochi and Kozhikode with passengers from the UAE. More flights carried stranded Indians from Bahrain, Saudi Arabia, Oman, Kuwait and Qatar. Since May 10, Indian Navy ships arrived at Kochi Port with repatriated Indian citizens from the Maldives. Migrants also came from Kuala Lumpur (Malaysia) to Kochi. As a result, on May 13, Kerala recorded ten new positive COVID-19 cases, reaching double figures for the first time since April 29. Kerala reported the fifth COVID-19 casualty on May 21, where a return migrant from Mumbai died in Trissur. May 24 witnessed the sixth COVID-19 death and recorded the second consecutive day with more than 50 positive cases in Kerala. The disease outbreak in the State was influenced more by the return of domestic migrants.

Figure 1: Effects of migration on COVID-19 spread
(First Phase: February 1-May 31)

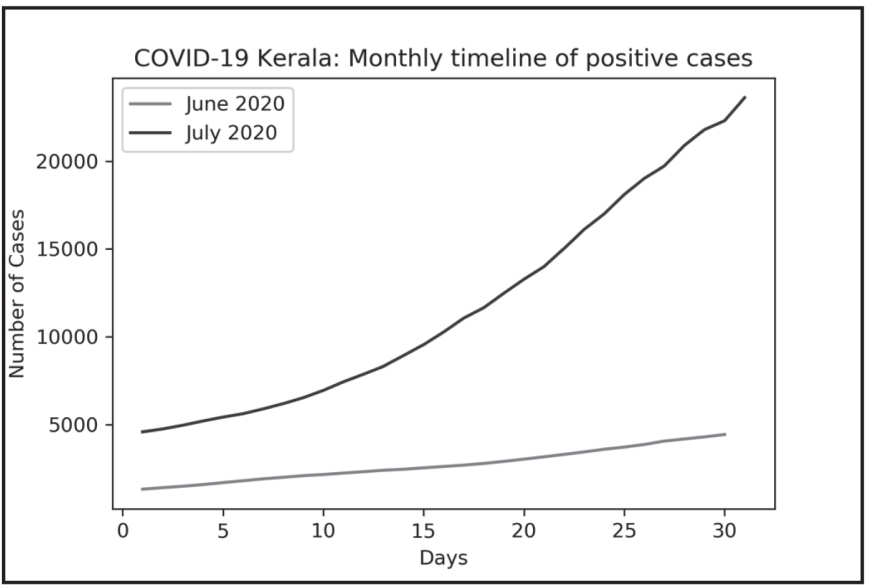


The State recorded 84 new COVID-19 cases and the death of a Telangana man in Thiruvananthapuram on 28 May, which occurred three days after

the restarting of domestic air travel. On the next day there were 91 new positive cases, of which 80 patients came from outside the State. After episodes of SARS in 2003, H1N1 influenza in 2009, and Zika in 2015, it has been found that such diseases can proliferate rapidly, and have a global impact in a matter of days (Carter, 2016).

As seen in Figure 2, there was an exponential growth in positive cases in July, where flights continued to bring migrants to Kerala. On 9 July, 339 new COVID-19 cases were detected, of which 133 became infected due to community transmission along the coast of Thiruvananthapuram. One week later in Kerala, COVID-19 cases skyrocketed with a significant portion of the patients getting the disease through local contacts.

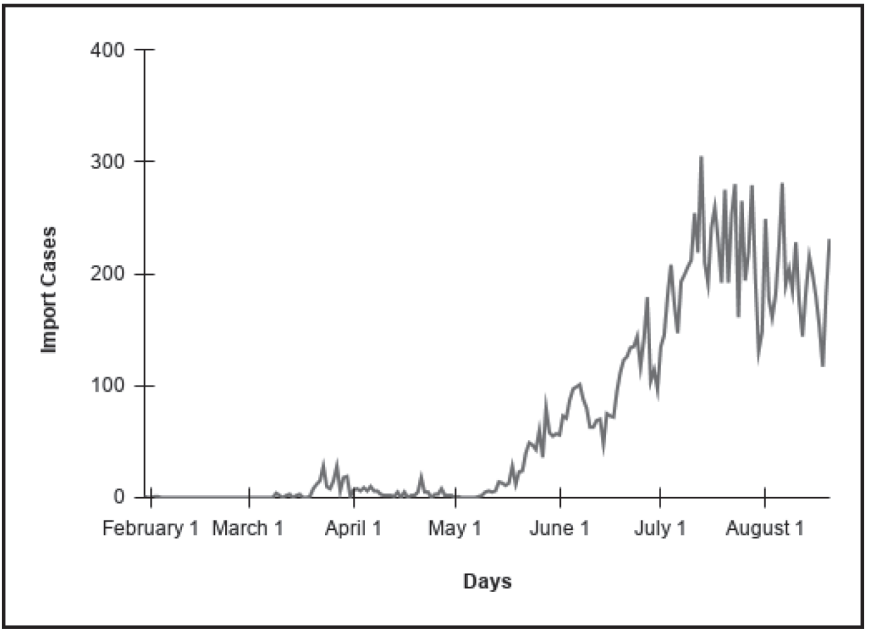
Figure 2: COVID-19 spread (Second Phase: June 1- July 31)



The study results are consistent with the findings of the Indian Council of Medical Research (ICMR) that the reverse migration from urban as well as semi-urban centres to rural areas resulted in a greater number of COVID-19 cases (Chandna, 2020). In addition to this, the COVID-19 pandemic in Kerala had strong international migration linkages starting from the first three known cases in India, which were first reported in Kerala in January 2020 (Mitra et al., 2020). In India, the majority of the Stage 1 imported cases were emigrants who returned home to join their families (Mitra et al., 2020).

As seen in Figure 3, the study has broad implications for the healthcare angle. Migration can have an adverse effect on health risks including the transmission of infectious diseases to others and to communities which interact throughout the phases of the journey of the migrants (Fokunang et al., 2015). It is challenging to manage the migratory population in large numbers where the receiving nations have limited facilities in place to manage the inflow of an uncontrolled populace, particularly those with health implications (Fokunang et al., 2015). The mass movement of immigrants makes the health screening process in host countries difficult, especially in mapping the state of their health before they arrive. Also, the extra costs when migrants access health care will be a considerable burden to the healthcare system (Acosta et al., 2020). The mass movements may give infections to the tourists, airline crew, travellers and others. Further, the destination countries and transit areas will be seriously affected if an epidemic spread goes unnoticed at the onset. Hence, the countries, airline counters, transportation hubs and tourist destinations must be vigilant and well equipped with the epidemic detection and control measures. An increased awareness must be created among the public on health emergencies and the necessary precautions to be taken.

Figure 3: Growth of COVID-19 cases in each month (January-July)



Emergence and re-emergence of these types of infections will upset the healthcare system and cause considerable economic losses (Rajendrakumar et al., 2020). While being loyal to the migrant workers as the present pillars of the Kerala economy and the international migrants for creating the present Kerala in its most refined form, the threats also have to be considered. Internal migrants need help to relocate or settle themselves back at home. There should be a legitimate control of internal migration, and the destination countries should consider their human rights in terms of their health safety and healthy living conditions. Properly planned migrant accommodation centres are needed at the destination countries, as vector-borne diseases may infect them at any time. There must be safe quarantine centres for the migrants, and the labour room quarantine should not become the epicentre of the pandemic and cause further community transmission. The returning migrants have to be accommodated in their homeland while strictly adhering to the epidemic protocol of the WHO.

The study inferences are relevant for academia and practitioners of health, as migration accelerates the epidemic transmission. There should be a health protocol while receiving migrants into any State or country, supported with state of the art technologies. The health system must be vigilant at all the entry points, even after mitigating the infection, and this must be continued as a regular preventive protocol. Due to ethnic reasons, the expatriates will continue to travel to Kerala, and the internal migrants will return once the public transport system is reinstated. Therefore increased vigilance on the migrant movements has to take place to avoid future predicaments.

Empirical evidence concerned with the epidemics dynamics and related trends has emphasised regional and national inconsistencies (Institute for Health Metrics and Evaluation, 2013; Lozano et al., 2012). Further study has to be carried out to know the magnitude of migration on healthcare systems at times of health hazards.

Conclusion

A migrating population is a vehicle for the transmission of diseases, especially during epidemics. Kerala has been the worst hit by the SARS-CoV-2 due to the returning and internal migration from May 2020 when community spread started resulting in an exponential growth in

COVID-19 positive cases. The magnitude of spread often depends upon the preventive and responsive mechanisms adopted by the health systems of various places. A health policy for the migrants to follow in emergencies, where the Universal Health Coverage (UHC) underpinning the Sustainable Development Goals (SDGs) recognises the migratory population, should be included under the umbrella of healthcare access. Mitigating the health risks accelerated through migration in a globalised world must be an essential portfolio for every country, regardless of its development. Continuous and systematic research must be an agenda for the authorities concerned, with the results providing a foundation for preparedness in future health emergencies. Feasible policies must be drawn up and implemented on how an epidemic can be mitigated in a migratory world.

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