Nurses in Supportive Housing are Associated With Decreased Health Care Utilization and Improved HIV Biomarkers in Formerly Homeless Adults

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*A San Francisco study conducted in 2008 showed that the permanent supportive housing program, Direct Access to Housing, dramatically decreased the risk of death in people living with HIV. In our study, we compared the health care utilization patterns and HIV-related biological markers of formerly homeless adults with HIV before and during two types of permanent supportive housing: (a) housing with on-site nursing care for residents, and (b) housing without on-site nursing care. Using nearest-neighbor matching with propensity scoring, the difference in outcomes was calculated. In the matched analysis, adjusted for adherence to combination antiretroviral therapy, people housed at sites with nurses had 4.8 fewer emergency department visits per person (*SE*: 1.53,* $p < .01$*), and they had an increased mean CD4+ T cell count (101.14 cells per person [*SE*: 55.10,* $p < .05$*]) compared to those who lived at sites without nurses.*

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Being homeless increases the risk of HIV infection, and the combination of HIV and homelessness results in more rapid progression of the disease and higher mortality rates when compared to other subpopulations of homeless adults (Barrow, Herman, Córdova, & Struening, 1999; Lim, Harris, Nash, Lennon, & Thorpe, 2015; Schwarcz et al., 2009). According to one review and meta-analysis, an estimated 0.3% to 21.1% of the homeless population in the United States had HIV infection (Beijer, Wolf, & Fazel, 2012). The overall HIV seroprevalence for single homeless adults in San Francisco was found to be 10.5% in 2004 (Robertson et al., 2004). The

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Centers for Disease Control and Prevention (2015) estimated that in 2013, 1.2 million people in the United States were living with HIV infection. Addressing the increased risk of HIV infection as well as the cost of infection for the homeless is a high priority for many city and state health departments. Research has shown that housing instability and homelessness contribute to HIV risk factors in multiple communities (Milloy, Marshall, Montaner, & Wood, 2012). Supportive housing for those who are homeless and living with HIV has been established as a successful intervention that can improve HIV treatment adherence, extend years of life lived, and improve the quality of life lived (Arno et al., 1996; Schwarcz et al., 2009; Wolitski et al., 2010). In a study conducted in San Francisco in 2008, researchers showed that supportive housing through the San Francisco Department of Public Health's Direct Access to Housing (DAH) program dramatically decreased the risk of death in people living with HIV (PLWH). That study used data from 1996 to 2006 to demonstrate that 76% of persons who were homeless at HIV diagnosis died within 5 years, compared to 7% of those who were housed in DAH ($p < .0001$; Schwarcz et al., 2009).

HIV infection and homelessness are critical public health issues that work synergistically to cause poor outcomes, yet the relationship is complex. Nationally, homelessness is not only associated with HIV but also with a wide array of other medical concerns, such as chronic disease, drug use, mental illness, and injuries (Baggett, O'Connell, Singer, & Rigotti, 2010; Substance Abuse and Mental Health Services Administration, 2011). Both a consequence of and a risk for lack of housing, many homeless persons in the United States suffer from co-occurring mental illness and substance dependence. Those who are homeless are more likely to be disabled and to suffer from one or more chronic medical problems, drug addiction, and/or mental health issues in addition to HIV. "Tri-morbidity," "co-occurring illnesses," and "triple diagnoses" refer to the concomitant presence of mental health, substance abuse, and chronic medical diagnoses (such as HIV) for an individual. One result of the burden of disease and triple diagnoses with HIV among those who are experiencing homelessness are increases in health care utilization (Arno et al., 1996; Kushel, Vittinghoff, & Haas, 2001; Masson, Sorensen, Phibbs, & Okin, 2004; Parker & Dykema, 2014; Thakarar, Morgan, Gaeta, Hohl, & Drainoni, 2015).

The public system of acute and emergency care is the safety net for people who are low income, unstably housed, and chronically homeless. This system of care is often overburdened by high utilization by a small proportion of the population, many of whom are homeless. Emergency department (ED) care in particular is often over-utilized, particularly for those who have co-occurring illnesses (Kushel et al., 2001; Parker & Dykema, 2014). Recent studies have demonstrated that the Housing First model of supportive housing for homeless adults effectively reduces the costs of health care to the system (Fitzpatrick-Lewis et al., 2011; Holtgrave et al., 2013; Wolitski et al., 2010).

HIV, Nursing, and Homelessness in San Francisco

In 2005, the Healthcare for the Homeless Clinician's Network published a report highlighting the role of nurses and nurse practitioners in caring for the homeless (Healthcare for the Homeless Clinicians' Network, 2005), and a recent survey of people experiencing homelessness or who were marginally housed showed that the use of primary care services was significantly associated with having contact with a community health nurse (Su, Khoshnood, & Forster, 2015). Other evidence has revealed a role for advanced practice nurses in delivering health care to people with mental illness, drug addiction, and chronic diseases (Archard & Murphy, 2015; Dahrouge et al., 2014; Fraino, 2015). While evidence exists that supportive housing is an effective intervention for those with dual mental health and substance abuse diagnoses, and that supportive housing can improve outcomes for PLWH, there are currently no studies on outcomes specific to on-site nursing care (OSNC) within supportive housing environments.

In San Francisco, the Department of Public Health uses local and federal funding to administer a housing program for homeless adults with medical problems, mental health disabilities, and/or substance dependence. The DAH program was founded in 1995,