

Original Research Article

Early detection of suspected cases of COVID-19: role of thermal screening at international airports in India

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ABSTRACT

Background: On January 30, 2020 WHO declared the COVID-19 as a PHEIC. In response to the increasing number of COVID-19 cases, Government of India started thermal screening of passengers at all PoEs. Present study was conducted to understand the screening activity done at international airports in India, to measure the prevalence of fever in passengers screened and to study the role of thermal screening in early detection of suspected COVID-19 cases.

Methods: Descriptive study design was used in current study and secondary analysis of data collected from CSMI airport Mumbai, IGI airport New Delhi, Cochin international airport Kochi and NSCBI airport Kolkata was done by using universal sample size and purposive sampling technique. Results were presented in the form of rates and ratios appropriately. Chi square test was used to examine the usefulness of the screening activity and $p \leq 0.05$ was considered statistically significant.

Results: At selected international airports, in January, February and March 2020, 5.49%, 19.57% and 79.54% of all arrived passengers were screened. Under Vande Bharat mission 100% of the international passengers arrived were screened and fever detection rate was 95 per million passengers screened. Outcome of the thermal screening at representative airports of North, South, East and West regions of India was significantly different.

Conclusions: Thermal screening of passengers at international airports has limited role in early detection of suspected cases of infectious diseases like COVID-19 and has minimum impact on the course of pandemic.

Keywords: COVID-19, Thermal screening, Early detection of COVID-19, PoEs, Fever detection rate

INTRODUCTION

The point of entries (POEs) means the area where any international passenger may enter legally from one country into another country. Health units responsible for undertaking measures for surveillance and response

health activities at airports/seaports/land border in India are known as APHOs (airport health organizations)/PHOs (port health organizations) and LHUs (land health units).^{1,2} Airport health organisation (APHO), Mumbai is a designated point of entry (POE) for coordination of activities and containment of public health emergency of

International concern (PHEICs). APHO Mumbai is nodal organization to coordinate the PHEIC activities at CSMI airport, Mumbai.²

CSMI airport is the primary international airport serving the Mumbai metropolitan area, India. It is the second busiest airport in the country in terms of passenger traffic and international traffic after Delhi and handles more than 780 aircraft movements per day. Daily more than 30,000 passengers arrive to CSMI airport, Mumbai.³

COVID-19 was first identified in Wuhan city of China in December 2019. On January 30, 2020 the world health organization (WHO) declared the COVID-19 as a PHEIC.^{4,5} On March 11, 2020, the WHO characterized COVID-19 as a pandemic.^{4,6}

Despite limited evidence for its effectiveness, airport screening has been previously implemented during the 2003 SARS epidemic and 2009 influenza A (H1N1) pandemic to limit the probability of infected cases entering other countries or regions.⁷⁻⁹ Entry screening is an intuitive barrier for the prevention of infected people entering a country or region. However, evidence on its effectiveness remains limited and given its lack of specificity, it generates a high overhead of screened travellers uninfected with the targeted pathogen.^{7,10}

When entry screening was implemented in Australia in response to the 2003 SARS outbreak, 1.84 million people were screened, 794 were quarantined, and no cases were confirmed.^{10,11} Syndromic screening designed to prevent infected and potentially infectious cases entering a country undetected is highly vulnerable to the proportion of asymptomatic infections and incubation periods.⁷

Thermal scanning, which can identify passengers with fever (high external body temperature), allows for passengers exhibiting symptoms of COVID-19 infection to be tested before they board a plane. Similarly, entry screening for flights originating in the most affected regions may be under consideration at airports in regions in and outside China.⁷

In response to the increasing number of COVID-19 cases, Government of India started thermal screening of passengers arriving from countries with local transmission at all PoEs. Present study was conducted to understand the screening activity done at international airports and role of thermal screening in early detection of suspected cases of COVID-19.

Objectives

Objectives of current study were, to study the COVID-19 screening activity at International airports in India, to measure the fever detection rate in passengers screened at international airports in India and to study the usefulness

of thermal screening at international airports for early detection of suspected cases of COVID-19.

METHODS

Descriptive study design was used and secondary analysis of the data of passengers arrived at international airports Cochin, Delhi, Kolkata and Mumbai was done. Data was collected from Cochin international airport Kochi, IGI airport New Delhi, NSCBI airport Kolkata and CSMI airport Mumbai. Universal sample size and selection criteria to include data of all passengers arrived at selected international airport.

To check the pan-India representativeness of the data we selected one busiest international airport from south, north, east and west regions of India by using purposive sampling technique. All records, reports and office orders in reference to COVID-19 available at APHO Mumbai were reviewed. Data from self reporting forms submitted by arriving passengers, reports of screening activity, daily reports submitted by airport health officers to higher authorities and patient referral forms was collected. Data was collected for the period 17 January to 30 September, 2020 from all four selected international airports.

Permission for the study was obtained from the appropriate authorities. The information extracted from the records of the passenger was kept confidential and not shared or used for any other purpose. Personal information of the study participants was not extracted. Confidentiality and anonymity of study participants was maintained by coding the self reporting forms.

We analyzed data using Microsoft excel, 2007. The results were presented in the form of rates and ratios appropriately. Chi square test was used to examine the usefulness of the screening activity and $p \leq 0.05$ was considered statistically significant.

RESULTS

During the reporting period from 17 January to 30 September 2020, total of 3241414 passengers arrived at Cochin, Delhi, Kolkata and Mumbai International airports. Out of these total passengers arrived, 1587034 (48.96%) passengers were screened to detect the suspected cases of COVID-19 (Table 1).

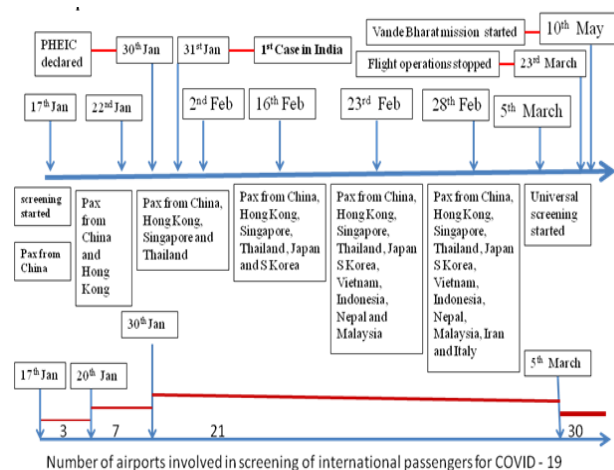
Screening of International passenger was started from 17 January onwards. In the month of January, out of 693316 total passengers arrived only 38061 (5.49%) were screened. In the month of February and March 19.57% and 79.54% of total passengers were screened respectively. In the month of April no passengers arrived due to lockdown. On 10 May 2020, onwards rescue flights were started under vande bharat mission and 100% of the passengers arrived at International airports were screened (Table 1).

Table 1: Distribution of international passengers arrived and screened at international airports.

Month (2020)	Total international passengers arrived	Passengers from countries with local transmission screened	Proportion of passengers screened (%)
January	693316	38061	5.49
February	1065897	208640	19.57
March	693352	551484	79.54
April*	0	0	0
May	22554	22554	100.00
June	128503	128503	100.00
July	169064	169064	100.00
August	172816	172816	100.00
September	295912	295912	100.00
Total	3241414	1587034	48.96

*no passengers arrived due to lockdown.

In view of the increasing cases of novel corona virus in Wuhan city of China, Government of India started screening of all international passengers arriving from China who visited Wuhan city in last 14 days. Initially screening was started at 3 International airports namely New Delhi, Mumbai and Kolkata only. Screening was started from 17 January 2020 onwards and was done by using a self reporting form incorporating questions related to signs and symptoms of severe acute respiratory infection (SARI) and checking temperature by using an infrared thermometer. From 20 January the screening was expanded on 4 more International airports namely Cochin, Hyderabad, Bangalore and Chennai and from 22 January onwards Hong Kong was also included in the list of the infected countries and passengers from Hong Kong were also screened (Figure 1).

**Figure 1: Evolution of strategies for screening of passengers at International airports in India.**

On 30 January, 2020 WHO declared COVID-19 as public health emergency of International concern (PHEIC) and guidelines, SOP were issued for surveillance and international travel. In India, first case of COVID-19 was reported on 31 January, 2020 in a student evacuated from Wuhan (Figure 1).

In view of this screening of international passengers was expanded to total 21 airports having international passengers arriving from countries with local transmission and the list of countries was also expanded to four namely China, Hong Kong, Singapore and Thailand. From date 16 February 2020 onwards Japan and democratic republic of Korea was also added to the list of infected countries and by 28 February 2020, Vietnam, Indonesia, Nepal, Malaysia, Iran and Italy were also added to the list of countries with local transmission and all passengers arriving from these countries were subjected to thermal screening at arriving airport (Figure 1). On 5 March, 2020 universal screening was started at 30 airports and all International arriving passengers were screened. In view of the increasing number of cases from 23 March 2020 onwards all flight operations were stopped and lock down started in whole country from 25 March 2020 (Figure 1).

Out of total 1593861 passengers arrived at International airports screened, 151 passengers were detected as suspected case of COVID-19. All these 151 passengers had fever (surface body temperature $\geq 38^{\circ}\text{C}$) and were detected on thermal screening. Out of 151 symptomatic passengers maximum (68.9%) were detected in the month of March 2020. Over all prevalence of fever was measured as 95 per million international passengers screened. At CSMI airport Mumbai, all 4 suspected cases detected on thermal screening were RT-PCR negative for COVID-19 (Table 2).

During the month of January to September 2020, a total of 364204, 784472, 93240 and 345118 passengers were screened at Cochin, Delhi, Kolkata and Mumbai international airports respectively. Out of all passengers screened 88 at Cochin, 46 at Delhi, 13 at Kolkata and 04 at Mumbai were detected as suspected case of COVID-19. Rate of detection at Cochin, Delhi, Kolkata and Mumbai was 241.62, 58.64, 139.43 and 11.59 per million passengers screened. The difference in the rate of detection of suspected cases of COVID-19 at different airports was statistically significant ($p < 0.001$) (Table 3).

Table 2: International passengers arrived and screened at international airports.

Month	Passengers from countries with local transmission	Passengers detected as suspected case of COVID-19 as per MoF & FW guideline.	Fever detection rate (per million passengers screened)
January	38061	4	105
February	208640	21	101
March	551484	104	189
April	0	0	0
May	22554	5	222
June	128503	2	16
July	169064	4	24
August	172816	6	35
September	295912	5	17
Total	1587034	151	95

Table 3: Comparison of outcome of screening of passengers at Cochin, Delhi, Kolkata and Mumbai international airports.

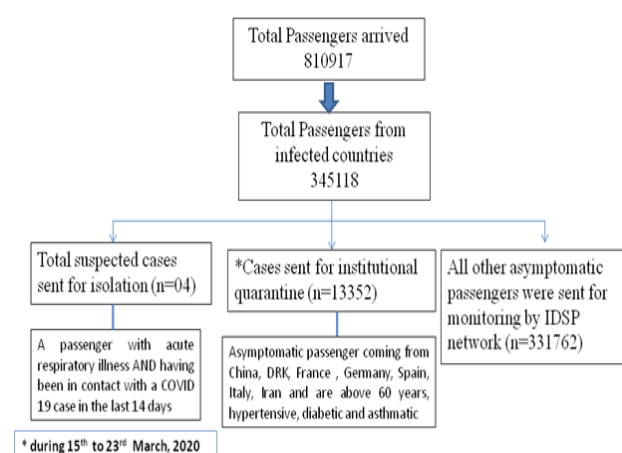
City	Number of passengers screened	Number of passengers positive on thermal scanning	Positive on screening (per million passengers screened)
Cochin	364204	88	241.62
Delhi	784472	46	58.64
Kolkata	93240	13	139.43
Mumbai	345118	04	11.59

passengers and asymptomatic passengers with co-morbidities were kept in institutional quarantine under observation for 14 days.

At CSMI airport Mumbai, a total of 13352 passengers were sent for institutional quarantine during 15 March to 23 March 2020 and all other asymptomatic passengers were sent for monitoring by IDSP network. Out of 345118 passengers screened, 115275 (33.4%) arrived under Vande Bharat mission. All passengers arrived under Vande Bharat mission were kept under institutional quarantine for 14 days and were released only if they tested negative for COVID-19 test (Figure 2).

DISCUSSION

In response to the increasing number of cases of novel corona virus in Wuhan city of China, Government of India started entry screening of International passengers. This precautionary decision was taken almost 2 weeks before novel corona virus was declared PHEIC by WHO. Entry screening, done on arrival at the destination airport, can be an opportunity to gather contact information that is useful if it turns out an infection did spread during a flight and to give travellers guidance on what to do if they become ill.¹² Also it shows the posturing of the Government to respond to the pandemic, building confidence in the citizens and travellers. Exit and entry screening may look reassuring, but experience with other PHEICs shows it's exceedingly rare for screeners to detect infected passengers and even if screeners do find

**Figure 2: Schematic flow of passengers screened at CSMI airport Mumbai and the outcome of screening.**

At the time of screening of passengers at International airports, any passenger detected as suspected case of COVID-19 was sent to the pre identified state government health facility for admission, testing and further management. During the reporting period a total of 810917 passengers arrived at CSMI airport Mumbai, out of which 345118 (42.56%) were screened as per the guidelines issued by the Government of India. Out of total passengers screened 4 were detected as suspected case of COVID-19 and were referred to the hospital for further management (Figure 2). From 15 March, 2020 onwards it was decided to categorize all screened

the occasional case, it has almost no impact on the course of an outbreak.¹²

During the screening over a period of 9 months a total of 1587034 passengers were screened and only 151 were detected with fever. The prevalence of fever in international arrivals was 95 per million passengers screened. Results of the thermal screening done at representative airports of North (IGI airport), South (Cochin airport), East (NSCBI airport) and West (CSMI airport) region of India were significantly different from each other. This difference could be due to the subjective variation in the interpretation of the case definition by the screener and also could be due to very less number of passengers screened at NSCBI airport Kolkata as there were special restrictions on flight operations during Vande Bharat mission.

Study conducted by William et al in 2010 during SARS pandemic reported the prevalence of fever as 600 per million passengers screened at international airports and concluded that public health surveillance of febrile passengers arriving at an International airport should not rely on voluntary passenger participation for the detection of imported contagious diseases.¹³

In present study the prevalence of fever in international arriving passengers was comparatively very low, this could be because of the exit screening which was already done at the departing airport due to which only afebrile passengers were allowed to fly.¹² The other reason could be that the due to fear of getting quarantined at arriving airport passengers could have taken anti-pyretic tablets before arriving at destination.¹⁴

There are many ways infected people can slip through the net. Thermal scanners and handheld thermometers aren't perfect. The biggest shortcoming is that they measure skin temperature, which can be higher or lower than core body temperature, the key metric for fevers. The devices produce false positives as well as false negatives, according to the EU health programme (travellers flagged as feverish by scanners typically go through a secondary screening where oral, ear, or armpit thermometers are used to confirm the person's temperature).¹² Passengers can also take fever-suppressing drugs or suppress information about their symptoms and where they have been. Most importantly, infected people still in their incubation phase (anywhere between 2 and 14 days) are often missed for COVID-19.¹²

Researchers at the European centre for disease prevention and control concluded that approximately 75% of passengers infected with COVID-19 and travelling from affected Chinese cities would not be detected by entry screening.¹⁵ A study by a group at the London school of hygiene & tropical medicine concluded that exit and entry screening is unlikely to prevent passage of infected travellers into new countries or regions where they may seed local transmission.^{12,16}

Limitations

Being a secondary analysis, present study has all the limitations of the secondary data analysis.

CONCLUSION

Thermal screening of international passengers at airports has limited role in early detection of suspected cases of infectious diseases like COVID-19 and has minimum impact on the course of pandemic. However entry screening coupled with data collection through self reporting forms gives opportunity to passengers to self report their symptoms and sensitizes the passengers and helps the system for contact tracing and testing of the passengers as and when required.

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