Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Commentary

Housing at the frontline of the COVID-19 challenge: A commentary on "Rising home values and Covid-19 case rates in Massachusetts"

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The SARS-CoV-2 virus has infected more than 45 million people worldwide (World Health Organization, 2020). In the early stages of the pandemic, international effort was (rightly) focused on understanding the virus, and limiting its spread. In the absence of effective treatment or vaccine, governments were forced to rely on social distancing, isolation, and other contagion limiting restrictions such as mask wearing. These responses have had profound economic and social effects, for example taking nations into economic recession, limiting the opportunity of millions to work, and interrupting the ability of many children to be educated. These economic consequences have been as impactful as COVID-19 itself. This paper by Arcaya et al. (2020) is important because it demonstrates, in a clear example, the immediate pressure a highly infectious disease puts on our non-health systems, and the severe economic consequences of COVID-19. The paper uses the concept of 'housing displacement pressure' (using area level variables such as rent, housing value, housing cost burden) to reflect the relative risk of exposure of local populations to COVID-risky housing in a major US city.

The universally accepted social determinants of health (SDH) perspective frames many of our global health challenges (such as cardiovascular disease) as having clear and well documented social causes (such as lack of job control) that slowly accumulate as health outcomes over peoples lifetimes (Marmot, 2003; Phelan et al., 2010). COVID-19 is a different health challenge. It is a highly infectious disease where social determinants (such as employment or housing) have been rapidly influential, (and without a vaccine) the most effective health interventions currently lie outside of the health system, and unequal ability to isolate has driven unequal transmission to some communities (for example Black Asian and ethnic minorities in the United Kingdom (Moorthy and Sankar, 2020)). As an illustration, measures to tackle COVID-19 (such as local lockdowns) have had severe, immediate and often uneven economic or social consequences (such as job or income loss), often disadvantaging people in our communities who were already facing hardship (Bambra et al., 2020; M. Marmot and Allen, 2020). Further, many people's exposure to the virus has been as a result of their (or another person's) economic need to continue working (and thereby not isolate), or their employment in jobs that are vulnerable to infection (for example Uber drivers). All of this clearly suggests that in parallel with the need for clinical research to understand the virus and develop effective medical treatment, urgent progress needs to be made to understand and limit the socio-economic transmission of the disease in our society.

We have long argued that housing is an important and underutilized health intervention (Baker et al., 2017; Bentley et al., 2011, 2018). Housing conditions affect chronic and infectious disease risk. The strategies that people use to cope with their housing problems (including affordability problems) put them at higher risk of COVID-19. Living in housing that is overcrowded or moving to more precarious housing situations are logical and pragmatic responses to untenable housing situations, financial constraint or hardship. Positioning housing within a system adds an additional dimension to our understanding, as the paper illustrates. Characteristics of the housing system, and not people's responses to their housing problems alone, is a key contributor to COVID-risk, as well as the economic vulnerability described above.

This mixed method paper firstly demonstrates how the housing system acts on individuals, affecting the quality and appropriateness of where they live. The paper's finding that increasing local housing values

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robustly and positively predict local COVID-19 case rates, is a valuable demonstration of how markets and societal forces external to our health systems shape health. The distribution of social and economic vulnerability is part of a complex and changing system with the, perhaps predictable, outcome that pockets of disadvantage are created in a process where the metric of interest is housing prices, property turnover and location. These spatial concentrations of disadvantage are the fault lines of our cities – marking our vulnerability to economic and health shocks. The problem, from a public health perspective in the search for effective interventions, is that the dynamic nature of these systems is hard to fully capture and their forward momentum is out of synchronicity with our need to adapt quickly to the shock of a pandemic.

The paper also highlights the complexity of the role of housing within the pandemic. Isolation, largely at home, is a key defense against transmission. People's homes enable them to quarantine; becoming places where they work, live and educate children. This experience has caused many to rethink their housing needs such as proximity to work (when they are working from home) and open plan living (when quiet and private space is needed to work and study). Importantly, while people with the means can make changes to improve their quality of life by improving their housing and living situation, the capacity of less well-resourced people to isolate at home is severely compromised. The creates a chink in our armor. Mobility and crowding amongst people disadvantaged in our housing systems hampers policy responses reliant on isolation and breaking chains of transmission. Late identification of the need to account for mobility and instability in housing and employment amongst disadvantaged groups by public health officials has been a critical oversight in implementation of spatially ringfenced lockdown measures.

Finally, the paper highlights that the dual roles of housing as commodity and home do not sit together well in times of crisis. If market forces determine housing access, then the ability for housing to be a health intervention for all is limited. We have seen this play out in other ways over the past decade. In Australia, for example, the cost of buying a home in Sydney and Melbourne has been substantially above what an average income earning household can afford (Senate Economics References Committee, 2015) forcing many people compromise on the suitability of their housing to meet their needs, the condition of their housing or to live a long way from where they work. If we use to housing to protect us from disease transmission in extraordinary times, how can we reconcile these tensions between the housing system driven by market forces and social need?

Overall this paper reminds us that our most important public health levers sit outside of primary health care. Covid-19 presents us with a health challenge that requires us to quickly understand and operate these levers in conjunction with our health response. In the absence of a vaccine, both our housing, and our housing *systems*, have an important role to play. While housing may provide individuals with a place to isolate, live and work safely away from contagion, our housing systems still have the potential to limit access to housing for some groups in our communities – thereby limiting the effectiveness of our ability to control the disease and generating concentrated areas of advantage and disadvantage in the housing market.

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