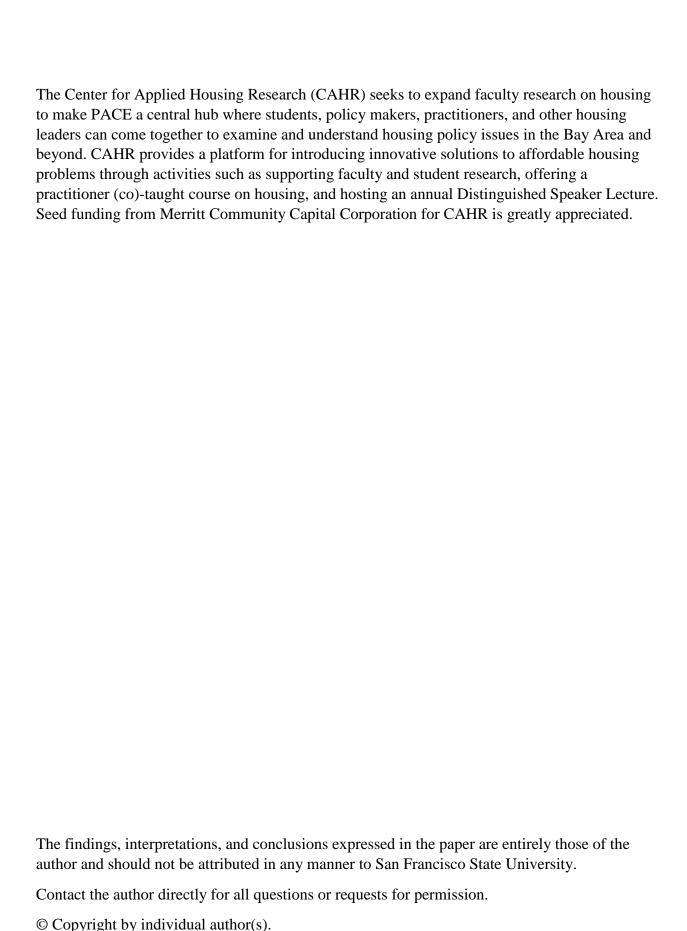CENTER FOR APPLIED HOUSING RESEARCH
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Overview of Health and Housing

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Abstract

One of the most significant social determinants of health is housing. The quality, stability, design, affordability, type and context of housing all have an impact on emotional and physical well-being. This paper provides an overview of how these dimensions of housing have an impact on health including the development of chronic and communicable diseases as well as mental health conditions for adults, children and families. Policies that reduce evictions, stabilize rents, address hazards in housing, and promote the development of affordable housing are essential to mitigate the harms of inadequate housing. Innovative approaches such as supportive housing; home visits; health services located in housing; housing based peer-to-peer programs; and, health care financing of housing all leverage housing to address health inequities.

Overview of Housing and Health

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INTRODUCTION

It is well understood that social conditions in which we live, work and play have a critical role in determining health outcomes. Access to social, educational and economic opportunities; the quality of physical environments; the resources and supports that are available; and, social structures and relationships are instrumental in perpetuating disparities in health outcomes between populations. Healthy People 2020, the Nation's 10 year agenda for improving health, prioritizes addressing these social determinants as they are preventable causes of illness and harm (Healthy People, n.d.). Furthermore, for policy makers it is increasingly clear that "in order to achieve the "triple aim" of improving population health, improving health care delivery and reducing costs" looking to social determinants is key (The Corporation for Supportive Housing 2014).

One of the most significant social determinants of health is housing (Mueller and Tighe 2007; The Corporation for Supportive Housing 2014). The quality, stability, design, affordability, type and context of housing all have an impact on emotional and physical well-being. This paper provides an overview of how these dimensions of housing have an impact on health. We first examine the policy and environmental context that form the conditions in which residents experience housing. Next, we explore the relationship between the environment inside homes and housing design and their impact on health. Finally, we discuss how housing status and vulnerability impact well-being. We conclude with a discussion of innovations in housing and health that unite these fields in evidence-based practices that have been demonstrated to make a real difference in health outcomes for individuals and families. Throughout we highlight examples from California and the San Francisco Bay Area to ground this paper in a local context.

HOUSING POLICY AND HEALTH

Policies at the federal, state and local level set the stage for the intersection of housing and health. Historic and current policies at all of these levels are instrumental in determining who lives where, and in what conditions, in communities across the country. U.S. policies that have restricted access to housing and supported residential racial segregation are a significant cause of inequality in the United States and stark disparities in health outcomes today. At the same time housing codes have been put in place to protect residents from hazards such as lead, carbon monoxide and fire. Housing policies are inextricably linked with health outcomes.

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In the first half of the 1900's, through the racist policy of "red lining," residents of color were excluded from entire neighborhoods across the U.S. regardless of financial means and urban "ghettos" were solidified (Allen and Wolin 2018; Rothstein 2017). Similarly, exclusion policies restricted where Chinese immigrants could live, forbade them from owning property and created "Chinatowns" across the country (Wu 2014). In the mid 1900's "urban renewal" cleared many of these neighborhoods designating them as "slum" housing and in the process thousands of African American families across the country were displaced and residential racial segregation was intensified in public housing and other communities (Fullilove 2001). At the same time, redevelopment of urban largely immigrant communities has displaced residents and fractured social networks (Wu 2014).

These policies have had dire health consequences that reach across generations. It is well documented that residential racial segregation is accompanied by disinvestment and neglect that results in significant deterioration of housing and the built environment, heightened exposure to environmental hazards and poor access to community resources. Across the Country, a high proportion of childbearing African American women live in hyper-segregated areas with limited access to the resources necessary to support maternal and fetal health. Today, in San Francisco, the majority of the city's dwindling African American population live in isolated, segregated public housing. This population experiences a disproportionate share of poor health outcomes and there are significant disparities in health outcomes between African Americans and other city residents (Allen and Wolin 2018).

In addition to restriction of neighborhood choice, historically, federal, state and local laws have blocked access of people of color to housing subsidies and loans limiting their ability to own a home. Restriction of home ownership and choice of neighborhood by people of color is a major factor in long-term income inequality in the United States. For many Americans, home ownership is a primary way to pass on wealth across generations. Building equity in a home provides a financial cushion that grows over time. Without this inherited wealth, many people of color are trapped in a cycle of intergenerational poverty that undermines their health and well-being (Allen and Wolin 2018).

Over a century ago, public health efforts and policies were aimed at eradication of tuberculosis, typhoid, and dysentery and the hazardous and inadequate housing underlying these health conditions. Over time these interventions were deemed successful, public health and housing efforts disconnected and separate government agencies were created to develop and enforce health policies and housing codes (APHA 2014). Today, there is no federal policy governing the provision of safe housing. State and local policy and codes now determine how building and maintenance of housing should protect the health of residents. However, the National Conference of State Legislatures reports that states inconsistently implement policies that regulate housing to ensure health. Policies designed to limit lead hazards in the home are in place in 44 states: twenty-nine states require carbon monoxide detectors, 37 states have laws related to radon, 9 states have laws related to health-threats from mold, 35 states have laws regarding stoves, heaters, fireplaces, and chimneys; and, 5 states have laws on mercury in homes (Neltnor and Farquhar 2015). This patchwork of housing codes is not a uniform approach to protecting housing residents from hazards known to compromise health.

CONDITIONS AROUND HOUSING IMPACT HEALTH

Where housing is located and what is in close proximity influences the health and well-being of residents. Even if a housing unit is well constructed and maintained, the surrounding community and its conditions create a context that can promote or degrade health. Proximity to freeways and other infrastructure and exposure to community violence have been demonstrated to negatively impact resident health while access to quality food, health care services, green space and community resources promote health and well-being. It is well understood that these health harming conditions are disproportionately found in low-income communities of color in the United States (Mueller and Tighe 2007).

Environmental Hazards

Housing that is built in close proximity to freeways, traffic prone roadways and rail-lines expose residents to significant health hazards. The link between air pollution and health conditions is well established. Coronary heart disease and asthma are two conditions closely tied to Near Roadway Air Pollution (NRAP). Recent research shows that a large burden of mortality due to Coronary Heart Disease is attributable to NRAP (Ghosh et al. 2016). Furthermore, living near freeways and busy roads is a risk factor for the development and exacerbation of childhood asthma (Anderson, Favarato, and Atkinson 2013). Despite this well understood health hazard, in California, housing is regularly built in extremely close proximity to major roadways. In 2017, 1 out of 4 of the 2,000 affordable housing units approved in Los Angeles in 2016, was built within 1,000 feet of a freeway. At the time, city officials were considering if they should approve for development housing on at least nine city-owned properties within 500 feet of freeways (Barboza 2017). Similarly, living close to a rail-line has been demonstrated to have a negative impact on health due to diesel exhaust and related emissions, particularly from trains carrying coal (Jaffe et al. 2014). In addition to transportation related hazards, studies have shown that living near a landfill also can result in health concerns such as lung cancer and other respiratory conditions (Mataloni et al. 2016).

Community Violence

Residents of housing situated in neighborhoods with high levels of community violence are deeply affected by stress and at times physical harm. Nationally, violent crime is concentrated in disadvantaged, racially segregated communities caused by ongoing structural disparities in community resources, economic mobility and social control strategies. Extensive and rigorous research has demonstrated that low income housing and its residents are not the cause of community violence and that violent crime generally does not increase in neighborhoods when households with housing vouchers move in. However, extensive research demonstrates that housing foreclosures increase violent crime on nearby blocks (Sackett 2016).

The health consequences of living continually exposed to community violence are disproportionally borne by the residents of low-income and racially segregated communities. The chronic stress associated with living in violent communities takes a toll on all residents. However, the effects on young people in these communities are particularly profound. Youth who experience or witness violence are at risk of mental health issues including depression, substance abuse/dependence and high vigilance (Howard et al. 2002; Kilpatrick et al. 2003; Li et al. 1998). Furthermore, for adults and children living in communities affected by violence and a

sense of an unsafe environment, restricting movement and play outdoors results in less physical activity and increases in rates of obesity (Fish et al. 2010).

Access to Community Resources

While exposure to environmental hazards and community violence can result in poor health outcomes for housing residents, living near essential community resources can promote health and well-being. It is well documented that access to supermarkets and neighborhood stores that stock healthy foods is associated with healthier eating habits and lower rates of obesity and diabetes. At the same time, living in a community with more convenience stores has been associated with higher Body Mass Index (BMI) (Lovasi et al. 2009). In California, obesity and diabetes rates are 20 percent higher for people living in environments with abundance of fast food and few quality food options (Treuhaft and Karpyn 2010).

Similarly, limited access to places outside the home such as bike and walking paths, parks and exercise facilities may inhibit physical activity. Living close to trails has been shown to improve the health of both low income adults and adolescent girls (Lovasi et al. 2009). Furthermore, living close to bike friendly roads promotes physical activity and health. People who live in housing within about a half a mile of roads with bike lanes get an extra 45 minutes of weekly exercise compared to those who live further away (Goodman, Sahlqvist, and Ogilvie 2014). However, the upkeep and safety of these resources matter, with poorly maintained sidewalks associated with higher rates of obesity for low-income residents (Lovasi et al. 2009). Furthermore, inhabitants of communities with limited road access or little phone or radio service may be detached from health services and are more prone to delays in diagnosis and an increase in the transmission of disease (Clark, Riben, and Nowgesic 2002).

HOUSING CONDITIONS, DESIGN and HEALTH

Just as the environment around housing has a significant impact on health and well-being, there is strong evidence that the design and upkeep of housing itself greatly influences the physical and mental health status of residents (Hood 2005). Inadequate housing conditions are associated with both physical and mental illness including occurrence of infectious diseases, chronic illnesses, injuries, poor nutrition, and mental health conditions (Suglia, Duarte, and Sandel 2011; Krieger and Higgins 2002). The way a home is designed and its relationship to other residences and the larger community can create a strong attachment to place, intertwining personal and place identity (Forrest and Kearns 2001).

Housing Quality, Inside Hazards and Health

At least since the 19th century, unsafe housing has been considered a cause of ill health. Today, it is estimated that 35 million, or 40%, of homes in cities in the United States have one or more hazards that could have an impact on resident health and safety. The hazards most commonly seen include water leaks, roofing problems, damaged interior walls, and signs of mice — all conditions associated with a range of adverse health outcomes (Allen and Wolin 2018). Tobacco smoke is also more prevalent in low-income and inner-city homes (Bashir 2002).

Housing in low-income neighborhoods is often older structures that are not well maintained and are at high risk for asthma inducing allergens and structural hazards (Wilson et

al. 2008). Cracks in building materials allow rodents and insects to penetrate the home. In multi-unit housing pests and rodents may circulate among units and spread disease. Cockroaches are of particular concern as they can cause allergic sensitization and are now understood to be a significant asthma trigger in poorly maintained buildings in low income neighborhoods. Similarly, mouse allergen can exacerbate asthma symptoms (Krieger and Higgins 2002; Mueller and Tighe 2007).

Mold develops where there is poor insulation that allows moisture to accumulate and can result in respiratory distress and asthma (Ineichen 1993). The association of damp and mold with childhood asthma has been repeatedly studied and is well understood (Ineichen 1993). Similarly, substandard housing may expose residents to hazards that promote the spread of infectious diseases such as unsafe drinking water, improper waste disposal, pest infestation and inadequate food storage (Krieger and Higgins 2002; Skolnick and Currie 2007).

Lead exposure is a well-publicized source of health problems particularly for children living in degraded and older housing where lead paint is common. Every year thousands of children suffer from lead poisoning despite prevention-oriented policies and mitigation efforts. It is estimated that twenty million homes in the U.S. contain lead paint hazards and 3.6 million children live in these units (Mueller and Tighe 2007). The Center for Disease Control and Prevention (CDCP) reports that long term exposure to lead can result in severe health consequences including gastro-intestinal problems, mental health issues, brain damage and harm to vital organs (CDC 2018).

Heat is another common health hazard present in inadequate housing. Faulty or sub-standard heating results in burns and fire-related injuries. Children are at particular risk to the harms of poor heating systems and wiring that are not up to code. Researchers have shown that lack of heat is also a concern and that ill health such as poor appetite, behavioral issues and feeling unwell are associated with living in poorly heated units (Mueller and Tighe 2007).

Degraded housing is associated with poor mental health for inhabitants (Roman and Knight 2010; Mueller and Tighe 2007). Depression and other mental health concerns are common amongst adults and children who live in unhealthy and substandard housing (Gallagher and Bajaj 2017; Roman and Knight 2010). Researchers have found an association between mold in the home and depression (Hyndman 1990). Stress and fear is exacerbated by living in an environment where exposure to toxins and unhealthy conditions is out of resident control (Krieger and Higgins 2002). As a result, improving the quality of the housing is associated with a reduction in stress (Evans, Wells, and Moch 2003). More than any other health conditions, mental health including behavioral problems and depression, improve for both youth and adults after moving into safer and healthy housing (Eiseman, Cove, and Popkin 2005; Katz, Kling, and Liebman 2000).

Beyond the housing itself, chemicals used to clean in a home environment may do harm to human health. Research has shown carpet and upholstery cleaners, spot removers, degreasers, bathroom cleaners, furniture polish and air fresheners all contain volatile organic compounds, some of which are specifically designated Hazardous Air Pollutants (HAPS) (Nazaroff and Weschler 2004). Adults in the U.S. spend an average of 20-30 minutes per day cleaning their

homes and during that time have a steady exposure to inhalation of these products (Nazaroff and Weschler 2004). Droplets from aerosol sprays and fresheners remain airborne after use; wood and floor cleaning products contain formaldehyde; and, chlorine bleach releases chloroform into the airspace. All of these are thought to be relatively safe to use, particularly when coupled with the proper protective wear, but their potential harmful effects intensify when they are combined with other pollutants (Nazaroff and Weschler 2004). Ammonia cleaners used in smoking environments, for example, prompts the release of nicotine from the walls making it airborne. Improper use of mixing cleaning chemicals and the resulting air pollutants can cause acute respiratory symptoms (Nazaroff and Weschler 2004).

Housing Design and Health

Housing design and layout has strong implications for mental health, sense of isolation, physical safety, social cohesion and health promotion. Research shows a strong association between housing layout and feelings of connection or isolation. As noted earlier, for public housing residents the spatial layout can also lead to fear and anxiety if they unable to monitor their safety due to the design of the physical environment (Evans, Wells, and Moch 2003). Living in high rise apartment buildings is associated with compromised mental health, decreased access to open space for play and fewer opportunities for social interaction with neighbors. Housing design can also promote social connections through the use of open space, common spaces and housing clusters (Lai and Rios 2017). Multi-family housing promotes social connections particularly when there are no more than 8-12 families who share a main entrance, such as townhouses, courtyard apartments, and cohousing (Montgomery 2017).

Seniors that live in housing that is dedicated for an aging population are particularly impacted by design decisions. Nursing homes may actually promote social isolation as they are often highly regulated, depersonalized and geographically detached from other community centers due to zoning laws. There are often few private areas for gathering, reducing opportunities for meaningful more intimate interaction among residents and visitors (Cannuscio 2003). Nursing homes also regard residents as "patients" resulting in a reduction in autonomy for family members in caring for their relative. Furthermore, personal cleaning facilities in nursing homes are often centralized to make it easier for staff to provide personal care for residents but diminishing privacy and accommodation of personal preferences about bathrooms and showers (Cannuscio 2003). As a result of these and other negative impacts of living in nursing home facilities, older Americans of all income levels prefer to live at home as long as possible (Memken and Earley 2007; Golant 2008).

HOUSING STATUS and HEALTH

If a person has adequate housing and what type of housing they live in are significant factors that determine health and well-being. Housing instability is a source of physical and emotional stress and in many communities living in public housing can be determinant of ill health. Homelessness, both chronic and sporadic have been shown to compromise the health of both individuals and families.

Public Housing

U.S. Department of Housing and Urban Development (HUD) reports that in the United States, 1.2 million households live in public housing units, managed by approximately 3,300

Housing Authorities (HUD n.d.). Public housing residents are particularly vulnerable with the elderly making up approximately a quarter of residents and a similar amount living with a disability. Over a third are households with children under the age of 18 and for the majority of all residents their stay in public housing is not short-lived with nearly 50% remaining in public housing for five years or more. Furthermore, families who live in public housing are exceedingly poor with the average annual household income of about $14,000, well below the federal poverty line (NCHPH, n.d.). Today, public housing sites are often located in distressed communities with high concentrations of poverty, elevated violence, hazardous living conditions, isolation, and racial residential segregation, and lack of access to resources and services.

There is some controversy about whether people who are already in ill health are more likely to move into public housing or if public housing itself causes poor health outcomes. Regardless, the residents of public housing have been shown to experience negative health conditions at rates higher than their peers living in housing provided on the private market. Chronic health conditions such as arthritis, asthma, diabetes, hypertension, and obesity all occur at higher rates among adults living in public housing. Children living in public housing bear a disproportionate burden of poor school attendance and trauma (Allen and Wolin 2018).

Public housing environments across the country are in significant disrepair and in some cases were never intended for long-term use. They are frequently highly segregated environments of concentrated poverty situated in larger low-income neighborhoods. Often times layout of public housing sites can contribute to stress as residents are unable to monitor their physical safety easily. In addition, to these challenges to well-being, the restrictive rules governing the lives of tenants or public housing cause stress and undermine family health. A large number of the male residents of family public housing sites are not officially permitted to live there because of policies restricting occupancy by former drug offenders. As a result, many males are considered "off lease" and hide in plain sight creating stress as families try to stay together. Furthermore. some of these "off-lease" residents provide income that if it were accounted for, would make the family ineligible for federally subsidized housing. Women living with "off lease" family members may put their housing at risk when they seek out health and social services and expose their living situation (Allen and Wolin 2018).

As public housing across the United States has fallen into disrepair and sites have become locations fraught with social and economic hardship, efforts to "transform" public housing have arisen. From HOPE VI in the mid 1990's to the more recent CHOICE Neighborhood Program and Rental Assistance Demonstration (RAD) program, large scale federal initiatives have supported the rehabilitation and rebuilding of public housing across the United States. At the same time, these efforts are controversial as one major consequence is the displacement of residents from their homes and communities. In San Francisco, there is a painful history and current reality of the redevelopment of public housing sites resulting in families moving to distant communities that are far away from trusted service providers and social networks (Allen and Wolin 2018). On the other hand, research has shown that adults and families that move out of degraded public housing into new environments, including more modern public housing units experience better health including fewer reported health problems, such as diabetes and asthma, and are less likely to report substance use problems after moving (Antonakos and Colabianchi 2018).

Housing Instability

There is not a uniform definition of "housing instability" or "housing insecurity." Characteristics that are often mentioned include challenges paying rent, frequent moves, paying more than 50% of household income on rent, living in overcrowded conditions and risk of eviction (Kushel et al. 2006). "Gentrification", the collective social and economic changes that result from increased housing investment, new commercial development, an influx of higher income and college educated residents and a decrease in residents living below the poverty line is one common source of housing instability, particularly in metropolitan areas such as the San Francisco Bay Area (Kennedy and Leonard 2001; Huynh and Maroko 2014).

For families and individuals living with such insecurity the health consequences can be negative and significant. The stress of housing insecurity cuts across all aspects of life and is a determinant of poor physical and mental health outcomes. Even for adults who are now adequately housed, housing deprivation in childhood is associated with ongoing ill health (Mueller and Tighe 2007). Fear of eviction, foreclosure, discovery of residents who are "off lease," conflicts with landlords, rent increases, and ultimately risk of homelessness, all contribute to a high level of stress experienced by families living with housing insecurity (Allen and Wolin 2018). Researchers have also observed that families will forgo health insurance in order to afford housing. For women, housing instability makes them vulnerable to ongoing violence as they may put up with abuse in order to preserve their housing (Olsen, Rollins, and Billhardt 2013) . Researchers have found that the need for safe and secure housing immediately and over time is one of the most critical concerns for women who are considering to or have just left a violent household (Clough et al. 2014).

For children, housing insecurity has harsh consequences. Children who live in unstable conditions are more likely to be hospitalized and experience developmental delays (BARHII and San Francisco FED 2017) Frequent moves associated with low birth weight and impairments in cognitive development (Carrion et al. 2015; Fowler et al. 2015). At the same time, studies show that the provision of affordable housing protects child health, reducing low birth weight and malnourishment (Mueller and Tighe 2007).

Overcrowding often occurs along with housing insecurity. The conditions associated with overcrowding put inhabitants at physical risk of disease and stress, while limited income for expenses other than rent can result in restricted spending on medicine, doctors and food (Stahre et al. 2015). People that live in overcrowded conditions are at elevated risk of exposure to communicable diseases, excessive noise and injury due to fire (Cohn et al. 2017). In particular respiratory infections such as tuberculosis are contagious and spread in overcrowded living conditions (Krieger and Higgins 2002). Overcrowding is also associated with stress, particularly for parents who may be anxious about child safety (Mueller and Tighe 2007). For children, the effects of living in an overcrowded environment can be seen in behavior, academic achievement and physical health. The home environment often acts as a primary setting for socialization, skill development and identity formation. With the stress of an overcrowded environment, these processes can be interrupted (Solari and Mare 2012).

Housing instability may result from gentrification of neighborhoods. Displacement of low-income families and the elderly has particularly negative health consequences (Cole et al. 2017; CDC 2018). Displacement may lead to increased levels of stress, injuries, violence, crime, and poor mental health (Cole et al. 2017). In cities such as San Francisco, displacement has resulted in families moving far away from their social support and service providers resulting in the disintegration of networks that are critical to health promotion (Allen and Wolin 2018). Research shows that people who are displaced may have shorter life expectancy and higher rates of cancer, chronic diseases and poor birth outcomes (CDC 2009).

Homelessness is an umbrella term that captures several forms of housing instability but individuals who live on the street tend to have worse health than those who live indoors (Hwang 2001). Researchers are challenged to determine if homelessness causes illness or if illness leads to homelessness or both. In addition, it is difficult to control for social determinants other than housing that are associated with both poor health and homelessness (Allen and Wolin 2018). Regardless, homeless populations have disproportionately high levels of health concerns compared to the general population and experience premature death more often (Hwang 2001; Raybould 2010).

Many health problems are exacerbated by homelessness while others develop as a result of homelessness. Poor access to physical and mental health care results in high incidence of acute and chronic health problems with conditions like mental illness, diabetes, hypertension, and anemia going undiagnosed and untreated (Hwang 2001; Henwood et al. 2013; Raybould 2010). Good nutrition is almost impossible without the proper storage and cooking facilities (Ineichen 2003). People who are homeless are frequently exposed to the elements and frost-bite and hypothermia are common during cold weather. Death due to freezing is real concern for people experiencing homelessness. Furthermore. without safe and accessible cleaning and bathing facilities or personal hygiene products such as soaps, toothbrushes and toothpaste, lotions and toilet paper, people who are homeless are prone to developing skin and foot problems (Hwang 2001). Similarly, long periods of walking and standing coupled with inadequate footwear, prolonged exposure to moisture and repetitive minor trauma can cause foot disorders (Hwang 2001). People who are homeless are also at increased risk of contracting communicable diseases such as tuberculosis and gastrointestinal diseases as outbreaks are common in shelters where inhabitants are subjected to overcrowding, high-turnovers, and inadequate ventilation (Ineichen 2003). Finally, men who are homeless are about 9 times more likely to be murdered than men in the general population (Hwang 2001).

There is also evidence that demonstrates the hazards of homelessness for families, children and pregnant women. Preterm birth and low birth weight rates are high for women who are not adequately housed due to the fact that they are less likely to receive adequate prenatal care, take prenatal vitamins, are more likely to smoke and be over- or underweight. Children who are homeless are burdened with negative health outcomes and challenges to their physical and emotional well-being and development (Allen and Wolin 2018).

CONCLUSION: INNOVATIONS IN HOUSING AND HEALTH

Ensuring individuals and families have access to safe, quality, stable and affordable housing is key to promoting their health and well-being. In fact, housing can be thought of as a

"vaccine" that "paves the way to long-term health and well-being" (Sandel 2016). Policies that reduce evictions, stabilize rents, address hazards in housing, and promote the development of affordable housing are essential to mitigate the harms of inadequate housing (BARHII and San Francisco FED 2017). Furthermore, the role of affordable housing in managing health care costs is well documented and one of its most discussed social benefits (Mueller and Tighe 2007; Sandel 2016).

Living in quality and stable housing has direct benefits to physical and mental health. The Center for Outcomes Research & Education (CORE) studied residents of 145 affordable housing developments and demonstrated that a decrease in emergency room visits and an increase in primary care visits was associated with a move into affordable housing. Similarly this study documented that residents of affordable housing reported that their access to care and its quality improved after moving into new housing (Sandel 2016). Increasingly, public health and housing practitioners are working together to make the case that housing is a health intervention. Together they are arguing that uniting housing and health is a critical approach to addressing housing instability, homelessness and ill health associated with living with poverty, racial residential segregation and related social conditions. Following are some of the promising approaches that leverage housing as a determinant of well-being and join housing and health to address health inequities.

Healthy Homes and the National Healthy Housing Standard

Due to these inconsistencies and lack of federal guidance about requirements to ensure healthy housing, the National Center for Healthy Housing and the American Public Health Association (APHA) created National Healthy Housing Standard as a "standard of care" for those who can work to improve housing conditions across the country. The standard is aimed at the over 100 million existing homes in the U.S, as opposed to new construction, that offer a critical opportunity to address health inequities and improve well-being. The standard is designed for use by policy makers and housing practitioners and to complement existing policies that govern housing maintenance. They are considered "minimum performance standards for a safe and healthy home (APHA 2014).

The Standards provide guidance on health protecting requirements including: Duties of Owners and Occupants; Structures, Facilities, Plumbing, and Space Requirements; Safety and Personal Security; Lighting and Electrical Systems; Thermal Comfort, Ventilation, and Energy Efficiency; Moisture Control, Solid Waste, and Pest Management (APHA 2014). However, the effectiveness of codes depends on meaningful enforcement which can be seen as punitive. An alternative are policies such as tax credits, low-interest loans, tax abatement and exemption programs that provide incentives for landlords to maintain and improve living conditions (NCHH n.d.).

Supportive Housing

Supportive housing is an approach that is recognized as an effective way to address homelessness, increase housing stability, address resident health issues, and decrease public costs. It links "decent, safe, affordable, community-based housing with flexible, voluntary support services designed to help the individual or family stay housed and live a more productive life in the community" (USICH 2018). Supportive housing is conceived of as housing with no

time limitation as long as residents meet the obligations of tenancy. Participation in services is generally voluntary. There is no single model for supportive housing's design with some approaches using single buildings or scattered units (USICH 2018).

Supportive housing has been shown to improve health outcomes for residents with a significant savings in health care costs. Researchers in San Francisco estimated that by year seven of a supportive housing project the health care cost savings were $13,095 per person per year (Sturtevant and Viveiros 2016). According to the Corporation for Supportive Housing, supportive housing influences health on three dimensions. First, and most essential, quality supportive housing provides a physically safe environment, protection from the elements and access to basic needs. Second, supportive housing improves access to quality health care, referrals to support staff and community-based services. Third, supportive housing is a model that supports residents to learn to manage their own conditions and engage in healthy behaviors (Healthy People, n.d.). Increasingly, supportive housing is a strategy implemented at scale across the country. Efforts to connect supportive housing and medical and behavioral systems of care were pioneered in California by the Corporation of Supportive Housing and local public health agencies such as the San Francisco's Department of Public Health. Essential to the effective, large scale implementation of supportive housing and a widespread impact on health outcomes and costs are policies that recognize the value in facilitating integration of housing and health care (Healthy People, n.d.).

Health Services Located in Housing

The Center for Outcomes and Research and Education (CORE) study showed that affordable housing properties that had health staff including doctors and nurses on site saw significant reductions in emergency room visits. They also reported that although there is a significant benefit of these onsite services, awareness of available health care is generally low. There is room to grow the benefit of integrated housing and health care services (Sandel 2016). For families living in public housing some of the most effective integrated health care approaches are "whole-family" or "two-generation" models that intervene simultaneously with different generations of the family. The Urban Institute has implented their Housing Opportunity and Services Together (HOST) program as a pilot in Chicago, Portland, New York and Washington D.C. The program engages families in intensive wraparound services providing services such as case management to heads of household while at the same time providing after-school activities, job training, academic support and behavioral health interventions for youth in the family. In Boston the Health Start in Housing (HsiH) program set aside public housing units for pregnant women and provided them with training and access to supportive services. HsiH was associated with improved birth outcomes and health of mothers engaged in the program (Allen and Wolin 2018).

According to Health Resources and Services Administration (HRSA), there are 291 Health Centers located in or immediately accessible to public housing sites across the country. Through the federal governments Primary Care in Public Housing Program 106 clinics provide primary care services including internal medicine, pediatrics, OB/GYN care, dental care, health education, laboratory services, and case management.to public housing residents (NCHPH 2018). In addition, to the delivery of primary care services onsite in public housing, on-site clinical services are used to supplement rather than replace off-site health care (Beigay 2007;

Naparstek et al. 1997; Rorie et al. 2011). When executed effectively, on-site services improve use and efficacy of traditional clinical health care, including increased likelihood of residents attending their scheduled off-site appointments and receiving preventive services between office visits (e.g., blood pressure and hypertension checks, glucose monitoring, dental disease screening), all of which support overall health (Beigay 2007). In addition, one way to coordinate on- and off-site services is through mobile clinics, which have often been used to bridge the gap between public housing residents and the larger health system (Naparstek et al. 1997; Rorie et al. 2011).

Peer-to-Peer Health Interventions in Housing

Another area of great interest and with increasing support is peer-to-peer health programming in housing settings. Peer-to peer health programs involve community residents working to address community health issues by serving as a source of health information, bridge to services, advocate for community health needs, facilitator of community action, and organizer of community health promotion activities. They reside in the community and serve the community. Peer-to-peer health programs located in public housing have been shown to improve well-being while building capacity to address community issues. Peer health programs in public housing demonstrate health improvements such as reduction of emergency room visits and admissions for asthma (Krieger et al. 2002, 2010; Takaro, Krieger, and Song 2004) and chronic conditions such as diabetes, hypertension (Brownstein et al. 2005; Zuniga et al. 2012; Edgren et al. 2005; Horowitz et al. 2011); Tuberculosis treatment adherence and influenza vaccination (Klein and Naizby 1995; Krieger et al. 2000; Tulsky et al. 2004); and decreased waist circumference and improved blood pressure (Ayala and The San Diego Prevention Research Center 2011). Furthermore, improvements in behavioral and self-reported outcomes such as smoking cessation (Andrews et al. 2012), increased physical activity (Ayala and The San Diego Prevention Research Center 2011), and increased consumption of fruits & vegetables (Larkey 2006) have all been reported.

In addition to improved health outcomes, hiring residents for outreach and for clinical and non-clinical roles has been shown to increase community participation and supports on-site clinical health interventions in public housing. Training residents as Community Health Workers (CHWs) to staff on-site clinics and provide door-to-door outreach can help programs reach residents. This process not only provides opportunities for employment but also increases accessibility to health services (Tiwari et al. 2014; HHS 2005). In public housing communities, peer-to peer health workers increase utilization rates of health assessments (hypertension, high cholesterol, diabetes, and dental disease) (Rorie et al. 2011). Similarly, housing staff and residents can be trained as "case finders" to identify and reach out to hardest-to-serve residents (Robbins et al. 2000). Furthermore. peer-to-peer health interventions in housing settings can build social cohesion and foster social connections (Ayala and The San Diego Prevention Research Center 2011; Krieger et al. 2009; McNeill and Emmons 2012; McNeill et al. 2009; Wolff et al. 2004).

Finally, there are significant positive outcomes for the people that serve as the "peer leaders" in peer-to-peer health programs in housing settings. Positive outcomes for them include changes in knowledge, attitudes and beliefs in their own health status. Leading exercise groups, conducting nutrition education, and counseling peers on safer sex influences the behavior and

positive health outcomes of peer leaders. In some cases, working as a peer leader serves as a professional development opportunity for community members and promotes empowerment, community engagement and self-efficacy (Condon et al. 2007; Plescia, Groblewski, and Chavis 2008; Brown et al. 2011).

Home Visiting

Home visiting programs use housing as a setting for delivery of services by bringing clinical and support services directly into patient's homes (Larkin 2003; Rabins et al. 2000; Robbins et al. 2000; Saegert et al. 2003; Westley and Glick 1997). Formalized home visiting models have been around since the 19th century (Allen and Wolin 2018), with medical care provision in the home surely going back much further. Home-based services connect residents and service providers in a familiar location and have shown to be a successful strategy in public housing to deliver care to seniors, families, and residents with behavioral health issues (Larkin 2003; Saegert et al. 2003; Rabins et al. 2000; Westley and Glick 1997). Similarly, in the field of maternal child health, home-visiting is viewed as a gold standard of early childhood interventions with an emphasis on decreasing risk and boosting protective factors. The Nurse Family Partnership is one of the most well-known and researched programs. The National Academy of Medicine has recognized home visiting as a key strategy for addressing social determinants of health (Brady and Johnson 2018). A key aspect of all home visiting programs is that they convey acceptance of a patient's living environment which is essential to building respect and understanding with providers (Larkin 2003).

Health Care Financing of Housing

As housing is increasingly understood to be one of the most powerful social determinants of health, health care institutions stretch beyond traditional boundaries and have become more directly involved in the financing, development and provision of housing. Across the country, health care institutions recognize that the creation of housing for patients and insurance plan members, in particular those that are high users of hospital services and are commonly known as "frequent flyers", is a good investment (Abrams 2018).

Health care institutions are investing in a variety of models to try to ensure stable, quality housing for patients and health insurance plan members. A collaboration of the Low Income Investment Fund and Mercy Housing, with support from the Kresge Foundation and the California Endowment developed a report on innovative models of how the health care system is addressing housing needs. The authors present three main investment strategies for health care systems to create access to affordable housing for patients: (1) use of shared savings, reserves, or increased financial flexibility within a capitated health care delivery system in partnership with a local housing authority; (2) use of a hospital community benefits obligation that requires hospitals to spend resources on community health to maintain tax-exempt status; and (3) local or state investment built upon resources from an expanding health care sector (LIIF and Mercy Housing 2017). Many health care partners will not fund "bricks and sticks" and instead provide resources for housing stability and supportive services. At the same time, there are health care institutions that are investing directly in the rehabilitation or development of affordable housing (Abrams 2018) .

Partnership across the health care and housing fields is not without significant challenges. Policy restrictions, siloed funding streams, lack of understanding across the housing and health care fields and dramatically different timelines and measures of success all present obstacles to effective collaborations that bring housing to the individuals and families facing some of the greatest health care needs (LIIF and Mercy Housing 2017). Furthermore when health care organizations want to prioritize certain target populations for interventions and in particular housing, they can run into fair housing laws that do not allow such prioritization (Abrams 2018). One of the most recent examples of a health care system and housing partnership is the Oakland-based Kaiser Permanente commitment of up to $200 million to address housing stability and homelessness, among other community needs. They describe their initial focus as "prevention of displacement or homelessness of lower- and middle-income households in rapidly changing communities; reducing homelessness by ensuring access to supportive housing; and making affordable homes healthier and more environmentally sound." (Kaiser Permanente 2018)

A Last Word

Bringing together housing and health is now a highly visible strategy to limit health care costs and improve health outcomes. Although these institutional partnerships are often hailed as innovative cross-sector collaborations, for individuals and families this is an obvious and commonsense approach to meeting their needs. Residents want accessible health care where they live, even provided in their home. For residents who suffer the harms of inadequate housing, the need for a safe place to live is a clear priority. Uniting the housing and health fields in an effort to prevent the damaging effects of housing instability and poor housing quality while promoting health through the provision of affordable housing will reap rewards for all involved.

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