



Why Special Help To Farmworker Families In Crowded Housing Is So Important As Part of Overall Strategy to Suppress COVID-19

By Ed Kissam, 7 April 2020

A Focused Strategy to Decrease COVID-19 Among Farmworkers and Their Families

Carefully considering the dynamics of the COVID-19 pandemic and how to reduce R_0 has important implications for initiatives designed to help keep farmworkers and their families safer.

The strategy recommended in our WKF March 29 paper, “Keeping Farmworkers Safe At Work and At Home In The COVID-19 Pandemic” pointed to crowded housing as a major problem. We argued that, at the same time, steps could be taken to address the housing and that these provide a promising “pressure point” for reducing SARS-CoV-2 transmission in the vulnerable farmworker community.

Here I look more deeply into the reasons why crowded farmworker housing is such an important issue to address in efforts to combat the COVID-19 pandemic in U.S. farmworker communities and suggest some solutions.

The reason why a “customized” strategy for combatting COVID-19 in the farmworker community is necessary is explained well by epidemiological expert Paul Delamater,

Estimations of the R_0 value are often calculated as a function of 3 primary parameters—the duration of contagiousness after a person becomes infected, the likelihood of infection per contact between a susceptible person and an infectious person or vector, and the contact rate—along with additional parameters that can be added to describe more complex cycles of transmission. Further, the epidemiologic triad (agent, host, and environmental factors) sometimes provides inspiration for adding parameters related to the availability of public health resources, the policy environment, various aspects of the built environment, and other factors that influence transmission dynamics and, thus, are relevant for the estimation of R_0 values.¹

¹ Delamater PL, Street EJ, Leslie TF, Yang Y, Jacobsen KH. Complexity of the Basic Reproduction Number (R_0). Emerg Infect Dis. 2019;25(1):1-4. <https://dx.doi.org/10.3201/eid2501.171901>



My discussion follows Delamater’s advice by looking specifically at the nature of the “built environment” in farmworker communities, i.e. housing accommodations for farmworkers and their families, as a key factor in overall spread of COVID-19² At the same time, I agree with epidemiologists’ astute and crucial observations that availability of public health services and policy environment affect COVID-19 in farmworker communities—in California, Florida, Washington, Texas and other states where labor-intensive agriculture is a major industry.

Component Factors That Determine R_0

The Imperial College, London modeling team identified the 3 components of the overall R_0 for the COVID-19 epidemic as follows:

*Transmission events occur through contacts made between susceptible and infectious individuals in either the household, workplace, school or randomly in the community, with the latter depending on spatial distance between contacts. ... approximately one third of transmission occurs in the household, one third in schools and workplaces and the remaining third in the community. These contact patterns reproduce those reported in social mixing surveys.*³

Within-Household Transmission of SARS-CoV-2 in Farmworker Communities

Farmworker households are not perfectly protected from risk of COVID-19 exposure because one, or several, household members may be continuing to work and be exposed at the workplace (since agriculture is an essential business). They also are at risk of infection if they ride to/from work in a crowded van, bus, or informal carpool. Consequently, farmworkers, along with other sectors of the essential labor force will continue to be at risk for introducing COVID-19 into their households.

Shelter-in-place provisions enacted in many states will make a valuable contribution to “flattening the curve” of the COVID-19 pandemic by increasing social distancing in the context of various casual community interactions—for farmworker families as well as others. However,

² I focus on factors that affect the probability of within-household spread of COVID-19 assuming that one infected person in the household who has contracted COVID-19 elsewhere may infect others in the household. The analysis, consequently, provides insights about the relative risk of in-home transmission of SARS-CoV-2 in a farmworker household as compared to an average U.S. household. However, further specifics of household composition, for example, whether or not multiple household members work, where they work, and the extent they are exposed to SARS-CoV-2 at work, may affect the overall risk that stay-at-home family members are infected via within-household transmission. As discussed in the paper, other facets of household composition will also affect risk in any particular household.

³ Ferguson et al., “Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand”, Imperial College COVID-19 Response Team, March 16, 2020.
<https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf>.



in order to be optimally effective, broad strategy needs to include provisions configuring public sector and philanthropic response to community diversity.

The extent to which housing conditions contribute to the overall R_0 of SARS-CoV-2 transmission reflects the types of interactions among individuals in the households once the first person in the household is infected.

Two specific quantifiable features of farmworker housing make in-home transmission particularly problematic in farmworker communities:

- Number of Individuals per Household in Farmworker Communities—American Community Survey data show that the average U.S. household has 2.63 persons.⁴ However, in Arvin, California, a typical farmworker community, showed an average of 5.1 persons per household.⁵ An average of 5 or 5.1 persons also is confirmed by 2 other studies.⁶ In communities with concentrations of solo migrant workers such as Immokalee, FL, a typical migrant worker household is one with 8 persons in a mobile home. The Pajaro-Salinas Valley Housing survey, in another region with a high concentration of migrant workers, showed an average of 7.3 persons per household.⁷
- Crowded Housing—The most-commonly used definition of a crowded housing unit is one where there is more than one person per room. Using this standard, the American Housing Survey for 2005 showed 2.4% of U.S. households were crowded.⁸ In contrast, National

⁴ ACS 1 year estimate for 2018

<https://data.census.gov/cedsci/table?lastDisplayedRow=10&table=B25010&tid=ACSDT1Y2018.B25010&hidePreview=true&q=B25010%3A%20AVERAGE%20HOUSEHOLD%20SIZE%20OF%20OCCUPIED%20HOUSING%20UNITS%20BY%20TENURE>

⁵ Edward Kissam, Arvin Monograph, New Pluralism Project. Survey data from 2006.

⁶ In Woodburn, OR, another farmworker community there is also an average of 5.1 persons per household. A California Institute of Rural Studies/UC Davis survey (Sherman et al. “Finding Invisible Farmworkers: The Parlier Study”, 1997) reports an average of 5.0 persons per household in the farmworker community of Parlier, CA.

⁷ California Institute of Rural Studies, “Farmworker Housing Study and Action Plan for Salinas and Pajaro Valleys”, April, 2018.

⁸ See Blake, K, Kellerson, R. Simic, A. “Measuring Overcrowding in Housing” Econometrica, Contract No. GS-10F-0269K, U.S. Department of Housing and Urban Development, 2007. There is an extensive discussion of the >1 person per room (PPR) indicator as the definition of crowded housing. There is also a body of research showing the relationship between crowded housing and infectious disease transmission within a household. The WHO Housing and Health Guidelines gives an excellent discussion of nuances of the relationship between housing and health (e.g. cultural factors, relationships within the household) concluding there is strong evidence for a relationship between crowding tuberculosis transmission as well as for other infectious respiratory diseases.



Agricultural Worker Survey (NAWS) data show that 33% of farmworker households are crowded.⁹ The Salinas-Pajaro Valley Housing Survey showed that 93% of farmworker households in that area were crowded and that 67% were extremely crowded (i.e. over 1.5 persons per room). For purposes of assessing the risk of in-home COVID-19 transmission, it is useful to also consider as an additional indicator of household crowding number of persons per bathroom because one of the CDC recommendations for establishing an “isolation zone” in a home with a COVID-19-infected person is for them to have a bathroom of their own. However, there is not much data on number of people per bathroom in housing but the Salinas-Pajaro Valley study, did collect data on this. It found a mean of 5.1 persons per bathroom for farmworker households.

Presumably, both the prevalence and severity of crowding in households as well as the actual size of the household – i.e. number of persons living in a household - each contribute independently to the likelihood of within-household transmission.

Household crowding increases likelihood of inadvertent transmission before an infected individual even experiences symptoms. But then, even if the SARS-CoV-2-infected individual in the household succeeds in getting tested and diagnosed or self-diagnoses as probably having COVID-19 and attempts to comply with CDC recommendations for self-isolation¹⁰, crowding minimizes the feasibility of in-home self-isolation – by virtue of the number of people per room and per bathroom and kitchen, specifically.

The more people who live in the household, the more potential infection targets there. However, the extent of household crowding is probably even more of a concern. Some of the housing arrangements where there may actually not be so many individuals in the household, for example, a small trailer shared by several workers, a converted garage rented out to a couple and their two children, a one-bedroom apartment shared by 4 co-workers, may present situations where a single COVID-19-infected household member doesn’t infect so many others but where the likelihood of transmission is very high.

How Serious a Risk Is Within-Household Transmission in Farmworker Communities?

All things being equal, more crowded housing and larger household size can be expected to greatly increase the risk of COVID-19 transmission.

I provide a very rough estimate of the extent to which both factors together increase likelihood of within-household transmission below. At the same time, it is important to remember that the actual increase in household transmission of COVID-19 may not be as neatly linear as this

⁹ NAWS 2015-2016 Report, p. 18 https://www.doleta.gov/naws/research/docs/NAWS_Research_Report_13.pdf

¹⁰ <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/disinfecting-your-home.html>



discussion implies—since household size and crowding interact with each other differently in differing housing situations, for example, in trailers, apartments, barracks, and single-family homes, in different types of household and family configurations.

Ideally, ethnographic research detailing the typical interactions of persons living over a period of time in distinct types of households could be used to document, the extent and type of contacts likely to result in SARS-CoV-2 transmission.¹¹ Nonetheless, an illustrative approximation of relationship between crowded housing and in-home transmission is provided below—because, in the current crisis, acting to overcome the problems of within-household transmission of farmworker households is urgent.

More persons living in a household (even without taking crowding into account) means more potential uninfected individuals in the household who might be infected as a result of in-home contact with the infected individual. Because the farmworker households have about 90% more persons per household than the average U.S. household (i.e. 5.1 persons in the average farmworker household vs. 2.63 persons in the average U.S. household) the probability that additional individuals in the farmworker household might be infected due simply to number of people living in the housing unit is also 90% higher. Thus, the relative risk for farmworker households stemming from household size is, therefore, 1.9 that of the average U.S. household

Because more farmworker households are crowded than the average U.S. household (i.e. 33% of farmworker households being crowded vs. 2.4% of non-farmworker households) and crowding is more severe, it is also reasonable to expect that this factor also increases in-home COVID-19 infection rates greatly. Given the difference in prevalence of household crowding it can be estimated that farmworker households have a relative risk stemming from crowding of 1.3, i.e. the proportion of farmworker households that are crowded divided by the proportion of U.S. households.

Farmworker households which are both larger than the average and more crowded, therefore, can be expected to have a composite in-home risk of COVID-19 transmission that can be roughly estimated as being product of both separate components of risk. This implies that risk of in-home COVID-19 transmission in farmworker households can be estimated as being 1.9 X 1.3 times higher than the average U.S. household. Thus, the relative risk of COVID-19

¹¹ For example, brief contact with an infected individual may often not result in transmission. However, more extended contact is more likely to result in transmission. Current guidelines for in-home isolation procedures tacitly distinguish between interactions of less than 15 minutes or more than that duration. Type of contact also matters. Reports are also beginning to emerge suggesting that higher viral exposure tends to result in more severe COVID-19 infection (Heneghan, C, Brassey, J, and Jefferson, T, “SARS-CoV-2 Viral Load and Severity of COVID-19” Centre for Evidence-Based Medicine, University of Oxford, March 26, 2020).



transmission in farmworker households can be expected to be about 2.47 times that of the average U.S. household.¹²

The Contribution of the Component of Within-Household Transmission to Aggregate R_0

The overall R_0 for the COVID-19 pandemic in the United States overall will, when computed and published, reflect different transmission rates in different states, municipalities, neighborhoods, and population sub-groups—because socioeconomic and cultural diversity implies different patterns of social interactions and different risk profiles for different communities and populations within each.

Based on the insights from the Imperial College modelers and from Delamater, I distinguish R_0 components from the domains of workplace, school, community, and within-household interactions as contributing to aggregate R_0 , that is the observed/estimated reproductive rate for the COVID-19 pandemic. It appears that within-household transmission will play a much larger role in farmworker communities than in the average U.S. community, i.e. ultimately R_0 reported for a state or for the nation.

The current R_0 for COVID-19 in the United States is not known but is assumed to be lower than the estimate from data collected in the initial phase of the pandemic in Wuhan—because experience gained in the ensuing months has informed mitigation/suppression strategy.¹³

Published reports, based on January-February data on COVID-19m estimate a R_0 of 1.4 to 3.58.¹⁴ Assuming that widespread efforts to promote social distancing in the U.S. have reduced the R_0 estimated for the initial outbreak in Wuhan substantially, for the purposes of the discussion here I estimate that the R_0 in the U.S., overall, may be about 1.8 assuming that social distancing efforts have had some success in reducing transmission. So this could be a very

¹² This rough estimate does not take into account severity of crowding in a household. The Pajaro Valley-Salinas Valley farmworker housing survey as well as observations in the course of face-to-face interviews with farmworkers in their homes over the years suggest that severity of crowding in farmworker households is more serious than indicated simply by the prevalence of households defined as “crowded” based on >1 person/room.

¹³ Experts stress the need to constantly be aware of the uncertainty of the underlying data in these epidemiological analyses. It is clear that, in China, in the U.S., and in Europe, that many asymptomatic COVID-19 cases were not identified, that some that were presumptively or definitively identified were not included in tabulation—because there was not and because there still is not serological testing and PCR-based testing still appears to generate a number of false negatives for a variety of reasons, including point in illness when a sample was taken.

¹⁴ World-o-Meters reports several estimates. The earliest estimate is from “[Statement on the meeting of the International Health Regulations \(2005\) Emergency Committee regarding the outbreak of novel coronavirus \(2019-nCoV\)](#)” - WHO, January 23, 2020 Their estimate was that the R_0 was between 1.4 and 2.5. A subsequent report, by Zhao et al, “Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak”, [Journal of Infectious Diseases](#), 27 January 2020, estimates R_0 as being between 2.24 to 3.58.



conservative estimate. Given this assumption and the Imperial College modelers' assertion within-household transmission accounts for about one-third of all transmission, then within-household transmission can be expected to be contributing about .6 to the composite R_0 , that is the aggregate of workplace, school, community, and in-home reproductive rate for COVID-19 growth in an average community in the United States without crowded housing and with smaller households than in farmworker communities.¹⁵

If the R_0 component of within-household transmission in farmworker households is, indeed 2.47 times higher than in my hypothetical estimate of the R_0 component of .6 stemming from in-home transmission in the average U.S. household, then within-household transmission contributes at least 1.48 to the composite R_0 in farmworker communities (i.e. $.6 \times 2.47$). This indicates that, even if the rough estimate provided here is not absolutely accurate, within-household transmission of COVID-19 plays a much more prominent role in determining overall R_0 in farmworker communities than in the average U.S. community.

Complicating and Complicit Factors Possibly Fostering Transmission

Additional difficult-to-quantify factors stemming from housing conditions in farmworker communities may well make within-household transmission still more problematic. These factors include: young children in a household who may not be easily isolated from a COVID-19 individual who's a parent, young children being cared for by older sibling so that their parents can continue working in the fields, lack of laundry facilities to wash an infected person's clothes as recommended by CDC, limited kitchen facilities for washing utensils and plates used by an infected individual, and limited hot water for showers and handwashing etc..

An additional issue that almost certainly affects in-home transmission in farmworker households is whether the first SARS-CoV-2 -infected individual in the household is part of a family or not and whether the household is a family household, a family household with "extra" individuals (often referred to as a "complex" household), or a household consisting entirely of unrelated or distantly-related individuals.

In households of solo male migrant workers, for example, even when there are friendships and efforts toward mutual support, the reality is that everyone in the household is working daily in the fields or packing sheds trying to make ends meet. The SARS-CoV-infected individual may get help from housemates/friends if they begin to have serious symptoms but it should not be

¹⁵ Estimates of R_0 are a function of social and economic conditions, in the workplace, in other daily social interactions, and in the home since COVID-19 is a respiratory disease transmitted by close contact. Nationwide provisions designed to decrease social distancing overall strive to bring R_0 in the United States below 1, i.e. suppression. The hypothetical estimate of a U.S. R_0 provided here simply assumes that, at this point in the battle against the pandemic, social distancing has successfully decreased the "community" transmission component substantially—while in-home and within-workplace transmission for workers in "essential" businesses is reduced slightly but still continues. However, shelter-in-place, by resulting in more children at home, may actually increase in-home risk of transmission if a household member does become infected.



expected that there will be a “dedicated” family caretaker for a person who is ill who can help them self-isolate.

Why the Issue of Housing Conditions and their Impact Deserves Special Strategic Attention

Because in-home transmission in crowded households is likely to be a major factor in the transmission of COVID-19 an important part of the overall strategy to combat spread of COVID-2019 in farmworker communities will be to address this challenge.

Unless the within-household component of SARS-CoV-2 transmission is successfully diminished, bringing R_0 below 1 and, thereby, halting COVID-19 spread in the community, will not be possible. If SARS-CoV-2 transmission is allowed to reach a high level in farmworker communities where there is both higher-than-average risk of in-workplace transmission and in-home transmission, even if meticulous compliance with social distancing guidelines has brought down the R_0 for adjacent affluent neighborhoods with fewer working families, farmworker communities will become a hot spot and surge into a “seed” and epicenter for COVID-19 resurgence.¹⁶

Providing easy, free, rapid access to allow SARS-CoV-2 infected individuals in large and/or crowded farmworker family households so that they can self-isolate, as well as providing similar accommodations for workers who must self-quarantine because of workplace exposure, can make a major contribution to reducing in-home SARS-CoV-2 transmission.

Easy access to alternative housing can be expected to reduce the duration of other household members’ exposure, the frequency of contacts that might result in infection, and the infectiveness of contacts—close in sleeping quarters, bathrooms, kitchen, and common areas in the household.

The good news is that self-isolation for COVID-19 is required for only a limited period of time—ideally 7 days or until testing shows that the infected person is no longer shedding virus.¹⁷ Emergency provision of publicly-funded housing accommodations for farmworkers and family members can clearly make a significant contribution to decreasing the spread without being too costly.

¹⁶ The unwelcome news is that vigorous efforts toward “flattening the curve”, a strategy of COVID-19 suppression rather than mitigation as the Imperial College modelers recommend will not avoid subsequent outbreaks of COVID-19 until a vaccine is developed or herd immunity is reached.

¹⁷ CDC Guidelines https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/index.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fhcp%2Fguidance-prevent-spread.html



Public funding to provide such housing accommodations is both necessary and affordable. Low-income farmworker family members are, practically speaking, not in a position to simply rent separate space for a family member or other person in the household to self-isolate. However, especially in the most economically-stressed rural communities, there is likely to be space that can be converted into temporary housing accommodations.

Conclusions

We estimate the risk of COVID-19 transmission is about two-and-a-half times higher in farmworker homes than in average U.S. homes

It is likely that public-sector proclamations to shelter in place can probably only impact the one-third of SARS-CoV-2 transmission that stems from “community transmission” so efforts to facilitate self-isolation and self-quarantine for those living in crowded housing is needed in order to decrease overall R_0 in farmworker communities dramatically.

To effectively reduce in-home spread of COVID-19 by rapidly moving individuals who need to self-isolate or self-quarantine into temporary housing, it will be essential to involve farmworker-friendly, culturally and linguistically competent case managers who can build trust, convince individuals who are uncertain about self-isolating away from their home to rapidly move to self-isolate themselves, and immediately provide access to such living quarters.

There will be particular issues to address in problem-solving if, for example, the SARS-CoV-2 infected household member is a child who will need to be accompanied by a parent or guardian or assured that their temporary quarters provide a safe, friendly home.

Assuming that there is local commitment to assist individuals both to self-isolate and to self-quarantine, there will still be challenges. It will be necessary to provide separate living quarters for those who are self-isolating because they are infected and those who are responsibly self-quarantining simply because of significant exposure.

Efforts to lower the rate of in-home transmission in farmworker communities could have at least as significant impact as the standard shelter-in-place provisions that are the core of the national and state strategies to combat the pandemic.

The same strategies that hold out promise for reducing in-home transmission of SARS-CoV-2 in crowded farmworker households may be very helpful in urban neighborhoods with concentrations of low-wage immigrant workers employed in “essential” businesses and living in crowded housing, also, because housing costs are so high in urban California cities.



Linking Provision of Temporary Housing for Self-Isolation or Self-Quarantine To Other Efforts

Each domain of social life where people interact is linked to the others. The focus in this paper has been on decreasing in-home transmission of COVID-19. But these efforts need to be coordinated with, and complementary to other efforts taking place as part of states' overall shelter-in-place and other strategies to defeat COVID-19.

Reducing any single component of COVID-19 transmission is extremely valuable but efforts in each domain—the workplace, community life, schools—interact and can be synergistic. In households where there is more than one worker (for example, a husband and a wife, one working in the fields, the other in a packing plant), if one transmits the infection to another at home, the second infected worker sharing the household may then go on to inadvertently infect co-workers in the workplace.

Proactive Efforts To Develop “Customized” Approaches to Reduce Workplace Transmission

Inevitably public agency guidance—from CDC, public health authorities, health providers, city and county officials—has to be pretty general. So it's everyone's responsibility keep on pushing relentlessly forward to do better and better--based on curiosity about the context of COVID-19 transmission in each specific workplace setting and for each specific sub-groups of workers.

A case in point is when it turns out a worker is ill with COVID-19. Public health agencies are, inevitably, totally overloaded. Companies will probably have to take initiative and move rapidly in talking with their workers if a crew member becomes ill. Even before public health agencies can find time to advise them, employers can take the initiative to gather detailed information from infected individuals about which other workers with whom they had contact. Getting supervisors thinking about the specifics of how one of their employees came to be infected and who they might have infected can be helpful—based on public health officials' general guidelines but digging deeper, thinking harder.

The Need for Employers To Take the Lead in Providing Temporary Housing

In California, aside from the case of H-2A workers, employers aren't responsible for workers' housing. So concerns about temporary housing accommodations for domestic workers are probably not always on the radar screen as employers think about what they can do to protect the health of their workforce.

But practically speaking, employers do have to worry about farmworker housing—for the welfare of their workers, but, also, for practical reasons. Reducing in-home transmission also reduces the chance that COVID-19 will be introduced in the workforce, even when otherwise good social distancing, transmission mitigation efforts are underway.



Such efforts are also consistent with national strategy. The administration’s “National Task Force Report on Coronavirus: A Roadmap to Reopening” offers a recommendation directly relevant to making self-isolation or self-quarantine facilities available to farmworkers and other families who live in crowded housing¹⁸:

Offer Voluntary Local Isolation and Quarantine. *Comfortable, free facilities should be provided for cases and their contacts who prefer local isolation, quarantine, and treatment away from home. For example, a member of a large household may wish to recover in a hotel room that has been repurposed rather than risk infecting family members. Isolation and quarantine away from home should not be mandatory or compelled by force (page 6 of the report)*

The National Task Force’s recommendation suggests that FEMA should take the lead in doing this—but in the real world it will be helpful if the private sector pushes forward to make this happen since FEMA is already overloaded. Making the specific arrangements to provide such temporary housing is, inevitably, going to happen faster if local employers and local government work together—even if, as would be desirable, federal funding is made available to help bear the cost.

¹⁸ <https://www.aei.org/research-products/report/national-coronavirus-response-a-road-map-to-reopening/>