A second wave of COVID-19 in Cook County: What lessons can be applied?

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Abstract

During the ongoing public health crisis, many agencies are reporting COVID-19 health outcome information based on the overall population. This practice can lead to misleading results and underestimation of high risk areas. To gain a better understanding of spatial and temporal distribution of COVID-19 deaths; the long term care facility (LTCF) and household population (HP) deaths must be used. This approach allows us to better discern high risk areas and provides policy makers with reliable information for community engagement and mitigation strategies. By focusing on high-risk LTCFs and residential areas, protective measures can be implemented to minimize COVID-19 spread and subsequent mortality. These areas should be a high priority target when COVID-19 vaccines become available.

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During the current public health crisis, many agencies and media outlets are reporting COVID-19 health outcome information based on the overall population of Cook County. As we have demonstrated, overall COVID-19 case counts and mortality can be misleading (details in Story Map 1). Moreover, they offer little guidance for delivering public health interventions to high risk populations, a critical need during this second and potentially more devastating wave of the pandemic. The University of Illinois Chicago School of Public Health's Public Health Geographic

Information System Program (UIC-SPH-PHGIS) and Purdue research team has been examining spatial and temporal patterns of COVID-19 mortality with a focus on the significant loss of life from COVID-19 among Long-Term Care Facility (LTCF) residents in contrast to mortality in the community among residents of private households (non-LTCF; referred to as household population, HP). The goals of the study are:

- Improve the accuracy of commonly quoted COVID-19 mortality indicators;
- Gain a better understanding of spatial and temporal distribution of COVID-19 deaths;
- Examine the role of race, ethnicity, and socioeconomic status in COVID-19 mortality;
- Identify population and organizational parameters that can inform strategies for public health interventions.

Prioritizing the allocation of resources based on reliable information is a prerequisite of a successful mitigation strategy and immunization plan. Findings from our research have significant practical implications. The state and federal government face a series of policy decisions both due to the recent surge in positive cases and, when the time comes, the need to rationalize distribution of vaccines to high priority groups beyond healthcare workers and nursing home residents in critical areas. The research team seeks to modify prevailing practices in order to derive reliable information that guides policy decisions. At this stage of the study, we identified high-risk LTCFs and residential areas (HP) of Cook County from readily available, real-time mortality data.

Spatial Distribution of COVID-19 Mortality

Our research has identified distinctly different spatial patterns in COVID-19 between LTCFs and community households. Figure 1 displays the difference of COVID-19 deaths by zip code among LTCF residents compared to residents of households (HP).

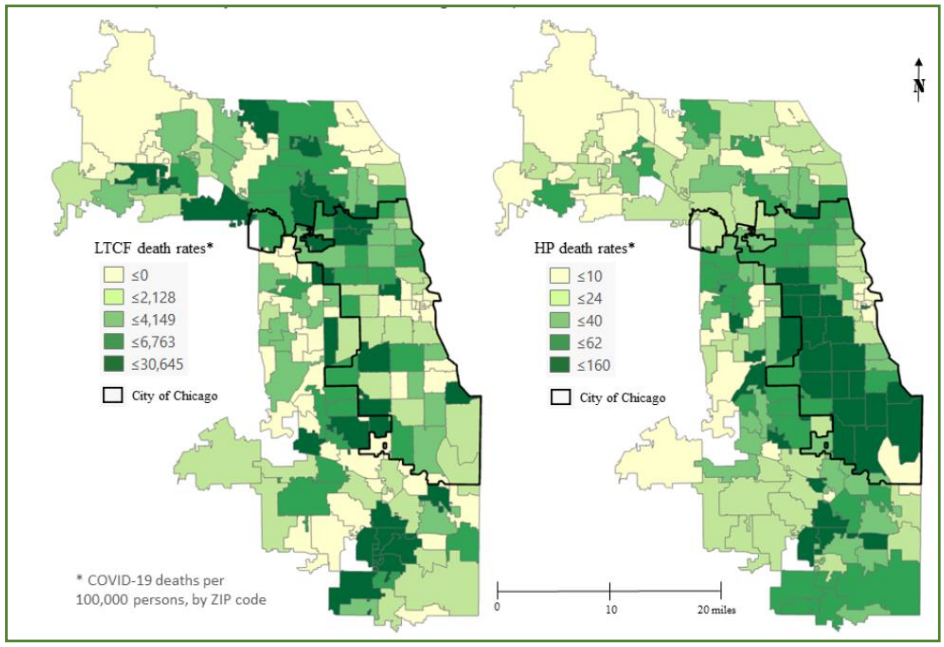

Figure 1. Difference of Long-Term Care Facility (LTCF) and Household Population (HP)-Related Mortality rate per ZIP Code (as of July 31, 2020). Original Figure in Story Map 3.

Characteristics of LTCFs and Neighborhoods Related to Mortality Rates

In preliminary analysis we found three neighborhood (zip code) characteristics related to COVID-19 mortality among persons in the community: high percentage of minority group residents, high density of the population (per square mile operational definition) and low socio-economic status (SES). The mortality rates in neighborhoods with high concentrations of African-American and Hispanic populations had the highest adjusted COVID-19 death rates for these populations. These findings are in line with other studies finding an elevated risk of COVID-19 in minority populations [1-3].

Higher density is a well know predictor of disease exposure. The low SES workforce is concentrated in service jobs, including in healthcare, increase the likelihood of COVID-19 exposure. Racial and ethnic disparities in health and healthcare likely increase risk of severe COVID-19 symptoms and mortality.

Rates of mortality in LTCFs were much more difficult to predict than household mortality. As implied Figure 1, the rate of community mortality was unrelated to the rate among LTCFs in the same zip code. The percentage of non-white residents did not seem to be a predictor of LTCF mortality rates overall or for African American/Black or Hispanic residents. We should caution that our measure of race/ethnicity may be unreliable. We are continuing to explore other characteristics such as medical complexity of residents, rate of post-acute admissions, and measures of overall care quality.

In our analysis of COVID-19 nursing facility data recorded by the Center for Medicare and Medicaid Services (CMS) [4], we found a correlation between the number of COVID-19 cases among nursing facility staff and cases among residents. Also, we found patterns over time in incidence of COVID-19 cases among nursing facility staff that paralleled cases among residents. These findings raises the possibility, suggested by other researchers, that the community COVID-19 incidence is related to LTCF incidence and mortality at a more general level [4,5]. Staff of LTCFs living in the wider community, outside the zip code of the LTCF and perhaps in high risk neighborhoods, may be transmitting COVID-19 to LTCF residents [6]. Simultaneously, LTCF facility staff may be contracting COVID-19 in the work setting and transmitting it back into the community. Another possible contributor to spread of COVID-19 in LTCFs is transfer of individuals between acute care hospitals and the LTCFs. According to CMS data, Cook County nursing facilities had over 190 weekly COVID-19 admissions from the hospital in June, a drop in admissions to 50/week from July – October, and then a sharp upward trend to 150 admissions/week in November.

Temporal Patterns in Mortality

To demonstrate the benefits of the analytical framework developed by our team, we present results of an early risk detection with the use of moving averages. During the first wave in the spring 2020 (see Figure 2), COVID-19 cases and mortality in LTCF have lagged behind the COVID-19 spreads and deaths in the community (household population, HP). The time lag between the LTCF (green) and HP (red) losses, probably represents the lag in transmission from community to LTCF. As seen in Figure 2, the LTCF related losses peaked after surpassing the HP losses reaching an average death toll of 40 per day.

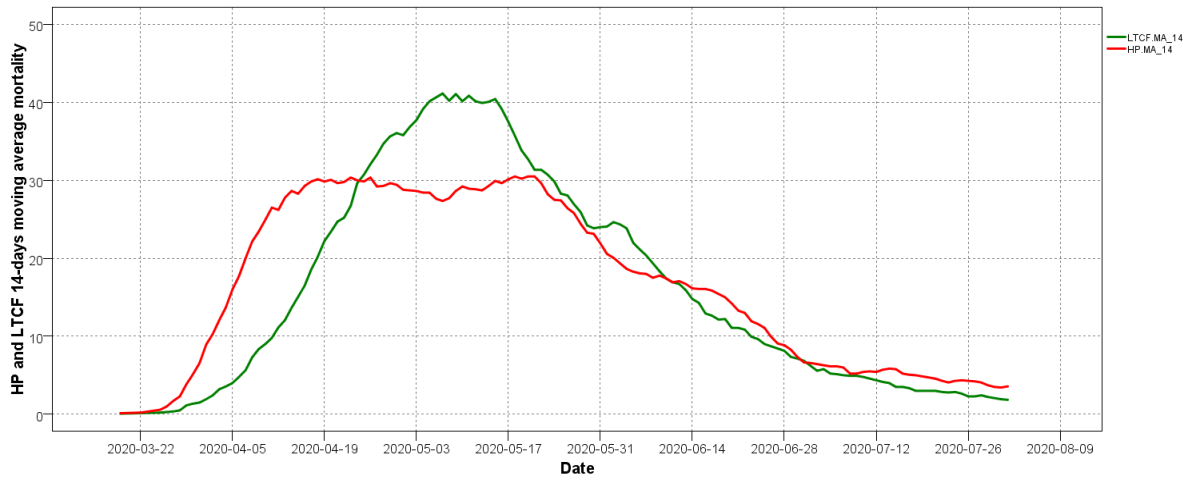

Figure 2. First wave characteristics of LTCF and HP related mortality depicted as a 14-days moving average. Original Figure in Story Map 3.

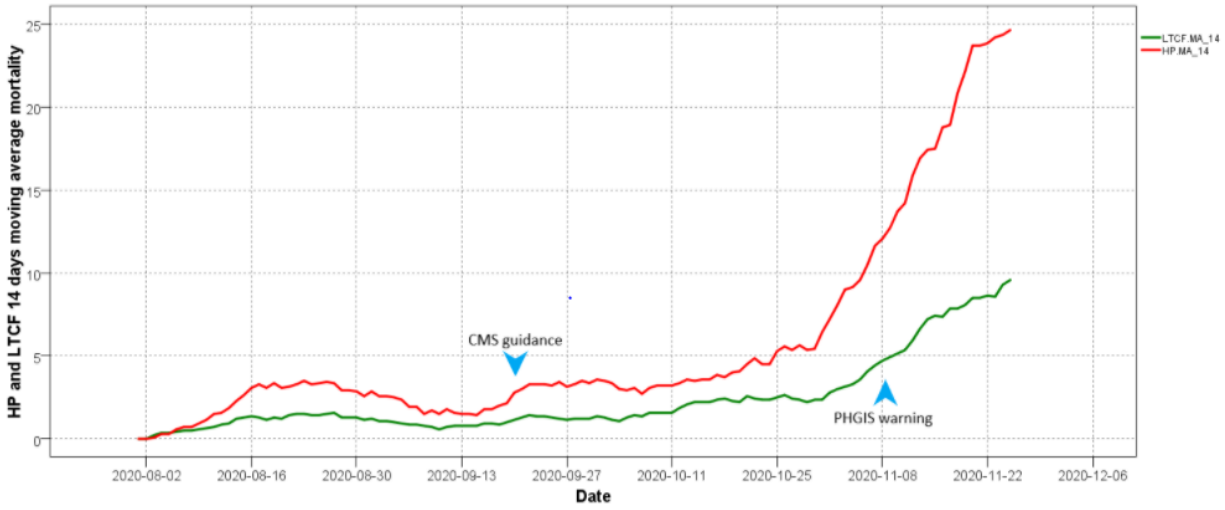

Figure 3. Transition and 2nd wave pattern of LTCF and community deaths (HP) depicted as a 14-days moving average. Original Figure in Story Map 3.

By taking into account the characteristics of the first wave, we performed an early assessment of the second wave pattern. Figure 3 displays the 14-day moving average which depicts the HP and LTCF related patterns of mortality. At the start, the almost parallel trajectories signify that the COVID-19 transmission pathway to the LTCF residents remained active during the low summer months. However, the latter part of the second wave graph raises serious concerns since after mid-October it is likely that the LTCF related mortality is entering an acceleration phase similar to the one seen during the first wave (see Figure 2). On the 8th of November the UIC-SPH-PHGIS team raised its concerns about this high risk potential (see Story Map 2)

As of November 25, 52% of LTCF deaths in Cook County are located 18 facilities and 10 ZIP codes. A month ago the losses were 2 per day, currently this loss is close to 10 per day. The risk that the overall death pattern will follow a similar, hopefully less intense, trajectory is further substantiated with the 21-days moving average pattern of the LTCF losses (not shown). Without measures, this pattern raises serious concerns since it is likely that within a week from now (12.7.20) the LTCFs death toll will exceed the 10 per day mark and continue its slow upward 14-days moving average trajectory.

Strategies to Address a Possible Second Wave of COVID-19

From a policy point of view, the above findings raise a number of issues that demand immediate public health action. Such action is imperative in order to avoid seeing the losses climb to a 40 per day 5-day moving average seen in the first wave. The first wave put enormous strain on LTCFs under circumstances of staff shortages and limited access to PPE [7]. The LTCFs are probably in a better position now to contend with COVID-19 compared to March when the initial COVID-19 surge began. According to reports for the week ending November 15 (CMS data), all Cook County nursing facilities had access to COVID-19 testing for residents and staff. Yet, only 26% of facilities had testing at the point of care and only 3% of facilities could obtain same-day results. Approximately three-fourths of nursing facilities did surveillance COVID-19 testing of asymptomatic staff or residents; the other one-fourth only tested when a person exhibited symptoms or had been in contact with a person having COVID-19. Over 95% of facilities reported having a 7-day supply of masks, eye protectors, and gowns. In addition, 91% of facilities reported no nursing staff shortages the week of November 15. However, it remains to be seen if staff shortages might arise in subsequent weeks with a new surge of COVID-19 cases.

Our findings lead to a two pronged approach aimed at breaking the cycle of transmission from community to LTCFs. Public health officials should re-double efforts to prevent a community surge through (1): Clearly articulated policies for social distancing, face covering, and restricted access to high-risk setting for spread of COVID-19 (2); Targeted testing in hot-spot or likely to be hot-spot neighborhoods that are densely populated, low income, and have concentrations of minority groups (3); Targeted interventions for vulnerable at-risk populations (with co-morbid conditions, advanced age, and residing in at-risk neighborhoods). When COVID-19 vaccines become available, they should be targeted to areas of the city at highest risk. These interventions should combine resources of health departments, Area Agency on Aging, and health systems to reach out to at risk individuals.

With regard to LTCFs, health system and public health agencies should devote resources to up-stream prevention of COVID-19 spread and mortality among LTCF residents before they are hospitalized and strain ICU capacity. The CDC [8], Illinois Department of Public Health [9], and other sources [10] have urged these actions (1): contact tracing of LTCF staff and residents (2); rapid testing of LTCF residents and staff (3); emergency nursing and medical support for burned out and depleted LTCF staff (4); transitional support between nursing facilities, hospitals, and community (5); vaccinate, as a priority, LTCF residents and all staff when COVID-19 vaccines become available (6). The issue of priority vaccinations for high risk communities should also be addressed. LTCFs should receive financial and other resources to step up their mitigation efforts, including carefully controlled visitation, isolation, PPE, and other infection control practices.

Targeting Areas of the City

The analytical framework developed by our team, provides a better visualization of the areas hard hit during the second wave. This visualization can assist policymakers address the high risk areas which are different than those during the comparable first wave phase. This is seen in Figures 4 and 5 where a comparable 1st wave data period is used. For the household population (HP), the majority of high death rate areas are concentrated in the periphery of the City whereas the comparable 1st wave areas where concentrated in the south and south east section. The LTCF distribution is different and the majority high death rate areas are concentrated in the North West part of Cook county whereas the comparable 1st wave areas where concentrated in the South West (see Figure 5).

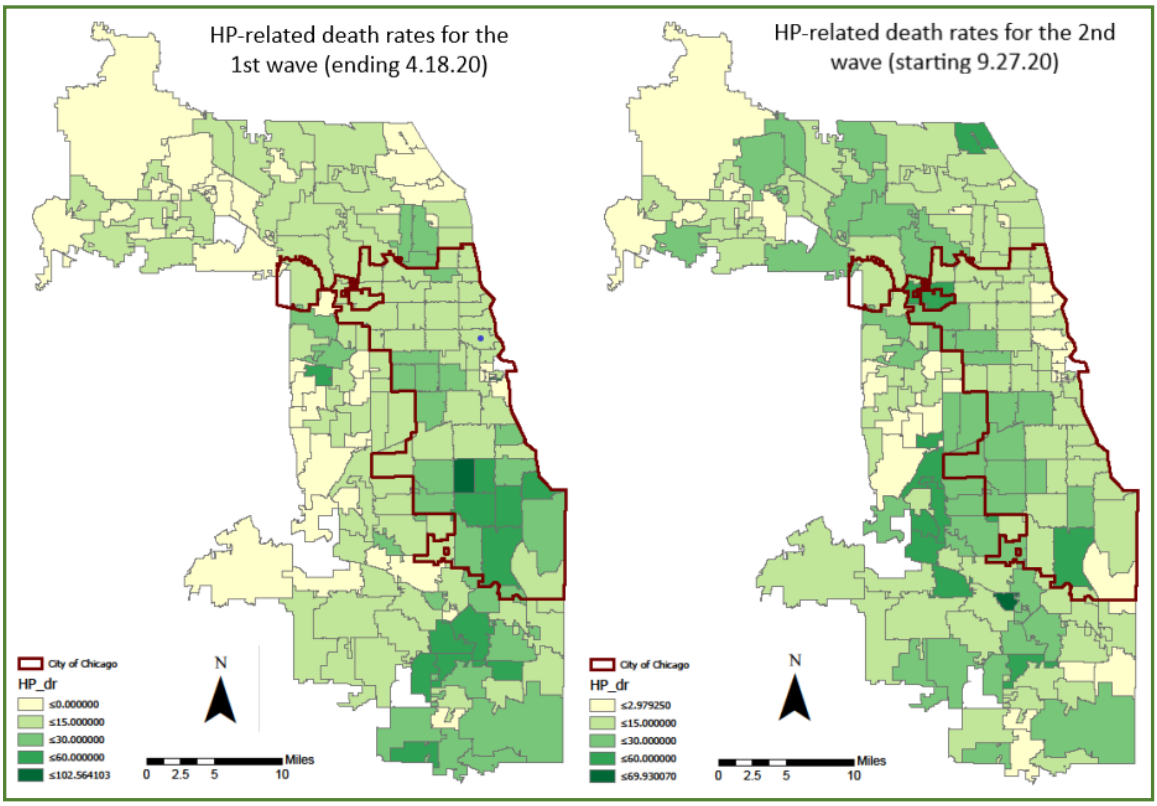

Figure 4. HP-related death rates (per 100,000 population) for the 1st (ending 4.18.20) and 2nd waves (starting 9.27.20). Original Figure in Story Map 3.

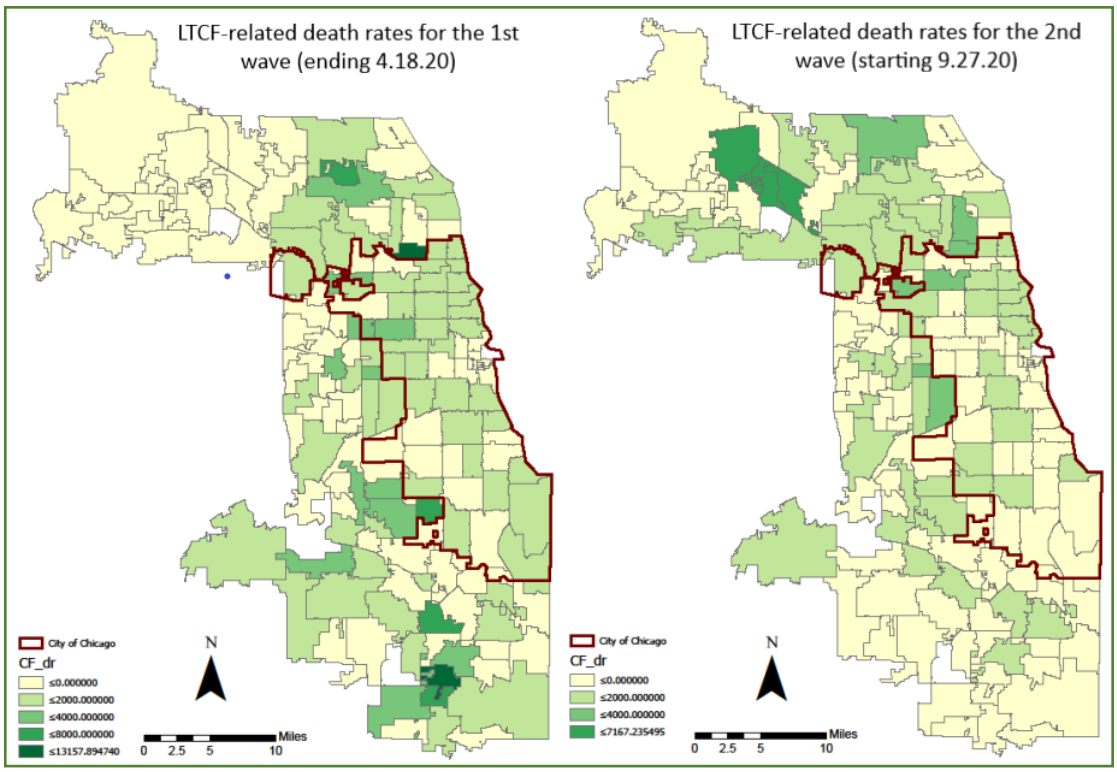

Figure 5. LTCF-related death rates (per 100,000 population living in group quarters) for the 1st wave (ending 4.18.20) and 2nd wave (starting 9.27.20). Original Figure in Story Map 3.

Conclusions

Prevailing practices which rely on overall population numbers are unreliable and can be misleading. We have shown how information on spatial and temporal patterns in COVID-19 mortality can guide policies to address high priority areas in Cook County. By focusing on high-risk LTCFs and residential areas, protective measures can be implemented to minimize COVID-19 spread and subsequent mortality. When COVID-19 vaccines become available, they should be distributed to the same high-risk populations. At a larger scale concerning the entire State of Illinois and its counties, a similar pattern (not shown) has been discerned.

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