Why it Makes Sense to Leave and Stay Gone: Understanding the Mass Exodus from Mumbai

Neeraj Hatekar[1] and Pallavi Belhekar

Abstract

India is experiencing a huge mass exodus of informal sector workers who are heading out of cities, bound homewards. Given the paucity of transport infrastructure, this is translating into one of the greatest mass tragedies of post Independence India. This has been rationalized as combination of people moving out because of a lock down induced loss of earnings and irrational fears stoked by the pandemonium. This paper argues that this exodus is in fact a perfectly rational response to the rapid spread of the virus in informal housing localities. We also outline three different policies, whose combination could have , and can still, reduce if not entirely stop the exodus.

Key words: Covid -19, Individual Contact Models, lock down, informal settlements, informal sector workers, policies

[1] Neeraj Hatekar teaches Economics at Mumbai University and Pallavi Belhekar does the same thing at a local college. The views expressed are personal. The authors are grateful to Avadhoot Nadkarni , Romar Correa,Ajit Karnik and Mr. Shrikant Barhate for useful discussion. The usual caveat applies.

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The mass exodus of so called "migrant workers" from cities is one of the grimmest human tragedies of post-independence India. The images of hordes of people, trudging along unending highways with painful resoluteness, children in arms, bundles on heads, taking on the impossible odds of completing the journey with life and limb intact, have shaken the nation. Several narratives have sprung around the spectacle. Majority of the narratives say that these formerly invisible figures are migrant workers, who are walking back to their homes because given the uncertainty of the lockdown, they are left with no money. Though the general narrative is not wrong, the actual story is likely to be much more nuanced. In a society as complex as India, simplistic narratives are often grossly misleading. We have made an attempt to understand the phenomena a little better. Our conclusion basically is that those who are leaving are not necessarily all migrant workers. Many of them have been settled in cities for generations. Neither are they leaving only because of the loss of earnings, though that certainly is a major factor. What is common to all of them is that they live in highly congested informal and semi-formal urban settlements with lack of basic amenities and near impossibility of social distancing. Given this reality, for risk averse individuals, getting away to avoid the infection is a completely understandable response. This is compounded by the fact that they may actually expect a higher degree of infection given poor health of the general population due to poor water and sanitation infrastructure(Marx, Stoker and Suri, 2013)[2] or due to pre-existing health conditions (Zheng et al

[2] Marx Benjamin, Thomas Stoker and Tavneet Suri (2013): "The Economics of Slums in the Developing World", Journal of Economic Perspectives, 27(4): 187-210

2020)[3] . Additional susceptibility to infection because of increased air pollution (Wu et al 2020)[4], could also be a factor ibn Mumbai, especially inn wards like M East, situated around the infamous dumping grounds. The fact that there are no economic returns to staying in the city has certainly given more weight to the decision to leave, but many would have left even without a lockdown. We outline a set of policies that could have been and can still be used to check the exodus.

Section 1.

We start our argument with the help of a stochastic discrete time individual contact model (ICM) of epidemic spread based on Churches (2020)[5] . The traditional SIR models are aggregative and deterministic. The ICM models are agent based microsimulation models that simulate agent interaction and disease spread. This variant of epidemic spread model allows for the introduction of chance in models of disease spread: for instance, if an infected person sneezes all over you, there is a certain probability (and not an absolute certainty) that you will be infected. The important point is that during a specific time interval, every individual potentially has a given number of encounters, say N, with infected individuals, and has a probability p of being infected at each such encounter. Once a person gets infected, she either dies or recovers. Higher the N and /or p, higher the number of individuals eventually affected. The impact of policy interventions can be studied either through variations in the number of contacts (N), which is

[3] Zheng Ying-Ying, Yi-Tong Ma, Jin-Ying Zhang and Xiang Xie (2020): "Covid-19 and the cardisovascular system",Nature Reviews Cardiology 17: 259-260

[4] Wu,Xiao, Rachel C. Nethery, M. Benjamin Sabath, Danielle Braun and Francesca Dominici (2020): Exposure to air pollution and Covid -19 mortality in the United States: A nationwide cross-sectional study ", medRxiv 2020.04.05.20054502

[5] Churches (2020, March 10). Tim Churches Health Data Science Blog: Modelling the effects of public health interventions on COVID-19 transmission using R - part 1. Retrieved from https://timchurches.github.io/blog/posts/2020-03-10-modelling-the-effects-of-public-health-interventions-on-covid-19-transmission-part-1/

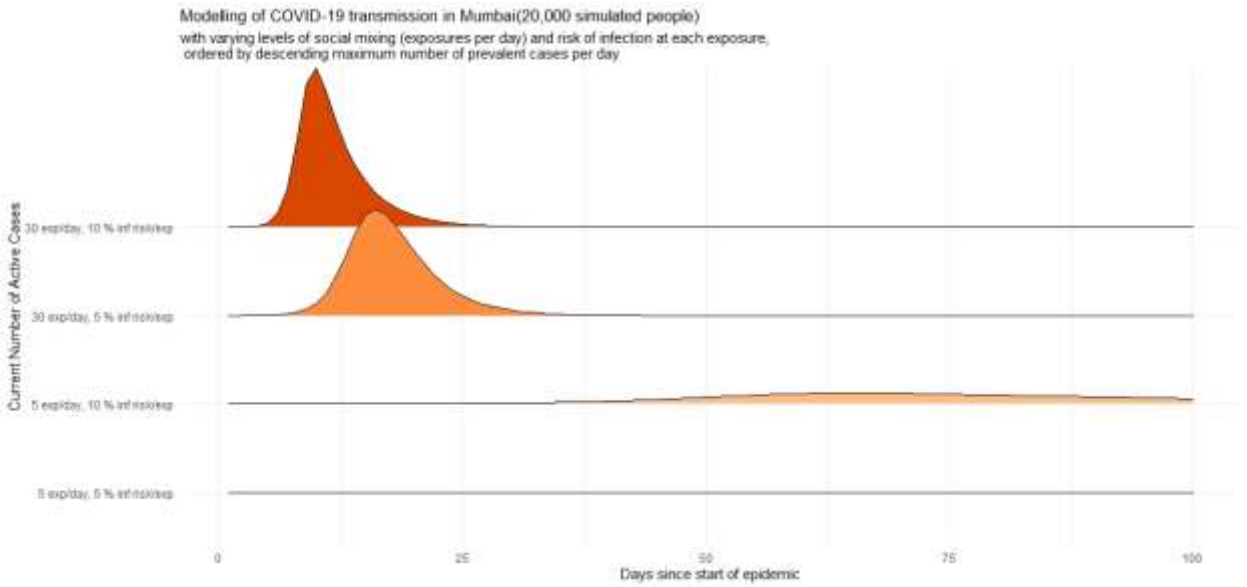
social distancing, or the probability of infection (p), through measures like wearing masks, washing hands, etc.

The epidemic in Mumbai is particularly strong in informal habitations, or where people live in highly overcrowded situations, mostly with common toilets and water sources. The cauldron of Covid infections in Mumbai are G North ward, G South ward, M East ward, K East, L and E ward all of which have very dense settlements of low paid informal sector workers.

The point we want to make is that given the high density of population, even if the base rate of infection is low, it is almost impossible for a resident of these settlements to protect herself from infection purely through actions that she has control over. We explain this with the help of a simulation exercise. Assume an informal housing settlement where the base rate of Corona infection is 10%, and that a person living in these settlements has about 300 daily encounters with others from the same settlement. This large number is to be expected if there are inadequate common latrines which must be visited while walking through narrow congested lanes. It is impossible to not encounter a large number of people who are going about their daily business in the settlement. Given 300 such daily random encounters and a 10% base rate infection, our person will encounter about 30 infected individuals. Now assume two scenarios: One of relatively poor self-care, which could mean infrequent hand washing, casualness about covering one's face and so on. We will refer to this level of care as "Casual Care". Let us assume that the chance of contacting an infection in this situation is 10% given an encounter with an infected person. Let us think of another scenario with a lot more care, with serious mask wearing and hand washing. Assume that this halves the probability of infection to 5%. We will call this the "High Care" situation.

Let us now think of another scenario of a person who lives in a housing complex, with access to personal toilets and a relatively small necessity of stepping out. Assume that the level of infection in this building is 50%, but our person randomly encounters only 10 persons a day. This will give him five encounters per day with an infected person. This person too can have two levels of care, "Casual Care" and "High Care" with the same probabilities of infections, i.e., 5 % and 10% per encounter. The figure below gives the results of simulating the ICM model under these scenarios:

Fig 1:



The first curve in the top panel shows the situation that would emerge if the person in the informal housing situation were to have a casual care level. The infections would spread fast, reach a peak and peter out. About 80% of the population will be infected, but the new cases will stop coming after about a month. If the person takes the trouble to use high level of care, the curve is flattened, but only a little bit. A smaller, but very significant percentage of people get infected, and the infections last only a little longer. Compare this to the third panel, where the number of encounters is 5, but the level of care is casual. The curve is substantially flattened, and a much smaller proportion of population gets infected, though the infection lasts for much longer. The final situation with low encounters and high care kills the infection quickly.

The important point is that even when the person living in the informal settlement takes twice as much care as the person living in the housing complex, the chance of being infected is much higher for her. Effectively, avoiding infection is not a choice, since there is only a certain limit to which one can take perfect personal care. A person living in an informal settlement would rationally expect to be infected, irrespective of what he or she does. This chance is about 60%, non-negligible by any chance. In response to the pandemic, some researchers have found a

widespread increase in recommended public health directives. Lee and collaborators (Lee et al 2020)[6] , in study of 1392 mainly poor and non-migrant workers in Delhi document a significant rise in mask usage, time spent indoors, and regular hand washing with a decline in smoking. Others (Afridi et al (2020))[7] find that with time, these practices dissipate to an extent. Both the behavioural pattens are consistent with our hypothesis that no matter how much care one takes, one cannot avoid being infected because of the living conditions. The first instance points to people starting with taking a lot of precautions that have some cost, inn order to protect themselves, while reducing the degree of protection later on is consistent with the realization that it is not likely to protect you much anyway.

Now, suppose there is no lock down, and our person can still drive her taxi. Let us try to understand her decision. First, let us assume that the person derives an instantaneous utility from earning a wage. We will describe this as follows:

$$u(w) = \sqrt{w} \qquad 1)$$

The person derives a disutility from illness, which we describe by $v(i)$ which has the following properties:

$$v(0) = 0, v'(i) > 0, v''(i) > 0, \lim_{i \to 1} v(i) \to \infty, i \in [0,1] \qquad (2)$$

We have a concave utility function, and a disutility function that increases in the extent of illness. i in equation 2 refers not to the duration of illness, but to its intensity, which we will argue can vary between 0 and 1. i=0 indicates a healthy person, while i=1 indicates death.

[6] Lee Kenneth,Harshil Sahai,Patrick Baylinsk, Michale Greenstone (2020): " Job Loss and Behavioural Change :Unprecedented Effects of the India Lockdown inn Delhi", Energy Policy Institute of the University of Chicago, Working Paper no:2020-65, May 2020

[7]Afridi Farzana (2020), Webinar on The Impact of COVID-19 on formal and informal workers In India, Ideas for India for more evidence based policy, International Growth Center, https://www.ideasforindia.in/topics/poverty-inequality/webinar-impact-of-covid-19-on -informal-and-migrant-workers-in-india.html

Assume that since the onset of the pandemic, there is a non-zero probability p, that a given individual gets infected. This implies that the expected utility from staying back in the informal settlement is:

$$E(S) = (1-p)\sqrt{w} - (1-p)v(i) \quad (3)$$

On the other hand, going back home gives a basic reservation utility, which we will set at zero for convenience.

It makes sense to stay back if the expected utility from staying back is at least as much as the reservation utility. This implies

$$(1-p)\sqrt{w} \geq pv(i) \quad (4)$$

Equation 4 can be very simply be re-written as :

$$\frac{\sqrt{w}}{v(i)} \geq \frac{p}{(1-p)} \quad (5)$$

which says that it makes sense to stay back if the ratio of utility from wages to disutility from infection is larger than the odds of getting infected. Equation (5) can be written more insightfully as:

$$\frac{\sqrt{w}}{\sqrt{w}+v(i)} \geq p \quad (6)$$

As we can see from (6), this equation is always satisfied for i=0, and starts violating the inequality as i crosses a point. This is important, because it shows that for a given wage rate if the extent of infection is small, for instance if it is just going to be just some flue like symptoms which can be cured by a vaccines, no body leaves. People in informal settlements keep on facing a barrage of illnesses, but mostly stick to their hard earned city jobs. However, the fact that there is no vaccine, and that infection can lead to death is a critical feature of the decision to leave.

Also, larger the probability of infection, the less likely is this inequality to be satisfied, for a given wage rate and given cost of infection. Let us now parameterize p. Let p be the instantaneous

probability that a person is infected at time t, given that the person has so far been healthy. We will also assume that longer the person stays un-infected, she faces a higher probability of infection. That is because the number of cumulative encounters that a healthy person has with infected people increases in time, increasing the chance of infection over time. This instantaneous probability can be well captured by the following function:

$$p(t) = \frac{1}{1+\alpha_t e^{-t}},\ \alpha_t > 1 \qquad (7)$$

Where t is the time spent in the uninfected state, and where α_t is a containment measure like enforcing of social distancing, contact tracing, quarantine of suspects, which is designed to slow down the spread of the infection. This leads to equation 6, at time t becoming

$$\frac{\sqrt{w}}{\sqrt{w}+v(i)} \geq \frac{1}{1+\alpha_t e^{-t}} \qquad (8)$$

Now, the problem lies here. The right hand side is increasing in t, where t is time. For a fixed v(i), and w, it is easy to show that a t will exist when the inequality is violated. This can be changed if wages are increasing fast enough, or the disutility of infection is falling rapidly enough to offset the increase in the hazard. But give that both things are unlikely, it makes sense to move. A lockdown makes the decision a brainer because the numerator of the left hand side becomes zero, swinging the decision completely in favor of moving. But the analysis proves also that many would have left had there been no lock out, as has happened in history many times in the past. That is the time that everybody rationally wants to leave. This also has the empirically verifiable property that those in more congested localities will want to leave faster than those in less congested localities, because the latter face a greater likelihood of infection. There is an alternative way of stating inequality (8). Given the expression for p(t), we have

$$\frac{p(t)}{(1-p(t))} = \frac{1}{\alpha_t e^{-t}} \qquad (9)$$

. This shows that the odds of infection increase with time, unless offset by corresponding improvements in the containment action levels. Substituting (9) into (5), we can say that it is better to stay back provided

$$\frac{\sqrt{w}}{v(i)} \geq \frac{1}{\alpha_t e^{-t}} \qquad (10)$$

Equation 10 has several important lessons for policy. If we don't do anything, the right hand side of the equation , $\frac{1}{\alpha_t e^{-t}}$ keeps on becoming bigger and bigger, and it is but a matter of time when most people will want to go home.

If we are keen to avoid the mass exodus of workers from urban informal settlements, we do have some policy instruments. The first is to generate regular direct income transfers in some forms, which will offset the increase in the right hand side of the equation. The other option is to work on v(i), by making medical care easy to access and making the experience of illness as little traumatic as possible. The third option is to keep on increasing the level of public action to slow the virus down: more testing, more contact tracing, quarantine, ensuring mask wearing , social distancing with increasing degree of strictness etc. Not only is it important to do this, but it is equally vital to communicate this and the results of the action clearly to the people living in informal settlements, so that they can use the information to make their decisions. The three options can be used simultaneously, in order to be most effective. In particular, by taking increasingly higher containment measures and making hospitalization and quarantine less undesirable, it would also be possible to reduce the amount of income transfers necessary to keep the workers in cities. This would require a clear plan of engagement and channels of communication with workers that are both open and transparent. It would also require coherence and clarity in decision making by the top authorities to make the whole exercise credible in the eyes of the informal workers. Most of these ingredients have been missing. There has been very little communication about government's efforts and clear demonstration that they are succeeding. On the front of direct income transfers, very little has been achieved except a one time provision of increase in PDS entitlements and a paltry Rs.500 one time transfer. These

transfers are simply too little. As we have argued, the income transfers have to be continuous in time, at a rate high enough to offset the ever increasing probability of becoming infected. The conditions of public hospitals and quarantine centers is bad enough to tempt inmates to run away.

If the policy mix is not implemented, or if there are failures to communicate the efforts fully to the wider population, mass exodus is to be expected. The transport facilities are limited, and need to be rationed. Prices rise. Those who can afford, take the limited stock of buses and trains. Those who cannot pay, but can walk, walk. Those who can neither pay nor walk, like the aged, infirm, sick, wait it out in their homes, hoping that the bug will bypass them somehow.

Section 2: What about the future?

Will the people who leave ever come back? It depends. As you can see from the simulation, the infection in the housing society is flattened, but long drawn out. Many workers in the informal housing sector are actually service providers to the formal housing sector. They could be taxi drivers, watchmen, garbage collectors, vegetable sellers, domestic helps. All these occupations risk a high degree of contract with the still on going, though low level of infection in the formal housing complex. Even though the percentage of infected people is low, say only about 2%, a taxi driver who interacts with 200 customers in a week will expect to encounter at least 4 coved cases during that time period. This means that he will expect a large chance of infection from outside the informal housing where he lives. This has an important implication: workers who have moved back to their villages might not wat to come back till the infection has cleared completely from the population that lives in formal housing areas. This is unlikely to happen quickly because, here, the curve has flattened a great deal. This means low but lingering infection.

But will all stay back? Perhaps not. The more risk loving, mostly young, unmarried, entrepreneurial folks might still come back. There are easy pickings now; the slots of settled businesses that the middle aged and old have now vacated and which are relatively lucrative. The new, young, risk taking entrepreneurial set will now spread into these slots. The old lot might never be able to come back.

Conclusion:

The Covid pandemic has created a massive exodus of people back to their villages. It is as yet a misunderstood phenomenon. It needs to be understood. In this paper, we claim that what we are seeing is the outcome of a rational decision-making process involving risk averse individuals. It has to do with the inability to protect oneself from the infection no matter what one does, while the lock down has served to make the choice to leave a no-brainer. The huge demand for transport services has led to rationing and forced several to take the next option. There is justifiably a lot of humanitarian focus of the travails of those who are walking. But we should also not lose sight of those who are forced to stay behind, being too poor and unhealthy to be able to move. There must still be several such individuals in informal settlements who would need care. In addition, the fact that the elderly and those with co-morbidities are the ones left behind also means that the Covid death rate is likely to be larger than what it otherwise would have been.

In addition, we foresee that the demographic composition of the informal labor market will change, as workers come back. The workers who return will probably be different from those who went back. But we need to do all that we can to prevent a recurrence of this tragedy. The answer will lie in minimizing the risks for the population by ensuring better housing, sanitation, public health, and by developing appropriate, affordable health insurance policies which will raise the risk bearing capacities of people. Another very important point needs to be made. The costs of the pandemic are being borne primarily by those who live in such crowded, insanitary areas. A vast majority of them are marginals; Dalits and Muslims. M east ward houses mainly Muslim informal sector workers. Dharavi is home to Dalits and Muslims from south India. E ward has mainly North Indian Muslim workers engaged in manual labor in small units in South and central Mumbai. It is these communities who must be forming the bulk of the sick and the dead, given the locations of the pandemic. In certain hyper-nationalist narratives, Muslims are portrayed as perpetrators of the pandemic; they are more likely to be the victims.

Since the migration has started, the reports of rising cases of infections from areas that are receiving the migrants have also started to come in. The rural pockets from which the migrants hail are mostly poor districts with very basic public health and infrastructural facilities , if at all. These areas will be unable to cope with the virus as effectively as urban local bodies can. If the virus becomes widespread in rural areas as well, the urban poor will have walked from the frying pan into the fire. The issue will then take on overwhelming proportions, and will require clear, long term strategizing to work the way out of this situation. It will need clear policies to contain the virus, unambiguous income transfer programmes to support those who have lost their livelihoods, very clear communication with people to ensure that people and the government are all on the same page, which will all require a highly consultative and deliberational approach. Lack of such an approach has been the weak link in India's strategy so far.