Introduction

The ongoing corona pandemic has created medical crises all over the world. It has caused immense morbidity and mortality. The first and second wave has led to 3 million global deaths. In India, India is in grip of the second wave reporting a total of 69,36,034 cases and 48,768 deaths in the month of April 2021. During this time of crisis and with further understanding of disease epidemiology the three important activities still hold true to control an outbreak, i.e., testing, tracing, and treatment. The first step towards a control strategy is testing the population for the disease. This can be done either in the hospital when a patient reports symptoms to a doctor or it can be done proactively in high-risk populations in closed settings. In hospital-based testing the preferable test is RT-PCR to get an accurate diagnosis, whereas, for community settings the preferable and recommended test to be used is the rapid antigen test for COVID-19.

Context: The ongoing corona pandemic has created medical crises all over the world. An increased surge in the number of COVID-19 cases was observed in the month of August, September and October 2020. Punjab has around 10 Lakh migrant workers. Intensive rapid antigen testing was done during this surge among factory workers. With this background, the study aims to find out the positivity rate of rapid antigen testing and to find out the final outcome of the COVID positive cases in terms of morbidity.

Materials and methods: Screening of factory workers working in various factories was done for COVID-19 by rapid antigen testing from 26th August to 31st October 2020. Those who tested positive were clinically examined, counseled, and followed up telephonically to get information regarding their course of illness. The collected information was entered in Microsoft Excel sheet and analyzed using SPSS.

Results: A total of 11045 factory workers were screened using the rapid antigen test. The mean age of subjects was 33.37 ± 10.97 years. The majority of them were males (88.3%) and migrants (who did not belong to Punjab) (97.3%). The majority of the subjects (97.3%) had no symptoms at the time of screening. COVID-19 positivity rate increased with age, was found to be higher in males (2.3%) as compared to females. The positivity rate was higher in asymptomatic males and local resident workers. Rapid antigen testing is an important public health measure to prevent the further spread of the disease during a pandemic due to its quick results and detection of asymptomatic patients.

Conclusion: The positivity rate was higher in asymptomatic males and local resident workers. Rapid antigen testing is an important public health measure to prevent the further spread of the disease during a pandemic due to its quick results and detection of asymptomatic patients.

Keywords: Asymptomatic, COVID-19, factory workers, isolation, rapid antigen testing

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of positive cases leading to immediate interruption in the chain of transmission of diseases amongst close contacts in specific social settings.

Specific social settings like factories are peculiar in terms of the inability to maintain social distancing, be it in transportation or at the place of work. A review of occupational outbreaks and clusters carried out by European Centre for Disease Control (ECDC) found that 95% were reported to have occurred in indoor settings, often in confined spaces where physical distancing could not be maintained or where workers shared transportation and/or accommodation. Workplace-based testing schemes may support the early identification of COVID-19 and prevent occupational transmission.[3]

Increased testing is an important strategy to interrupt silent transmission of COVID-19 from symptomatic and pre-symptomatic persons.

Large-scale testing allows for identification, isolation of infected individuals, and quarantining contacts, thereby restricting the community transmission.[6]

In addition to testing symptomatic persons and those with a known exposure, a strategy of routinely testing at primary care setting, certain population groups with a high number of interactions with other persons, based on their occupational or residential settings, can more rapidly identify asymptomatic and pre-symptomatic infectious persons and their close contacts for isolation and quarantine.[7] As per the World Health Organization (WHO) sensitivity of 80% and specificity of 97% is considered as acceptable performance for SARS-CoV-2 Ag-RDTs.[8]

Rapid antigen testing is also relevant in the primary care setting in the community, where asymptomatic person can be identified by a primary care physician at the point of first contact followed by isolation. This early identification can prevent viral transmission in the family and at workplace.

This background prompted the investigators to analyze the data generated during the screening of factory workers for COVID-19 by rapid antigen testing. This intensive testing was done during an increased surge in the number of COVID-19 cases in Ludhiana city in the month of August, September, and October 2020. The analysis of data was done to find out the positivity rate of rapid antigen testing in factory workers and to study the pattern of distribution of disease in the same population. The factory workers typically belong to the migrant population in urban Ludhiana working in industries of the city. Punjab has around 10 lakh migrant workers including 7 lakhs in Ludhiana only.[9] They are mostly living in overcrowded urban slums with the compromised unhygienic living condition. The observation of this study can add to the existing knowledge of the epidemiology of COVID-19 in a specific population of factory workers and further in the prevention and control of COVID-19 in the same population. The investigators also tried to follow up the COVID positive cases telephonically during their isolation period and later on to know about their morbidity status. This information can provide insight into the experiences of positive cases during the isolation period leading to necessary social changes that can be done to enhance the support system for COVID positive cases. This study was done to find out the positivity rate, disease distribution in factory workers and to find out the final outcome of the COVID positive cases in terms of morbidity.

Materials and Methods

The department of community medicine DMCH was involved in field-based rapid antigen testing of factory workers, working in various factories for COVID-19 in Ludhiana district. When a surge in the number of COVID positive cases were observed in Ludhiana city it was planned by experts from department of community medicine Dayanand Medical College and district health department to conduct rapid antigen testing in community in order to isolate positive cases immediately after detection. Special vans with built-in kiosk were provided by district administration for sample collection in community. It was planned to screen factory workers in various factories as there was a demand from association of industrialists of Ludhiana for the same. Two teams were constituted by the department comprising of staff for registration, sample collection, testing, counselling of positive cases and miscellaneous work. List of factories with their location, estimated number of workers to be tested and concerned person to be contacted was given to teams previous evening by health department. On the day of testing the concerned person from the factory was asked to make arrangements for screening in an open area within the factory premises. The workers were asked to stand in line with physical distancing followed by registering their particulars including complete address and phone numbers. From registration to rapid antigen testing results, the average time taken was 40 minutes. After sample collection followed by testing those who tested positive were examined clinically for oxygen saturation, fever, and other symptoms by the doctor attached with the team. They were counseled regarding home isolation or referral to level one COVID care facility depending upon the facilities available at their home. Those agreeing for isolation at level one COVID care facility were transported by ambulance. Those who tested negative but symptomatic were asked to undergo the RTPCR test at the nearest government testing facility. A total of 11045 workers were screened for COVID-19 using STANDARD™ Q COVID-19 Antigen Testing kit (Q-NCOV-01G) manufactured by SD Biosensor, Inc., Republic of Korea.[10] Out of 11045 workers who were screened, 250 came positive and were followed up telephonically. Out of which 176 subjects responded on follow up and 74 subjects could not be contacted because of incorrect telephone number given or it was unreachable or they didn’t pick up the phone. On getting no response after calling twice they were excluded from the study [Table 1].

All the infection prevention and control practices were followed by team members. All the team members wore protective
Table 1: Flow diagram of screening process and follow up

| NUMBER OF FACTORY WORKERS SCREENED FOR COVID-19 (11045 WORKERS) |
|-------------------------------------------------------------|
| RAT POSITIVE WORKERS (250) |
| RAT NEGATIVE WORKERS (10795) |
| Followed up telephonically RESPONDED (176) |
| Followed up telephonically NOT RESPONDED (74) |

The positivity rate was found to be higher in males (2.3%) as compared to females (2.1%) (p = 0.65). The local resident workers had a higher positivity rate as compared to migrant workers and the difference was statistically significant (P = 0.001).

It was also observed that asymptomatic subjects had a significantly higher positivity rate as compared to those having symptoms (p = 0.001) [Table 3]. Out of a total of 176 subjects, who were followed, the majority of the subjects (82.4%) were asymptomatic during their isolation period. Most of the subjects (90.3%) isolated themselves at home and a few (9.7%) were isolated at level 1 government facility.

About one-third (31.8%) of infected subjects had got their family members tested with COVID-19. The majority of the infected subjects (91.5%) did not perceive any social stigma related to the disease from the community. When enquired about any call received from health authorities, 88.2% of subjects gave the positive affirmation and 72.7% of subjects had received SMS about their positive status.

On calling factory supervisors subsequently after 31st October, nil mortality due to COVID-19 infection was reported from factories screened for COVID-19.

The testing activity was done from week 35 to 44 week of the year 2020. The maximum average weekly positivity rate was 4.77% and it coincided with the Ludhiana district positivity rate for COVID-19 [Figure 1].

Discussion

In the present study, the mean age of the subjects was 33.4 ± 10.9 years and the majority were males. The positivity rate of 2.3% was observed. A study done by Gupta et al.[11] at a tertiary level hospital in North India reported that the mean age of the subjects was 34.1 ± 12.6 years; 70% of the subjects were males and the rapid antigen positivity rate was 19%. However, the positivity rate differed because the current study was done in community settings.

A total of 11,045 subjects were screened and the majority of the subjects (97.3%) had no symptoms at the time of screening. The purpose of rapid antigen testing in this group was to screen for asymptomatic SARS-CoV-2 infection so that those with a positive result can be isolated early, to stop the COVID transmission to potentially susceptible workers and other staff and from the factory to the community. A study conducted by Sutton in New York City, among all pregnant patients presenting for delivery, observed most of the patients who were positive for SARS-CoV-2 at delivery were asymptomatic, and more than one of eight asymptomatic patients who were admitted to the labor and delivery unit were positive for SARS-CoV-2.[23]

Though the prevalence of asymptomatic cases is not well understood, and still debatable, recent studies suggest that asymptomatic cases can contribute between 30-80% of the total transmission of COVID-19 infections. Therefore, we cannot ignore the role of asymptomatic cases in the transmission of...
COVID-19 in India and the recent surge in COVID-19 cases in many states due to the laxity of COVID-19 appropriate behavior. A seroprevalence study conducted in Spain reported that nearly a third of people with SARS-CoV-2 antibodies were asymptomatic.

In the present study, among the asymptomatic 18.6% of workers were positive for SARS-CoV-2. Whereas among symptomatic, 16.7% were SARS-CoV-2 Positive.

Community screening to identify viral super-carriers within pre-symptomatic and asymptomatic stages of the disease is important as these individuals will continue to sustain and drive the epidemic if not located. Therefore, screening needs to target the healthy population.

Transmission without symptoms can critically contribute to the spread of COVID-19 and present a considerable challenge in the prevention and spread of infection. Detection of asymptomatic individuals is the most important advantage of mass screening of persons at the workplace by rapid antigen testing. This ensures a safe work environment from COVID-19 by allowing those who test negative to resume their normal activity.

Quick test results lead to prompt decision to isolate a COVID-positive person from the workplace or community. This further helps in breaking the transmission chain. However, the isolation of COVID-positive people should be prompt and followed by a rapid response team. The person isolated at home or level-1 care facility should be followed up regularly either telephonically or by community workers.

Out of 250 positive patients, 10% chose for level 1 COVID care facility. The reason behind this decision was the lack of a separate toilet facility at home or the unavailability of family members to take care of the patient.

During their isolation period, the patients were telephonically followed by authors and were asked regarding the number of days spent in isolation. The majority 94% of them spent more

| Characteris | No of persons | Frequency (%) |
|-------------|---------------|---------------|
| Age (Years) |               |               |
| 0-20        | 756           | 6.8           |
| 20-40       | 7078          | 64.1          |
| 40-60       | 3045          | 27.6          |
| 60 & Above  | 166           | 1.5           |
| Gender      |               |               |
| Male        | 9754          | 88.3          |
| Female      | 1291          | 11.7          |
| Residential status | |               |
| LOCAL      | 1988          | 18            |
| Migrant    | 9057          | 82            |
| Symptomatic|               |               |
| Yes        | 300           | 2.7           |
| No         | 10745         | 97.3          |

*Statistically Significant at <0.05 level

Table 3: Persons screened Positive for COVID-19

| Variable          | No of Subjects (n=11045) | COVID19 Positive (n=250) | Positivity rate | Chi-square | P (at 0.05 level) |
|-------------------|--------------------------|--------------------------|-----------------|------------|-------------------|
| Age (n=11045)     |                          |                          |                 |            |                   |
| 0-20              | 756                      | 16                       | 2.1             | 5.55       | 0.135             |
| 20-40             | 7078                     | 153                      | 2.2             |            |                   |
| 40-60             | 3045                     | 73                       | 2.4             |            |                   |
| 60 & Above        | 166                      | 8                        | 4.8             |            |                   |
| Sex               |                          |                          |                 |            |                   |
| Male              | 9754                     | 223                      | 2.3             | 0.196      | 0.65              |
| Female            | 1291                     | 27                       | 2.1             |            |                   |
| Locality status   |                          |                          |                 |            |                   |
| Local             | 1988                     | 67                       | 13.4            | 0.0001*    |                   |
| Migrant           | 9057                     | 183                      | 183             |            |                   |
| Symptom status    |                          |                          |                 |            |                   |
| Symptomatic       | 300                      | 50                       | 16.7            | 289.1      | 0.0001*           |
| Asymptomatic      | 10745                    | 200                      | 18.6            |            |                   |

Figure 1: COVID-19 Weekly Positivity Rate Comparison: District Vs Current Study for 28 Aug to 31 Oct
than 17 days in isolation. This was as per guidelines released by
govt of India (≥17 days) at that time.18,19

Only 49% underwent repeat testing before joining their place of work.18 The reason could be the frequently changing government rules, hesitancy, or fear on part of the employer of the further loss of manpower.

The majority of subjects received a salary during the isolation period, except for 7 subjects and 2 subjects voluntarily left their job. The reason for receiving salary could be repeated instructions from the government (Centre or state) to provide salary for the time period of isolation.20

A total of 13 subjects went to their native village, 9 after completing their isolation period and 4 didn't complete their isolation period.

Subjects who were admitted to level 1 facility, complained that they did not receive any medication but they were provided with 3 times meals free of cost during their period of stay.

COVID-19 is associated with the social stigma. Many studies all over the world have reported it.21–23 In the current study, 8.5% of positive subjects felt and faced social stigma. One of them reported that on knowing their positive status the shopkeeper refused to give grocery and the garbage collector refused to collect garbage from their home. During this pandemic, people are labeled, stereotyped, discriminated against, treated separately, and/or experience loss of status because of a perceived link with a disease.24 Therefore to overcome this problem, two of the subjects did not disclose their positive status in the neighborhood.

Conclusion
The data from this study shows that majority of factory workers who were declared positive by rapid antigen testing were young, migrant, asymptomatic. The positivity rate was higher in asymptomatic males and local resident workers. On following up isolated positive workers, the majority isolated themselves at home and received telephone calls from the health department and few faced the social stigma because of COVID-19 positive status.

With this activity of mass screening, 250 factory workers could be detected and isolated promptly preventing further spread of disease at their workplace as well as their place of residence. Rapid antigen testing is an important public health measure to prevent the further spread of the disease during a pandemic due to its quick results and detection of asymptomatic patients.

Limitation
In the present study, the study sample cannot be extrapolated to the general population, as the sample consists of factory workers, mostly males in the age category of 20–40 years and had migrated from other states.

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Conflicts of interest
There are no conflicts of interest.

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