

Housing Status, Medical Care, and Health Outcomes Among People Living With HIV/AIDS: A Systematic Review

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Background. Accumulating evidence suggests responses to HIV that combine individual-level interventions with those that address structural or contextual factors that influence risks and health outcomes of infection. Housing is such a factor. Housing occupies a strategic position as an intermediate structural factor, linking “upstream” economic, social, and cultural determinants to the more immediate physical and social environments in which everyday life is lived. The importance of housing status for HIV prevention and care has been recognized, but much of this attention has focused on homeless individuals as a special risk group. Analyses have less often addressed community housing availability and conditions as factors influencing population health or unstable, inadequate, or unaffordable housing as a situation or temporary state. A focus on individual-level characteristics associated with literal homelessness glosses over social, economic, and policy drivers operating largely outside any specific individual’s control that affect housing and residential environments and the health resources or risk exposures such contexts provide.

Objectives. We examined the available empirical evidence on the association between housing status (broadly defined), medical care, and health outcomes among people with HIV and analyzed results to inform future research, program development, and policy implementation.

Search methods. We searched 8 electronic health and social science databases from January 1, 1996, through March 31, 2014, using search terms related to housing, dwelling, and living arrangements and HIV and AIDS. We contacted experts for additional literature.

Selection criteria. We selected articles if they were quantitative analyses published in English, French, or Spanish that included at least 1 measure of housing status as an independent variable and at least 1 health status, health care, treatment adherence, or risk behavior outcome among people with HIV in high-income countries. We defined housing status to include consideration of material or social dimensions of housing adequacy, stability, and security of tenure.

Data collection and analysis. Two independent reviewers performed data extraction and quality appraisal. We used the Cochrane Risk of Bias Tool for randomized controlled trials and a modified version of the Newcastle Ottawa Quality Appraisal Tool for nonintervention studies. In our quality appraisal, we focused on issues of quality for observational studies: appropriate methods for determining exposure and measuring outcomes and methods to control confounding.

Results. Searches yielded 5528 references from which we included 152 studies, representing 139 757 HIV-positive participants. Most studies were conducted in the United States and Canada. Studies examined access and utilization of HIV medical care, adherence to antiretroviral medications, HIV clinical outcomes, other health outcomes, emergency department and inpatient utilization, and sex and drug risk behaviors. With rare exceptions, across studies in all domains, worse housing status was independently associated with worse outcomes, controlling for a range of individual patient and care system characteristics.

Conclusions. Lack of stable, secure, adequate housing is a significant barrier to consistent and appropriate HIV medical care, access and adherence to antiretroviral medications, sustained viral suppression, and risk of forward transmission. Studies that examined the history of homelessness or problematic housing years before outcome assessment were least likely to find negative outcomes, homelessness being a potentially modifiable contextual factor. Randomized controlled trials and observational studies indicate an independent effect of housing assistance on improved outcomes for formerly homeless or inadequately housed people with HIV. Housing challenges result from complex interactions between individual vulnerabilities and broader economic, political, and legal structural determinants of health. The broad structural processes sustaining social exclusion and inequality seem beyond the immediate reach of HIV interventions, but changing housing and residential environments is both possible and promising. (The full article is available online. *Am J Public Health*. 2016;106:95, e1–e23. doi:10.2105/AJPH.2015.302905)

PLAIN-LANGUAGE SUMMARY

We conducted a systematic review of the empirical evidence on the role of housing status for medical care and health outcomes among people with HIV infection. We searched 8 electronic databases and contacted experts for studies published through March 2014. We included quantitative studies with at least 1 measure of housing status as an independent variable and 1 health status, health care, treatment adherence, or risk behavior

outcome among people with HIV in high-income countries. We identified 152 studies: 2 randomized controlled trial housing interventions, 64 cohort or case-control studies, and 86 cross-sectional studies. Findings demonstrate that unstable or inadequate housing and homelessness are associated with differential utilization of HIV care, reduced treatment effectiveness, and HIV transmission risk behaviors, controlling for a range of individual and care system characteristics. Improved housing

appears to improve access and retention in care and clinical and other outcomes. Evidence supports considering housing status as a contextual factor that influences consistent, appropriate HIV medical care, adherent antiretroviral medications use, and sustained viral suppression. Interventions addressing housing needs potentially will improve health outcomes for people with HIV, reduce transmission, reduce HIV-related health disparities, and move us closer to ending AIDS.

As global, national, and local HIV responses evolve from emergency initiatives focused primarily on treatment access to longer-term strategies for chronic disease management, increasing attention is paid to structural and contextual factors that may affect treatment effectiveness. Accumulating evidence suggests the promise of multifaceted approaches to the HIV epidemic that combine individual-level interventions with those that address community and societal influences on risks for and health outcomes of infection.^{1–3}

A case in point is “test and treat”—a structural intervention to change policy and practice by increasing the availability and use of HIV testing and providing universal access to treatment for people diagnosed with HIV infection. This approach aims to improve the health and longevity of people with HIV and to reduce the potential for ongoing HIV transmission by reducing the level of the virus in the blood to an undetectable level.⁴ However, test and treat will work only if engagement in treatment is timely and sustained, with strict adherence to antiretroviral (ARV) medications over time.

Evidence suggests that this is not accomplished for most people with HIV, with substantial fall-off observed at each stage of the care continuum: diagnosis, linkage to care, retention in care, access to ARV therapy, adherence to treatment regimen, and viral suppression. For example, the US Centers for Disease Control and Prevention estimates that fewer than half of all persons with HIV in the United States are in medical care and that only 30% have an undetectable viral load, to the detriment of their own health and the promise for reduced transmission.^{5–7}

The HIV care continuum is useful for identifying opportunities to address contextual factors that pose barriers to sustained engagement in care and treatment success. Housing status is such a factor. Housing occupies a strategic position as an intermediate structural factor, linking upstream economic, social, and cultural determinants to the more immediate physical and social environments in which we carry out our day-to-day lives.^{8–10}

Housing comprises more than just physical shelter. Where we live is where our personal, social, and economic lives come together. People who lack stable, secure, adequate housing lack a protected space to maintain physical and psychological well-being—finding themselves consistently in stress-producing

environments with consequences for mental health and immunological functioning. The press of daily needs can be a barrier to the use of available services. Home structures the private sphere: the lack of stable housing is a barrier to forming and maintaining stable intimate partner relationships and networks of social support.

The importance of housing status and living conditions for HIV prevention and care has been the subject of a growing body of research. Much of this attention, however, has focused on “the homeless” as a special risk group. Less often, analyses have addressed community housing availability and conditions as a factor influencing population health or unstable, inadequate, or unaffordable housing as a situation or temporary state that people may experience.¹¹

Although it is important to understand and address the needs of people who are homeless, literal homelessness is merely the most extreme among a range of unstable and inadequate living arrangements that can compromise health.^{12–14} People who are homeless have higher rates of HIV than do people who are stably housed,^{15,16} but people who are HIV positive are also at increased risk for inadequate or unstable housing and housing loss.^{17–20} Poor health, loss of income, stigma, and policy restrictions on housing assistance for people with drug use or incarceration histories, as well as preexisting social disadvantage, make it difficult if not impossible for many people with HIV to secure or maintain adequate housing.¹⁰

The US Department of Housing and Urban Development Office of HIV/AIDS Housing recently reported that in the United States an estimated 145 366 people living with HIV (a number equal to 12% of all HIV-positive people in the United States) have a current unmet housing need; of these 44% needed ongoing assistance to pay rent, 36% sought

a supportive housing placement, and the remainder required short-term emergency assistance to secure or maintain housing.¹⁶ A focus on individual-level characteristics associated with literal homelessness and its health correlates glosses over social, economic, and policy drivers operating largely outside any individual’s control that affect housing and residential environments and the health resources or risk exposures such contexts provide.

We systematically examined the empirical evidence on the association between housing, medical care, and health outcomes among people with HIV, and we have presented results to inform future research, program development, and policy implementation.

METHODS

We searched 8 electronic databases (MEDLINE, PsycINFO, HealthSTAR, EMBASE, Sociological Abstracts, Social Science Abstracts, CINAHL, and the Cochrane Library) using the following set of search terms: (housing OR dwelling OR homeless OR homelessness OR living accommodation OR residence OR residential) AND (human immunodeficiency virus (HIV)) OR (acquired immune deficiency syndrome) OR (people with AIDS (PWA)) OR (people with HIV or AIDS (PWA)) OR (people living with AIDS (PLWA)) OR (people living with HIV or AIDS (PLWA)). We searched databases from January 1, 1996, through March 31, 2014, with no other search limits. We also searched a resource database developed for the North American Housing and HIV/AIDS Research Summit series,²¹ reviewed unpublished reports known to the study investigators, and contacted experts in the field to identify additional literature.

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Note. The findings and recommendations in this article are solely the responsibility of the authors and do not necessarily represent the official views of the Ontario HIV Treatment Network, Canadian Institutes of Health Research, or the US Department of Housing and Urban Development.

Study Selection

Two reviewers independently assessed all titles and abstracts we retrieved through the search strategy using a priori inclusion and exclusion criteria. We selected articles if they (1) included people with HIV in the sample, and (2) included at least 1 measure of housing status as an independent variable and at least 1 of the following outcomes as a dependent variable: health status, access to or utilization of health care, or risk behaviors. We included only studies of people living with HIV in high-income countries and excluded case studies, qualitative studies, and articles published in languages other than English, French, or Spanish.

Consistent with Leaver et al.,²² we broadly defined housing status to include consideration of material or social dimensions of housing adequacy, stability, and security of tenure. We included any measure of homelessness, unstable or stable housing, quality of housing, or affordability. We also broadly defined health-related outcomes, including HIV clinical health outcomes (CD4 count, viral load, mortality), other health outcomes (non-HIV conditions, physical and mental health functioning, quality of life), health care and treatment variables (access to treatment and care, health service utilization, adherence to treatment), and HIV sex and drug using behaviors.

We retrieved full-text articles that at least 1 reviewer classified as either include or unclear. Two reviewers then independently assessed each article using the same selection criteria. Any disagreements between reviewers were resolved by consensus and, if that failed, a third independent reviewer.

Data Extraction and Quality Appraisal

One reviewer completed data extraction from included articles and then another reviewer independently checked it. For each included study, we extracted study characteristics (e.g., study year and location), study aims or objective, methodological design, sample recruitment, sample characteristics, details about the independent (housing status) and dependent (health outcomes) variables, and key findings as they relate to housing status.

We conducted quality assessments (QAs) of each included study. For randomized

controlled trials (RCTs), we rated studies using the Cochrane Risk of Bias Tool, which classifies trials as having a low, unclear, or high risk of bias.^{23,24} We assessed the quality of nonintervention studies using a modified version of the Newcastle Ottawa Quality Assessment Tool²⁵ by adopting specifications used in previous reviews of housing-related studies that encompassed diverse study designs and extreme heterogeneity in conceptualization and measurement of housing status and outcomes.²² Our QA protocol focused on universal issues of quality in observational studies, including appropriate methods for measuring exposure and outcomes and methods to control confounding. We evaluated each study on these 3 domains, judging each study within each domain on a quality continuum with 3 levels (good, fair, poor).

We rated the approach to measure exposure in a study “good” if it used a clear and replicable definition of housing status that included reference to 1 or more defined component of housing (aspects of dwelling context, personal assets, or housing quality) and a time specifier (e.g., within the past 6 months). A rating of “good” for outcomes under investigation required objective measurement (e.g., record linkage, diagnosis made by clinician, laboratory finding) or use of validated self-reported measures. We developed a guide to rating measures for each outcome domain. We rated the method to control confounding (i.e., between cases and controls and exposed and not exposed study participants) “good” if the study used appropriate analytic methods with adjustment for confounding, including at least 1 indicator of socioeconomic status (e.g., income, income source, work status, education) and 1 behavioral health indicator (e.g., substance use, mental health symptoms).

Because poverty affects both access to stable housing and health outcomes among people with HIV, an analysis of the role of housing requires multivariate models that include socioeconomic indicators as potential confounders. Likewise, mental illness and substance abuse are known predictors of both homelessness and unstable housing and health outcomes. Detailed instructions for QA ratings as good, fair, or poor along with a listing of QA ratings for all included articles are available as a supplement to this article at <http://www.ajph.org>.

RESULTS

Our searches yielded 5528 references from which we included 152 studies. These consisted of 2 RCTs,^{26,27} 64 studies with a longitudinal design (55 prospective cohort studies,^{17,28–81} 6 retrospective cohort studies,^{82–87} 3 case-control studies^{88–90}), and 86 cross-sectional studies.^{91–175} The studies included 143 404 participants of whom 139 757 were HIV positive. Study sample sizes ranged from 20 to 28 817 (at baseline). Most studies ($n = 112$) were conducted in the United States, with the rest conducted in Canada ($n = 27$), France ($n = 7$), Spain ($n = 3$), and 1 each in Italy, Finland, and South Korea. Our study selection process is summarized in Figure 1.

Overall, findings from included studies show that worse housing (i.e., stability, structure, or quality of housing) is associated with poorer access to and engagement in health care and treatments, lower adherence to ARV therapy, worse health outcomes, and higher rates of HIV risk behaviors. Only 8 of 152 studies reviewed did not find that worse housing status was associated with poorer medical care or health outcomes.^{34,48,76,77,87,118,122,125} Not all associations were statistically significant; however, methodological considerations limit substantive interpretation of nonsignificant findings.

Relatively few studies (29%) were designed specifically to examine the role of housing status on outcomes, and many studies were underpowered to show statistical significance (e.g., Martin⁹²). The range of housing situations in some studies was restricted, comparing people with HIV who were literally homeless to those in unstable or inadequate housing, with no “good” housing comparison (e.g., Riley et al.³⁴). Studies that measured housing status at a single earlier point in time, substantially before outcome assessment, were limited by possible unmeasured crossover because people who were stably housed lost their housing and their formerly homeless counterparts may have gotten housing needs resolved (e.g., Anema et al.⁶⁴).

We assessed both RCTs as having a risk of bias because of lack of blinding. However, blinding was not possible because the intervention consisted of providing permanent housing assistance. We rated 41 studies (27%) “poor” on 1 or more of the 3 QA domains.

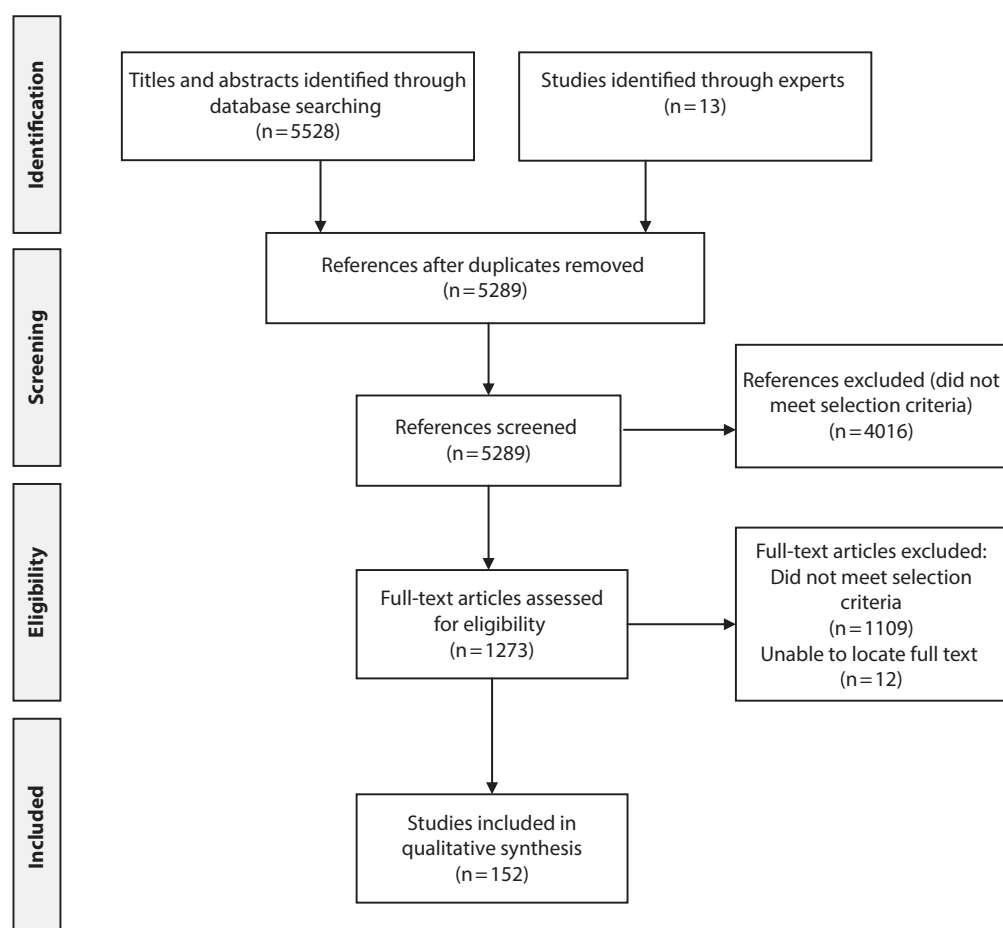


FIGURE 1—Flow Diagram Documenting Systematic Search Conducted to Identify Included Studies: 1996–2014

Studies received a “poor” rating primarily for undefined or ill-defined housing status and secondarily for lack of adjustment for confounders. We excluded all studies from further discussion that did not rate “good” or “fair” on all criteria; we have provided descriptive details for all included studies (Appendices 2 and 3, available as a supplement to this article at <http://www.ajph.org>). Table 1 summarizes the results of the 111 studies (2 RCTs, 50 cohort or case-control studies, 59 cross-sectional studies) that we gave a quality rating of “good” or “fair” on all QA domains.

We grouped studies according to 6 outcome domains (some studies examined more than 1 outcome domain):

1. HIV health care access and utilization (n = 35),
2. adherence to ARV treatment (n = 30),

3. HIV clinical health outcomes (n = 27),
4. other health outcomes (n = 27),
5. emergency department (ED) and inpatient use (n = 13), and
6. HIV risk behaviors (n = 22).

For each outcome domain, we have provided the proportion of studies that found poorer housing to be associated with poorer outcomes and the proportion of findings that are statistically significant in adjusted models. If any finding among multiple outcomes within the same domain was statistically significant, we classified the study as having a statistically significant association with a negative outcome in that domain area. For example, if the adjusted odds ratio (AOR) for viral load was statistically significant but the AOR for CD4 was not, we classified the study as showing a statistically significant

association between housing status and an HIV clinical health outcome. Table 1 summarizes the number of studies in each outcome domain by study design.

Table 2 provides a summary of the characteristics and findings from each of the studies with longitudinal design that we rated “good” or “fair” on all QA criteria. We have provided detailed information regarding study design, sample, measures, and outcomes for all 152 included studies (data available as a supplement to this article at <http://www.ajph.org>) organized by author within year of publication.

HIV Health Care Access and Utilization

Thirty-five studies examined housing status and HIV health care access or

TABLE 1—Association of Homeless, Unstable, or Inadequate Housing Status With Negative Outcomes Among People With HIV/AIDS: 1996–2014

	Study Design			Total Studies
	RCT Housing Interventions	Cohort or Case-Control Studies	Cross-Sectional Studies	
Health care access and utilization ^a				
Negative outcome ^b	1/1	9/11	23/23	35
Statistically significant ^c	0/1	9/11	20/23	29/35
% significant	0.0	81.8	87.0	82.9
Antiretroviral adherence ^d				
Negative outcome	0/1	10/11	18/18	30
Statistically significant	0/1	9/11	15/18	24/30
% significant	0.0	81.8	83.3	80.0
HIV clinical health outcomes ^e				
Negative outcome	2/2	13/15	9/10	27
Statistically significant	2/2	10/15	8/10	20/27
% significant	100.0	66.7	80.0	74.1
Other health outcomes ^f				
Negative outcome	1/1	8/8	17/18	27
Statistically significant	1/1	8/8	16/18	25/27
% significant	100.0	100.0	88.9	92.6
ED visit or inpatient stay ^g				
Negative outcome	1/1	7/7	5/5	13
Statistically significant	1/1	6/7	5/5	12/13
% significant	100.0	85.7	100.0	92.3
HIV risk behavior ^h				
Negative outcome	1/1	8/9	12/12	22
Statistically significant	0/1	8/9	10/12	18/22
% significant	0.0	88.9	83.3	81.8

Note. ED = emergency department; PWH = people with HIV or AIDS; RCT = randomized controlled trial. Articles were “good” or “fair” on all quality assessment ratings ($n = 111$); number of articles across outcome domains adds to more than the number of included studies because some addressed multiple outcomes.

^aRegular source of HIV care, number of visits for HIV care, care meets clinical practice standards.

^bWorse outcomes for homeless and unstably or inadequately housed PWH than for other PWH in studies that considered this outcome.

^cStatistically significant association of worse housing status with negative outcomes.

^dAdherence to antiretroviral medication regimen among those prescribed antiretroviral medication.

^eViral suppression, viral load, CD4 count, and mortality.

^fNon-HIV conditions, physical and mental health functioning, health quality of life.

^gED visit, hospital admission, inpatient days, for any reason.

^hSexual or drug use risk behaviors.

utilization: 1 RCT, 11 cohort or case-control studies, and 23 cross-sectional studies. Although indicators of appropriate care varied, considering timely entry into care, retention in care, number of HIV primary care visits, and ARV medication use, 29 of the studies reported statistically significant associations between unstable housing and not receiving appropriate HIV care. Along every step of the care

continuum, people with HIV who are homeless or have other housing needs are less likely to be engaged in care than are their counterparts without housing challenges.

Multiple studies on the basis of general samples of people with HIV^{17,29,46,49,71,100,148,175} as well as studies targeting substance using, recently incarcerated, or other socially marginalized

HIV-positive people^{38,42,44,72,103,110,149,152} found that poorer housing status was associated with lack of regular visits for HIV primary care. Conversely, several studies found that receipt of housing assistance or other services that improved housing was significantly associated with routine use of primary health care services.^{17,29,42,44,176} For example, a study of housing status, housing assistance, and medical care utilization among a large probability sample ($n = 1661$) of people living with HIV in New York City demonstrated a strong and consistent relationship between housing need and remaining outside HIV medical care.¹⁷

Overall, 70% of the sample had 1 or more episodes of housing need during the 12-year study period (1994–2006). In separate multivariate analyses, housing status (past 6 months) was among the strongest predictors of accessing HIV primary care, maintaining continuous care, receiving care that met clinical practice standards, and entry into HIV care among those outside the health care system. In addition, housing assistance increased access and retention in medical care and appropriate treatment. The relationship between housing status and medical care outcomes remained, controlling for client demographics, health status, insurance coverage, co-occurring mental illness, problem drug use, and the receipt of supportive services to address co-occurring conditions.

Access to ARV medications is a crucial component of HIV medical care. Unstable or inadequate housing is one of the most important factors limiting uptake of ARV medications, regardless of insurance or payer status or other health services considerations.^{37,46,52,103,117,142,161} In a multisite study of HIV-positive injecting drug users in primary care, those with stable housing had double the odds of ARV medication use than did those in care but without stable housing.⁵² In a large surveillance study, all individuals reported with AIDS to the San Francisco Department of Public Health between 1996 and 2001 were followed through 2006.

People who were homeless at AIDS diagnosis were significantly more likely to delay or never initiate ARV treatment; neighborhood socioeconomic characteristics affected ARV initiation but housing status was

TABLE 2—Characteristics of Longitudinal Studies With Health, Medical Care, Adherence, and Risk Behavior Outcomes: 1996–2014

Study and Location	Focus	Study Design and Sample	Housing Measures	Outcomes	Main Housing-Related Findings ^a
RCT housing interventions: multiple outcomes					
Wolitski et al. ²⁶ , Baltimore, MD; Chicago, IL; Los Angeles, CA	To assess the effects of permanent rental housing assistance on the health and risk behaviors of homeless and unstably housed PWH	RCT of housing intervention Convenience sample recruited by agencies providing housing assistance and social services to PWH	In past 90 d: homeless ≥ 1 nights: slept in shelter or places not suitable for human habitation; unstably housed: temporarily doubled up with others, lived in a transitional or transitory setting; stable housing: had own place, a room, apartment, or house that is your home	HIV clinical health Other health outcomes Medical care ED and inpatient use Risk behaviors	Improved housing status resulted in substantial reductions in medical care utilization and improvements in self-reported physical and mental health functioning; significant differential change benefiting the intervention group for mental health indicators Significant differences between homeless and stably housed participants found in as-treated analyses for ED use, mental health, and detectable viral load
Buchanan et al. ²⁹ , Chicago	To determine the health benefits of permanent supportive housing among homeless persons hospitalized with a chronic medical illness	RCT of housing intervention convenience sample from the inpatient medical and surgical service	Homeless: no source of stable housing (with no time limits, for which the person has adequate resources) at hospital discharge and during 30 d before admission	HIV clinical health	At 12 mo, intervention group significantly more likely to be alive with intact immunity, with significantly lower median viral loads
Longitudinal design: HIV health care access and utilization and ED and inpatient use					
Muthulingam et al. ⁷¹ , San Francisco, CA	To measure sociodemographic and risk disparities in timely linkage to care, retention in care, and viral suppression among persons with HIV	Prospective cohort study Surveillance data from San Francisco Department of Health	Housing status: homeless, not homeless, unknown at HIV diagnosis; homelessness noted on medical record or address was homeless shelter, a health clinic, or free postal address not connected to a residence	Unknown housing status at diagnosis associated with lower rates of linkage to care; homelessness and unknown housing status independent predictors of failure to achieve viral suppression 12 mo after diagnosis	
Weiser et al. ⁷² , San Francisco	To examine the association between food insecurity and health care utilization, hospitalizations, and ED visits, among homeless and marginally housed PWH	Prospective cohort study Probability sampling from homeless shelters, free food programs and SROs in 3 low-income neighborhoods	Homeless: slept on the street or in a homeless shelter in the past 90 d	ED and inpatient use	Homelessness significantly associated with hospitalization in the unadjusted model and significantly associated with ED use in both unadjusted and adjusted models
Fairbairn et al. ⁷⁵ , Vancouver, BC	To examine prevalence and correlates of ED use, ED diagnoses, and hospital admission rates among HIV-positive IDUs	Prospective cohort study Convenience sample recruited in a low-income central city neighborhood through word of mouth and street outreach	Unstable housing: SRO hotel, shelter, recovery or transition house, jail, on the street, or having no fixed address	ED and inpatient use	Living in unstable housing independently associated with higher cumulative incidence rate of ED use and shorter time to first ED visit during the study period

Continued

TABLE 2—Continued

Knowlton et al. ⁵² ; Baltimore; Miami, FL; New York City; San Francisco	To identify multilevel factors associated with HAART use among a community sample of active IDUs recruited from US urban epicenters	Prospective cohort study Convenience sample active and passive recruitment at AIDS service organizations, medical clinics, methadone clinics, homeless shelters, and street-based settings	Stable housing: self-report currently has a place to stay 5–7 d/wk	HIV medical care	Participants with stable housing had double the odds of HAART use than did those without stable housing
Arnold et al. ⁴⁶ ; San Francisco	To assess the role of neighborhood socioeconomic context on racial/ethnic disparities in ART initiation and AIDS survival	Prospective cohort study HIV surveillance data reported to San Francisco Department of Health 1996–2001 followed through 2006	Homeless: at the time of HIV diagnosis homelessness noted on medical record or address was homeless shelter, a health clinic, or free postal address not connected to a residence	HIV medical care HIV clinical health (mortality)	Homeless at time of AIDS diagnosis significantly associated with being uninsured; homelessness at diagnosis had an independent effect on delayed or no ART initiation, controlling for neighborhood socioeconomic context Homelessness associated with mortality within 30 d of AIDS diagnosis; excluding persons who died within 30 d, homeless at diagnosis not associated with 5-year survival
Gardner et al. ⁴⁹ ; Atlanta, GA; Baltimore; Los Angeles, Miami	To identify demographic, structural, behavioral, and psychological subgroups for whom intervention had differential effects in linking PWH to care	Pre-post intervention study of linkage to care intervention Convenience sample recruited from sexually transmitted disease clinics, hospitals, and community-based organizations	Unstable housing: on the street, in shelter, or other temporary housing, in an institution (treatment facility, halfway house, group home, hospital or nursing home); stable housing: in a house or apartment alone or with others	HIV medical care	PWH with unstable housing at baseline were less likely than were those with stable housing to link with HIV primary care In multivariate analysis of effect modification, intervention had a stronger effect on linkage to primary care for unstably housed participants than for stably housed
Aidala et al. ¹⁷ ; New York City	To examine housing and connection to care in a probability sample of PWH tracking housing status and medical care utilization over an extended period	Prospective cohort study Multistage probability sampling using sequential enrollment or list-based systematic random sampling of clients from a stratified sample of medical and social service agencies	Homeless: sleeping on the street, drop-in center, shelter, SRO, place not meant for sleeping Unstably housed: transitional housing, jail, treatment facility doubled up; stably housed: permanent housing in own house or apartment; housing assistance: receipt of rental or other direct housing assistance; housing need: homeless, unstably housed, need assistance to maintain housing	HIV medical care	PWH who are homeless, unstably housed, or with other housing needs significantly less likely to have received HIV medical care; receipt of housing assistance significantly increases the odds of visits for HIV care Analysis over time shows housing needs are associated with lack of continuity of HIV care; receipt of housing assistance predicts retention in care Among PWH unconnected to HIV care, those who have housing needs are half as likely to enter care within 12 mo; receipt of housing assistance predicts transition into care

Continued

TABLE 2—Continued

Nosyk et al. ⁸³ , Vancouver	To determine the effect of homelessness and neighborhood SES on hospitalization patterns and costs in patients with HIV and AIDS	Retrospective cohort study Recruitment method: convenience sample of hospitalized PWH patients residing in downtown Vancouver, Canada	Homeless: patients without a fixed address during ≥1 admissions within a particular calendar year; DTES: patients with a fixed address within the most impoverished neighborhood in a particular calendar year	ED and Inpatient Use	Homeless patients had more ED admissions; homeless males had longer length of hospital stay and homeless IDUs had more hospitalization than did PWH in high SES neighborhoods PWH residing in the low-SES neighborhood had more ED admissions, and males had longer length of hospital stay than did PWH living in high SES neighborhoods
Rumptz et al. ⁴² , 10 US urban centers	To examine factors associated with engaging socially marginalized PWH in primary care	Pre-post intervention study Convenience sample of participants in 10 urban interventions to improve primary care engagement; recruited via outreach and referral from service providers	Housing arrangements in previous 6 mo: own home or apartment, someone else's home, or temporary arrangement; unmet needs for housing; not otherwise defined	HIV medical care	PWH with unmet needs for housing less likely to improve engagement with HIV primary care in bivariate analysis Decrease in composite measure of unmet needs (including housing needs) significantly associated with improved engagement with care in multivariate models
Wilkinson et al. ⁴⁴ , Baltimore, Miami, New York City, San Francisco	To identify factors associated with medical care utilization by IDUs PWH participating in adherence and risk reduction intervention	Prospective cohort study Convenience sample using active and passive recruitment at AIDS service organizations, medical clinics, methadone clinics, and street-based settings	Stable housing: self-report has a place to stay 5–7 d/wk	HIV medical care ED and inpatient use	Obtaining or maintaining stable housing associated with using an outpatient setting rather than the ED as the usual source of care at 12-mo follow-up
Kim et al. ³⁷ , Boston, MA	To examine whether episodes of homelessness are independently associated with suboptimal medical utilization among problem alcohol users	Prospective cohort study Convenience sample of PWH with alcohol problems indicated by screener questionnaire or physician assessment, recruited from HIV primary care and specialty clinics	Homelessness Self-report of any night spent on the street or in a shelter in the past 6 mo	HIV medical care ED and inpatient use	No significant difference found in primary care visits between homeless and housed periods in longitudinal regression model Homelessness significantly associated with higher ED utilization rates and rates of inpatient hospitalization Length of time homeless associated with higher utilization of both ED and inpatient hospitalization
Kushel et al. ³⁸ , San Francisco	To determine if case management associated with acute medical care use and improved clinical outcomes in homeless and marginally housed PWH	Prospective cohort study Probability sampling from homeless shelters, free food programs and SROs in 3 low-income neighborhoods	Marginally housed: at least 90% of nights spent in a residential hotel or an apartment; homeless: <90% of nights spent in a residential hotel and ≥1 nights slept on the street or in a shelter, in the past 90 d	HIV medical care ED and inpatient use Adherence HIV clinical outcomes	Homelessness negatively associated with receipt of routine primary care in bivariate but not full-adjusted models No difference in the uniformly low rates of viral suppression among marginally housed and homeless participants

Continued

TABLE 2—Continued

Palepu et al. ³² , Boston	To examine the association of substance abuse treatment services with hospitalization among PWH with a history of alcohol problems	Prospective cohort study Convenience sample of PWH screening positive for alcohol problems; recruited from medical settings serving PWH, including respite care facility	Homeless: ≥ 1 nights on the street or in a shelter in the past 6 mo	HIV medical care ED and inpatient use	Rates of hospitalization higher among homeless PWH with alcohol problems Recent homelessness significantly increased odds of hospitalization in longitudinal analysis
Masson et al. ³⁰ , San Francisco	To examine factors affecting medical service use among PWH with substance abuse disorder	Prospective cohort study: pooled data from RCT case management intervention study Targeted and purposive recruitment from ED, inpatient wards, and outpatient detox clinic of a public hospital	Current living situation: homeless: living in a shelter, car or outdoors; institution: such as jail or hospital Room in a hotel or motel; halfway house or residential treatment; house or apartment of a friend or relative; house or apartment you rent or own	HIV medical care ED and inpatient use	Homelessness associated with significantly higher utilization of both ED and inpatient services among PWH with a substance abuse disorder
Messeri et al. ²⁵ , New York City	To examine the impact of nonmedical supportive services on engagement with HIV medical care	Prospective cohort study Multistage probability sampling using sequential enrollment or list-based systematic random sampling of clients from a stratified sample of medical and social service agencies	Housing need: self-report experienced housing problems or need for assistance with housing in past 6 mo; housing services: received help or assistance with housing in past 6 mo	HIV medical care	Housing services have a weak positive effect on entry into any medical care but none on entry into appropriate HIV care Individuals who receive housing services are more than twice as likely to retain appropriate medical care as those not receiving housing services
Longitudinal design: ART adherence					
Weiser et al. ⁶⁶ , San Francisco	To examine food insecurity and HIV outcomes in a longitudinal study of marginally housed PWH	Prospective cohort study Probability sampling from homeless shelters, free food programs, and SROs in 3 low-income neighborhoods	Homeless: sleeping on the street or in a shelter in the past 90 d	ART adherence HIV clinical health	Recent homelessness was associated with less than optimal adherence and having a detectable viral load
O'Neil et al. ¹³⁴ , BC	To determine factors associated with adherence among PWH receiving ART therapy	Prospective cohort study Convenience sample recruited through providers, community advertising, and referral	Unstable housing: living in a SRO hotel, shelter, hostel, treatment center or prison, or having no fixed address	ART adherence	PWH with optimal adherence more likely to be stably housed, but housing status not a significant predictor of ART adherence in adjusted models
Roux et al. ⁶⁷ , 17 outpatient hospital services in France	To investigate the relationship between initiating HCV treatment and ART adherence HIV and HCV coinfecting patients	Prospective cohort study Convenience sample of PWH recruited in outpatient hospital services delivering HIV and HCV care in France	Good housing conditions: participant answered "quite comfortable" or "very comfortable" vs "uncomfortable" or "very uncomfortable" housing conditions	ART adherence	Good housing conditions were associated with reduced risk of nonadherence to ART, regardless of treatment of HCV
Milloy et al. ⁵⁸ , Vancouver	To investigate the impact of homelessness on viral suppression among illicit drug users initiating ART in a setting with universal access to HIV care	Prospective cohort study HIV-positive illicit drug users recruited via outreach and snowball sampling from street and service settings in a disadvantaged urban neighborhood	Homelessness: living on the street with no fixed address at any time in the past 6 mo	ART adherence HIV clinical health	Homelessness independently associated with lower levels of ART adherence Homelessness significantly associated with lower likelihood of achieving viral suppression and with longer time to viral suppression after initiation of treatment

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TABLE 2—Continued

Palepu et al. ⁸⁵ ; Vancouver	To determine the longitudinal impact of homelessness on adherence to ART therapy	Retrospective cohort study Snowball sample of IDUs recruited through street outreach	Homelessness: living on the street or no fixed address in the past 6 mo	ART adherence	Homelessness significantly negatively associated with ART adherence
Kalichman et al. ⁵⁶ ; Atlanta	To examine the association of social, health, and poverty-related stressors on ART adherence in PWH with low literacy	Prospective cohort study Convenience sample recruited through service organizations, health care providers, and word of mouth	Housing poverty experience: worried about having a place to stay; poverty experiences: sum of poverty-related stressors, including housing poverty	ART adherence	Poverty experiences significantly associated with poorer ART adherence in a group with low adherence rates; being worried about a place to stay not significantly associated with ART adherence as independent predictor
Lima et al. ⁸⁴ ; BC	To determine the scale of regional migration and its association with ART adherence patterns over time	Retrospective cohort study Medical record review of all patients initiating ART therapy through regional HIV/AIDS treatment and medication distribution sites	Migration: cumulative number of residential address changes during course of HIV treatment	ART adherence	Migration was associated with nonadherence to ART; increase in number of address changes associated with greater odds of nonadherence
Kim et al. ⁴¹ ; Boston	To investigate predictors of discontinuing ART in PWH with alcohol problems	Prospective cohort study Convenience sample recruited from health care centers, homeless shelters, drug treatment programs, community advertisements, and a previous study of PWH and alcohol problems	Homelessness: any night spent in a shelter or on the street in the past 6 mo	ART adherence	Homelessness predicts discontinued ART therapy in the unadjusted analysis; not significant in fully adjusted models
Berg et al. ⁵³ ; New York City	To identify gender differences in social and behavioral factors, including drug or alcohol use associated with ART adherence	Prospective cohort study Convenience sample of current or former HIV-positive IDUs recruited from outpatient methadone-maintenance treatment program	Housing status: own apartment, other's apartment, or temporary housing (in a hotel, motel, shelter, temporarily with someone, or being without shelter) long-term housing: in current residence ≥ 3 y	ART adherence	Lack of long-term housing stability was significantly associated with worse ART adherence for both men and women
Spire et al. ⁵⁵ ; 47 locations in France	To analyze relationships between ART adherence and PWH characteristics and experiences before and after ART initiation	Prospective cohort study Convenience sample of PWH initiating an ART regimen 1997–1999, recruited from 47 clinical centers	Housing condition: self-report current housing unstable housing, stable but poor housing, or stable (adequate) housing	ART adherence	Both stably but poorly housed participants and unstably housed participants had higher risk of not adhering to ARTs than did PWH with stable, adequate housing
Longitudinal design: HIV clinical health outcomes					
Anema et al. ⁶⁴ ; BC	To assess the potential relationship between food insecurity and all-cause mortality among HIV-positive IDUs initiating ART in BC	Prospective cohort study Sample population of IDU, PWH initiating ART across BC 1998–2011	Unstable housing: living in a hotel, boarding house, group home, jail, on the street, or having no fixed address at the time of program entry	HIV clinical health (mortality)	No significant association between unstable housing at treatment program enrollment and all-cause mortality over median 133 y of follow-up
Fuster et al. ⁷⁹ ; Boston	To assess association between HCV infection and overall and liver-related death in PWH with alcohol problems	Prospective cohort study Convenience sample recruited at HIV clinics, hospitals, and homeless and drug treatment programs	Homeless: ≥ 1 nights in a shelter or on the street 6 mo before assessment period	HIV clinical health (mortality) Other health	Recent homelessness associated with HCV infections among PWH with alcohol problems; homelessness not associated with all-cause mortality

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TABLE 2—Continued

Meyer et al. ⁶⁰ ; 9-state multicenter study in US	To examine HIV treatment outcomes among PWH released from jail participating in care linkage intervention	Pre-post intervention study Convenience sample of PWH from 10 prisons taking part in intervention to transition from the jail to postrelease services	Homeless: self-report being homeless or sleeping in a shelter or public space 30 d before incarceration or 30 d before follow-up interview	HIV clinical health	Prejail homelessness inversely correlated with baseline viral load suppression; not significant in adjusted models; housing status not associated with viral load suppression at 6-mo postintervention follow-up
McMahon et al. ⁶⁹ ; Boston; Providence, RI	To investigate whether SES predicts mortality in HIV-positive persons in the era of HAART	Prospective cohort study Convenience sample recruited through advertisements, posters, presentations at HIV organizations, primary care clinics, and public media	Homeless: no fixed and regular nighttime residence, sleeping in a shelter, welfare hotel, boarding house, or place not normally used for sleeping	HIV clinical health (mortality)	Homelessness independently associated with increased risk of mortality controlling for HIV disease markers
Schwarz et al. ⁸⁹ ; San Francisco	To examine the effect of homelessness on the mortality of persons diagnosed with AIDS and measure the effect of receipt of supportive housing on AIDS survival	Case-control study Public health department records identifying AIDS-diagnosed adults and adolescents 1996–2006; persons who entered a supportive housing program at any point after AIDS diagnosis	Homeless: address recorded in AIDS registry as homeless, a known homeless shelter, a medical care clinic, or a free postal address not connected to a residence; receipt of supportive housing; entry into supportive housing program	HIV clinical health (mortality)	Homelessness significantly increased the risk of death within 5 y of AIDS diagnosis Homeless persons with AIDS who obtained supportive housing had significantly lower risk of death than did those who did not
Oppenheimer ⁵⁰ ; Austin, TX	To examine the effect of demographics, stress, coping strategies, and clinical medical support on HIV progression	Prospective cohort study Convenience sample of patients visiting a publicly funded HIV/AIDS treatment clinic	Housing status: currently having a home: renting or owning a home or staying with family or friends; vs not having a home (homeless)	HIV clinical health	Homelessness significantly negatively correlated with CD4 count over 15 mo Homelessness the only significant predictor of decrease in CD4 over time among patients with inconsistent clinic visits
Walley et al. ⁴⁵ ; Boston	To assess the impact of recent heavy alcohol use, heroin or cocaine use, and homelessness on short-term mortality in PWH with alcohol problems	Prospective cohort study Convenience sample recruited by multiple methods from service sites and community referral	Recent homelessness: ≥ 1 nights in an overnight shelter or on the street in the past 6 mo	HIV clinical health (mortality)	Over a 10-y period, recent homelessness significantly associated with increased risk of short-term mortality among PWH with current or past alcohol problems
Miller et al. ⁸² ; BC	To provide a profile of Aboriginal people initiating ART and their response to treatment	Retrospective cohort study Convenience sample identified through Medical records review of all patients initiating ART therapy through regional HIV treatment sites who completed a baseline survey	Unstable housing: living in a hotel, jail, boarding house, group home, on the street, or having no fixed address at time of ART initiation	HIV clinical health	PWH with unstable housing at baseline were less likely to achieve viral suppression

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TABLE 2—Continued

Riley et al. ³⁴ ; San Francisco	To estimate mortality rates and examine the effect of sustained treatment exposure on survival rates of homeless or marginally housed PWH	Prospective cohort study Probability sampling from homeless shelters, free food programs, and SROs in 3 low-income neighborhoods	Currently homeless: spend most nights on the street or in a shelter; lifetime homeless experience: homeless > 1 y as an adult	HIV clinical health (mortality)	There were no differences in risk of death within 6 y between those who were homeless at baseline and the unstably housed; lifetime homeless experience was not associated with increased mortality risk Sustained ART treatment significantly reduced the risk of death regardless of recent or lifetime homeless experience
Lieb et al. ⁹⁰ ; 4 Florida cities	To evaluate modifiable factors associated with HIV/AIDS mortality in a nonresearch setting	Case-control study Statewide HIV/AIDS reporting system and medical records used to identify all PWH treated at 4 health clinics who died during 1999, and control participants randomly selected from other PWH seen at the clinics	Housing status; medical record indicates homelessness on the basis of description of living situation during the 1-y period before last clinic visit	HIV clinical health (mortality)	Recent homelessness an independent predictor of mortality among PWH In multivariate model with treatment variables and behavioral factors related to treatment, homelessness increased risk of mortality almost 10-fold
Longitudinal design: other health outcomes					
Rourke et al. ⁵⁹ ; ON	To examine the relationship between material, meaningful, and spatial dimensions of housing and health-related quality of life among adult PWH	Prospective cohort study Stratified purposive recruitment through community-based AIDS service organizations, including efforts to locate and recruit PWH not in services	Homelessness: emergency shelter, living in a car, on the streets, or couch surfing; inadequate housing: motel, hotel, or boarding house	Other health outcomes: Physical and mental health functioning; quality of life	Baseline housing and neighborhood variables associated with physical and mental health quality of life Difficulty paying housing costs associated with worse mental health over time Satisfaction with housing associated with improved mental health score
Riley et al. ⁵⁷ ; San Francisco	To identify and empirically rank factors that longitudinally affect the physical and mental health status of HIV-positive homeless and unstably housed women	Prospective cohort study Probability time and location sampling by a mobile outreach team at homeless shelters, free food programs, and low-income hotels	In prior 90 d: homeless: slept on the street or in shelter; unstably housed: slept in SRO hotel or other marginal housing; unmet subsistence needs: composite measure includes difficulty with a place to sleep	Other health outcomes: Physical and mental health functioning; gynecological symptoms	Homelessness significantly associated with worse mental health functioning Unmet subsistence needs had the strongest effect on mental health, gynecologic symptoms, and overall physical health functioning in adjusted models
Popovich et al. ⁸⁸ ; Chicago	To assess population-level incidence of HIV+ patients with community-associated methicillin-resistant CA-MRSA	Case-control study Identification of cases and controls using electronic data from all patients receiving medical care in a multicenter regional safety net hospital and ambulatory care system	Alternative housing: Current residence in subsidized housing, shelters, or substance abuse centers	Other health outcomes: CA-MRSA	Residence in alternative housing (shelters) independently associated with increased risk of CA-MRSA among PWH

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TABLE 2—Continued

Chin et al. ⁴⁷ , New York City	To examine the impact of substance use status, ART treatment status, and housing stability on physical and mental health–related quality of life	Prospective cohort study Sequential enrollment of participants in social service intervention programs over a 5-y period	Unstably housed: homeless, living in a residential or SRO hotel, shelter, or emergency housing Stably housed: rent or own an apartment or home, live with family or friends, or reside in HIV housing	Other health outcomes: Physical and mental health functioning; quality of life	Consistently unstable housing or change from stable to unstable housing associated with lower quality of life scores Change in housing status from unstable to stable housing associated with improved physical and mental quality of life scores but not statistically significant in full adjusted models
Mrus et al. ³⁹ , Cincinnati, OH; Pittsburgh, PA; Washington, DC	To compare health-related quality of life and predictors of quality of life among PWH receiving care in VA settings and non-VA settings	Prospective cohort study Convenience sample of patients visiting HIV outpatient clinics at 4 sites in 3 cities	Unstable housing: self-report housing situation as “transient and live in shelter” or “homeless” among other housing options	Other health outcomes: Quality of life	Stable housing significantly associated with better self-reported health status at baseline and with indicators of better health quality of life in longitudinal analysis
Hall et al. ⁵⁴ , San Francisco	To investigate HCV prevalence, incidence, and treatment in an HIV-positive cohort of the urban poor	Prospective cohort study Probability sampling from homeless shelters, free food programs and SROs in 3 low-income neighborhoods	Recently homeless: spent a night on the street or in a shelter in the past 30 d; lifetime homeless experience: total time homeless > 1 y	Other health outcomes: HCV	Lifetime homeless experience significantly associated with baseline HCV-positive status Lifetime or recent homeless experience not associated with incident HCV infection during follow-up period
Longitudinal studies: HIV risk behaviors					
Cox et al. ⁶³ , Canada	To examine the occurrence of drug use cessation and its correlates in a Canadian cohort of HIV–HCV coinfecting drug users	Prospective cohort study Convenience sample of HIV–HCV coinfecting IDUs or crack users, recruited from existing clinic populations	Unstable housing: not having a fixed address (a personal address where mail can be delivered)	Risk behaviors Drug use	Cessation of drug use was significantly more likely among participants with a fixed address
Krishnan et al. ⁶¹ , CT, GA, IL, MA, NY, OH, PA, RI, SC	To examine substance abuse outcomes among a large cohort of HIV-infected jail detainees after release	Pre-post intervention study Convenience sample of PWH from 10 prisons taking part in intervention to transition from the jail to postrelease services	Homeless: self-report being homeless or sleeping in a shelter or public space 30 d before incarceration; or 30 d before follow-up interview	Risk behaviors Drug use	PWH who were homeless 30 d before incarceration were significantly more likely to use cocaine after release than were participants housed before incarceration PWH homeless at 6-mo follow-up were significantly more likely to use cocaine and opioids than were those stably housed
Vijayaraghavan et al. ⁶⁵ , San Francisco	To examine rates of and factors associated with opioid analgesic misuse in a community-sampled cohort of indigent adult PWH	Prospective cohort study Probability sampling from homeless shelters, free food programs and SROs in 3 low-income neighborhoods	Currently homeless: sleeping on the street or in a shelter in the past 90 d	Risk behaviors Drug use	In multivariate analysis, current homelessness was associated with opioid misuse

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TABLE 2—Continued

Zelenov et al. ⁸⁰ , CT, GA, IL, MA, NY, OH, PA, SC, RI	To examine correlates of homelessness and housing transitions and effect of housing status on HIV treatment outcomes	Pre-post intervention study Convenience sample of PWH from 10 prisons taking part in intervention to transition from the jail setting to postrelease services	Homeless: self-report being homeless or sleeping in a shelter or public space 30 d before incarceration or 30 d before follow-up interview Risk behaviors Drug use Other health Health QOL HIV clinical health	Homelessness after incarceration was associated with higher odds of heroin, cocaine, and alcohol use and higher drug use and alcohol severity Homelessness after incarceration was associated with higher odds of depression and psychiatric severity and lower odds of physical and mental health quality of life PWH homeless at baseline less likely to have HIV provider, be on ART, or be adherent; individuals who were homeless at 6-mo follow-up had lower probability of being viral suppressed
Shannon et al. ⁷⁶ , Vancouver	Longitudinal examination of the impact of severe food insecurity on sexual risk taking among HIV-positive IDUs both on and not on HAART	Prospective cohort study Convenience sample of PWH recruited through snowball sampling and extensive street outreach methods in the city's DTES (the drug use and HIV epicenter)	Homeless: living primarily on the streets or staying in SROs Risk behaviors Sex behavior	Homelessness was not a significant predictor of unprotected sex Homelessness was not a significant predictor of unprotected sex
Aidala et al. ³⁵ , New York City	To examine overtime patterns of sexual behavior and sexual risk among a large, representative cohort of HIV-positive adults	Prospective cohort study Multistage probability sampling using sequential enrollment or list-based systematic random sampling of clients from a stratified sample of medical and social service agencies	Homeless: sleeping on the street, drop-in center, or shelter, SRO, place not intended for sleeping Unstably housed: transitional housing, jail, treatment facility with no other place to live, temporarily doubled up in someone else's home Own place and stably housed: permanent housing in an apartment, house, or congregate setting Risk behaviors Sex behavior	Recent homelessness was associated with unprotected sex with HIV-negative or status unknown partner among men sexually active with women in unadjusted but not adjusted models Recent homelessness was associated with unprotected sex among sexually active women in both unadjusted and adjusted models Women who experienced recent homelessness were significantly more likely to exchange sex for money or drugs in both unadjusted and adjusted models

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TABLE 2—Continued

Aidala et al. ³⁶ ; New York City	To examine sexual relationships and sexual behaviors among HIV-positive men sexually active with women and racial/ethnic differences in sexual behavior and sexual risk	Prospective cohort study Multistage probability sampling using sequential enrollment or list-based systematic random sampling of clients from a stratified sample of medical and social service agencies	Homeless: sleeping on the street, drop-in center or shelter, SRO, place not intended for sleeping Unstably housed: transitional housing, jail, halfway house, treatment facility, doubled up in someone else's home; own place and stably housed: permanent housing in an apartment, house, or congregate setting	Risk behaviors Sex behavior	In analyses over time, recent homelessness was associated with unprotected sex with an HIV-negative or status unknown woman partner among the total sample and among the subsample of African American men
Aidala et al. ³¹ ; 18 primarily urban US service areas	To examine HIV drug and sex risk behaviors among PWH with no or inadequate housing compared with PWH with stable housing; to examine change in risk behavior associated with change in housing status	Prospective cohort-pooled data from multisite intervention study Sequential enrollment at first visit for medical or social services during study period	Homeless: sleeping on the street, place not intended for sleeping, shelter, SRO; unstably housed: in a temporary housing, jail, drug treatment with no other address, doubled up with others; improved housing status: change from homeless to unstably housed or stably housed, or from unstably housed to stably housed; worse housing status: change from stably housed to unstably housed or homeless, or from unstably housed to homeless	Risk behaviors Drug and sex behavior	Recent drug use, needle use, or sex exchange at baseline higher among homeless and unstably housed PWH than among PWH with stable housing PWH whose housing status improved between baseline and follow-up significantly reduced drug use, needle use, needle sharing, and unprotected sex; PWH whose housing status worsened were more likely to engage in sex exchange In both cross-sectional and longitudinal analyses, homeless PWH had higher rates of risk behavior than did unstably housed PWH and both had higher rates of risk behaviors than did stably housed PWH
Palepu et al. ³³ ; Boston	To examine the association of substance abuse treatment with sexual and drug use risk behaviors among PWH with a history of alcohol problems	Prospective cohort study Convenience sample of PWH screening positive for alcohol problems; recruited from primarily medical settings serving PWH including a respite care facility	Homeless: ≥ 1 nights on the street or in a shelter in the past 6 mo	Risk behaviors Drug and sex behavior	At baseline, homeless PWH with alcohol problems had higher drug risk scores than did those with no recent homelessness experience; sexual risk scores were similar In overtime models, homeless status was associated with higher drug risk scores, regardless of receipt of alcohol or drug treatment

Note. ART = antiretroviral treatment; CA-MRSA = community-associated methicillin-resistant *Staphylococcus aureus*; DTES = Downtown Eastside; ED = emergency department; HAART = highly active ART; IDU = injection drug user; PWH = people with HIV or AIDS; QOL = quality of life; RCT = randomized controlled trial; SES = socioeconomic status; SRO = single-room occupancy; VA = Veterans Affairs.

independently associated with ARV medication use, controlling for disadvantaged neighborhood context.⁴⁶ Numerous studies from a multisite initiative in the United States designed to enhance links to HIV primary care in jail settings and after release found that homelessness or precarious housing before and after incarceration was associated with not having a regular HIV provider or not being on ARV medications.^{103,110,111}

Adherence to Antiretroviral Therapy

Adherence to the ARV medication regimen is crucial for the health of people with HIV. Thirty articles examined housing status and ARV adherence. Of these, 24 reported significantly lower adherence among those who were homeless or unstably housed. The association between unstable housing and poor adherence has been documented in the United States and other countries since the early days of ARV therapy. For example, unstable housing and stable but poor housing conditions were the strongest predictors of nonadherence in a 1997 study of HIV-positive patients receiving care from 47 specialized HIV clinics in France (AOR = 2.70; 95% confidence interval [CI] = 1.20, 6.08; and AOR = 1.71; 95% CI = 1.01, 2.92, respectively).⁵⁵ More recently, homelessness (sleeping in a shelter or on the street in the past 90 days vs maintaining residence in other temporary or marginal housing arrangements) was associated with ARV nonadherence in a community-recruited cohort of people living with HIV in San Francisco followed from 2007 to 2010 (AOR = 1.55; 95% CI = 1.04, 2.32).⁷¹ Numerous studies in Canada have found similar patterns.^{13,58,84,85,102}

HIV-Related Clinical Health Outcomes

A total of 27 articles rated “fair” or “good” on all QA domains examined HIV-related clinical health outcomes (e.g., CD4 count, viral load, HIV-related symptoms, opportunistic infections, mortality). Of those, 20 found that worse housing status was associated with worse health outcomes for people with HIV. Both of the RCT housing interventions and 13 of 15 longitudinal studies reported significantly worse HIV-related clinical health outcomes

among people with HIV who were homeless or unstably or inadequately housed than among comparable study participants with safe, secure, appropriate housing.

Six prospective cohort studies^{34,45,46,64,69,79} and 2 case-control studies^{89,90} examined mortality. Five of these studies found homelessness to be associated with an increased risk of premature mortality. One study compared the differential mortality risk of people with HIV who were homeless at baseline (on the streets or in a shelter) with those who were unstably housed but not literally homeless at baseline and found that mortality rates were high among both subsamples.³⁴ Studies that examined housing status as a time-varying variable found the strongest associations between housing status and mortality risk. An early study by Lieb et al.⁹⁰ found that homelessness during the 12 months before last clinic visit increased the risk of mortality almost 10-fold (hazard ratio [HR] = 9.98; 95% CI = 2.34, 42.5) in a multivariate model controlling for demographics, behavioral health, CD4, and HIV treatment variables. Walley et al.⁴⁵ found that recent (past 6 months) homelessness was independently associated with higher risk of mortality among HIV-positive adults with current or past problem alcohol use (HR = 2.92; 95% CI = 1.32, 6.44), controlling for a range of other time-varying or baseline variables.

A study examining the effect of homelessness and housing assistance on mortality used an HIV surveillance registry to identify homeless and housed people diagnosed with AIDS between 1996 and 2006 matched with a housing database of homeless people who received supportive housing after their AIDS diagnosis. Homelessness at AIDS diagnosis significantly increased the risk of death over a 5-year period (adjusted hazard ratio [AHR] = 1.20; 95% CI = 1.03, 1.41).⁸⁹ However, formerly homeless people with AIDS who obtained supportive housing had a lower risk of death than those who did not (AHR = 0.20; 95% CI = 0.05, 0.81).

Seventeen studies examined plasma viral load, CD4 counts, or other clinical markers of HIV disease progression. An RCT in the United States examining access to immediate rental assistance versus standard care for 630 formerly homeless or unstably housed people with HIV found no differences in detectable viral load or CD4 T-cell count below 200 after

18 months; however, substantial crossover limited power in the intent-to-treat analyses. Using an as-treated analysis, the authors found that participants who continued to experience homelessness during follow-up had 2.5 times the odds of having a detectable viral load, compared with those with no homeless experience.²⁶ The other RCT included in our review provided immediate housing and intensive case management to people with HIV who were homeless at hospital discharge. At 12 months, median viral loads were significantly lower in the intervention group and a greater proportion of intervention group members reached the primary endpoint of survival with intact immunity (CD4 T-cell ≥ 200 and viral load $< 100,000$).²⁷

Homelessness or unstable or inadequate housing was linked to higher viral loads and failure to attain or sustain viral suppression or low or declining CD4 count in 15 of 17 prospective cohort or cross-sectional studies.^{38,50,58,60,66,71,82,92,99,102,114,129,137,150,161} In a large surveillance survey conducted in 19 geographic areas in the United States, people with HIV who were homeless had significantly lower odds of viral suppression than did those who were housed; and housing status remained a significant predictor of most recent viral load, controlling for demographic, socioeconomic status, and drug and alcohol use variables (AOR = 0.69; 95% CI = 0.48, 0.99).¹⁶¹

In a prospective cohort study of community-recruited injection drug users in Vancouver, Canada, recent (past 6 months) homelessness was inversely and significantly associated with time to viral suppression (HR = 0.56; 95% CI = 0.40, 0.78) and was independently associated with lower likelihood of achieving viral suppression following initiation of treatment, adjusting for a range of covariates including year of ARV initiation and baseline viral load (AHR = 0.60; CI = 0.43, 0.84).⁵⁸ Studies in the Canadian context with universal access to health care highlight the effect of housing status on HIV health outcomes independent of insurance or payment barriers.^{58,102}

Other Health Outcomes

Twenty-seven articles looked at other health outcomes, of which 25 reported that homelessness or unstable or inadequate housing was associated

with significantly poorer outcomes on 1 or more indicators of physical or mental health functioning and quality of life,^{39,47,57,59,80,92,146,161,167} mental health symptoms or diagnoses,^{26,102,147,156,157,161} or diagnosed physical health comorbidities such as hepatitis C and tuberculosis.^{43,54,88,106,144,159,161} All but 1 of 10 studies that examined health-related quality of life using the Medical Outcomes Study SF-36^{177,178} or similar standardized instruments reported strong associations between worse housing and worse health-related quality of life.^{39,47,57,59,80,92,147,161}

Rourke et al.⁵⁹ conducted the most comprehensive examination of multiple dimensions of housing and quality of life. The study examined associations between material (adequacy of space, light, heating, etc.), meaningful (identification, satisfaction, and pride in home), and spatial (features of neighborhood, including proximity to services) dimensions of housing and health-related quality of life among 502 people with HIV living in Toronto, Canada, and demonstrated the influence of different housing dimensions on both physical and mental health-related quality of life in cross-sectional and longitudinal analyses, controlling for a wide range of covariates.

A community-based research study of homeless or marginally housed people with HIV in San Francisco examined physical and mental health functioning among HIV-positive adults. Unmet subsistence needs (indicated by reported difficulty gaining access to housing, a place to sleep, a bathroom, or sufficient food or clothing) had the largest effect on changes in Medical Outcomes Study SF-36 mental health scores among women, and any experience sleeping on the streets in the past 90 days further reduced mental health functioning scores.⁵⁷

All studies that examined the association between housing status and hepatitis C found that homelessness or unstable housing was associated with elevated rates of HCV infection in both US^{43,54,161} and Canadian^{106,144} contexts.

Emergency Department Visits and Inpatient Hospital Stays

ED and hospital inpatient visits are often a marker for poor chronic care

management as well as a matter of concern regarding inefficient treatment and unnecessary medical care costs. Twelve of 13 “good” or “fair” rated studies examining acute care services found that people with HIV in unstable living arrangements or who were homeless had higher utilization of hospital-based ED or inpatient care than did people with HIV who were stably housed. Findings were consistent regardless of study design and whether a study focused on specific at-risk populations (impoverished, alcohol or drug abusing, injection drug user)^{30,32,38,44,72,75,120} or a general sample using comprehensive surveillance or insurance data systems (Medicaid, Veterans Administration).^{148,161,175}

Masson et al.³⁰ examined factors affecting service use over a 2-year period among a sample of people diagnosed with HIV and substance use disorder. People with homeless experience had 92% more ED visits and 113% more inpatient admissions than did those with no homeless experience. Several studies compared acute care use among people with HIV who were literally homeless with those in marginal housing situations and found what appears to be a dose effect; that is, HIV-positive individuals who were literally homeless had more acute care use than did those who were unstably or inadequately housed but not literally homeless.^{38,72,120}

In a probability sample of homeless and marginally housed people with HIV recruited from shelters, free food programs, and single-room occupancy hotels, any nights homeless on the street in the past 90 days was one of the strongest predictors of acute care use in multiple logistic regression (AOR = 4.21; 95% CI = 1.08, 16.41).¹²⁰ Among formerly homeless or unstably housed participants in a housing intervention, in as-treated analysis, literal homelessness (1 or more nights homeless in the past 6 months) was significantly associated with receiving care in an ED.²⁶

HIV Risk Behaviors

Eighteen of 22 included articles examining housing and sex or drug risk behaviors among people with HIV found statistically significant associations between housing need (homelessness or unstable or inadequate housing) and risk behaviors for forward transmission of infection. Sexual risk behaviors examined

included number of partners, sex with status unknown or HIV-negative partners, condomless sex, and exchanging sex for money, drugs, or a place to stay. Problem drinking and any illicit drug use as well as injection drug use behaviors were considered drug-related risk behaviors because substance use may reduce users' inhibitions to engage in risky sexual practices.^{179,180}

A collaborative study designed to examine the relationship between housing and drug and sexual risk behaviors among people with HIV used pooled data from more than 2000 clients receiving services at 16 programs participating in a national multisite service integration project.³¹ In separate adjusted models, the odds of recent drug use, needle use or sex exchange at the baseline interview were 2 to 4 times as high among unstably housed HIV-positive clients as among those with stable housing. Follow-up data collected 6 to 9 months after baseline showed that change in housing status was associated with change in risk behaviors. People whose housing status improved between baseline and follow-up significantly reduced their risks of drug use, needle use, needle sharing, and unprotected sex by half compared with individuals whose housing status did not change.³¹ For clients whose housing status worsened between baseline and follow-up, odds of recently exchanging sex were more than 5 times as high than for clients whose housing status did not change.³¹ Homelessness, unstable housing, or housing loss was also associated with an increased risk of problem alcohol or drug use or relapse among former users.^{33,96,98,161,164,170,172}

A large-scale US behavioral survey of 8000 adults recently diagnosed with HIV documented the relationship between drug use and risky sex behaviors among those who were homeless.¹⁷⁰ Homeless people living with HIV had higher rates of both drug use and risky sexual behaviors than did those who were housed. Homeless respondents who were sexually active reported a greater number of sexual partners in the past 12 months, were more likely to exchange sex for money or drugs, and were nearly twice as likely to engage in unprotected anal or vaginal sex with an unknown status partner. Sexual risk results remained significant after controlling for alcohol and drug use and other potentially confounding factors.

Other studies have shown that homelessness or unstable or inadequate housing is associated with higher rates or greater frequency of risky sex among women, men sexually active with women,^{35,36} and men who have sex with men.^{94,104} A recent retrospective, cross-sectional analysis of clinical cohort data examined patterns of high-risk sexual behavior, detectable viral load, and antiretroviral resistance to identify factors associated with the potential transmission of drug-resistant HIV.¹¹⁴ People with HIV who experienced homelessness after their HIV diagnosis had relatively high rates of unprotected sex and were significantly more likely to have ARV-resistant HIV mutations (71%) than were patients with no homeless experience ($P < .01$). Homelessness was associated with a greater risk of transmitting drug-resistant HIV because of the rates of unprotected sex, detectable viral load, and drug-resistant HIV (adjusted prevalence ratio [APR] = 2.20; 95% CI = 1.16, 4.18).

DISCUSSION

We found strong evidence that the lack of stable, secure, adequate housing is a significant barrier to consistent and appropriate HIV medical care, HIV medical access, and adherence to ARV treatment; sustained viral suppression; and reduction of HIV risk behaviors. Although specific indicators of housing status vary across studies, “worse” housing status is associated with less than optimal engagement and utilization of HIV medical care or poorer health outcomes, controlling for a range of individual patient and care system characteristics.

Studies that considered outcomes associated with a history of homelessness or problematic housing some years earlier (e.g., homeless or unstably housed at HIV diagnosis or cohort enrollment) were least likely to find associations between housing status and medical care or health or HIV risk behavior outcomes. Such a lack of association is consistent with understanding homelessness or inadequate housing as a structural or contextual factor affecting HIV-related outcomes—a temporary situation or state that people may pass through, rather than a trait or fixed characteristic of a person. Evidence from 2 RCTs supports a large body of evidence from observational cohort studies that receiving housing

assistance or other services that improve housing status has an independent, direct impact on improved medical care and health outcomes for formerly homeless or unstably or inadequately housed people with HIV.

There has been both an increase in quantity and improved quality of studies published since the first systematic review of the literature on housing and HIV published in 2007.²² However, some methodological challenges remain. There continues to be a lack of consistency with regard to specific indicators of housing status that limits comparisons across studies. The great majority of included studies (78%) used a dichotomized indicator of housing status—most often “homeless” versus “not homeless”—which limits examination of possible differences in outcomes associated with different material, social, emotional, and moral dimensions of housing status.^{10,59,181}

People with HIV who are literally homeless tend to, but do not always, have worse outcomes than do those who experience other housing challenges. For example, staying in a shelter for homeless persons provides an organizational setting where services (meals, case management, medical care) can be provided; transient couch surfing—temporarily doubling up with different people—may avoid literal homelessness but is associated with its own stresses, vulnerabilities, and service needs that are often hidden from the purview of service providers.

None of the studies we reviewed included empirical investigation of possible pathways or mechanisms by which housing or lack of housing may affect health for people with HIV. Few studies used probability sampling approaches that followed individuals over time as they might move into and out of different housing situations. There is a decided lack of well-designed housing intervention studies—interventions to address lack of stable and adequate housing or to prevent housing loss. With the exception of 2 RCTs that provided housing assistance along with supportive services,^{26,27} interventions among included studies that were designed to improve outcomes for homeless people living with HIV evaluated services such as adherence or risk reduction counseling or patient navigation without directly addressing housing needs. Research is needed to better understand different dimensions of housing that may be protective or problematic with regard to optimal outcomes for people with HIV. Research is

also needed to examine different models and levels of housing assistance, to inform the development of housing interventions.

Strengths and Limitations

This systematic review has several strengths. The methods we used are robust with regard to search strategies for identifying studies. The process for determining eligibility and quality appraisal followed an a priori protocol. Two independent reviewers quality appraised all the identified studies. The details from the 152 eligible studies are available as a supplement to this article at <http://www.ajph.org>. Because of the lack of a standard definition of housing status, details of the definition of housing status have been included for each study.

There are also some limitations. We included only studies based in high-income countries. Gray literature searches were limited; thus we may have missed some potentially relevant studies grounded on empirical research reports but not formally published. Because of the number of eligible articles, we limited discussion of specific studies to a few examples within each outcome domain.

Implications

We found strong evidence demonstrating that homelessness and unstable or inadequate housing are inconsistent with the sound medical management of HIV. Thus, interventions meeting the housing needs of people with HIV can significantly improve their connection to HIV care, adherence to treatment, and health outcomes. Sustained engagement in HIV care and adherent ARV medication use are also essential to realizing the prevention benefits of treatment. Theoretical decreases in HIV incidence from expanded ARV treatment access must be viewed with caution because of the contextual and behavioral factors that present barriers to long-term effectiveness in real-world settings.^{5,182,183}

Our results support the position of the National HIV/AIDS Strategy for the United States¹⁸⁴ and Ontario's HIV/AIDS Strategy to 2025¹⁸⁵ and the recommendations of the International Association of Physicians in AIDS Care,¹⁸⁶ which stress the importance of addressing the housing needs of people living with HIV as a necessary component in efforts to achieve individual- and population-level medical care, health, and prevention goals,

including reducing disparities. As the Ontario strategy notes, we can stop new infections and reduce HIV-related illness only when we focus on both the health of people with HIV and the broader structural factors driving the epidemic, including socioeconomic inequities, multiple forms of discrimination and oppression, the lack of adequate housing, and other basic human needs.¹⁸⁵

Housing interventions for homeless and unstably housed persons with HIV and other chronic illness are also receiving growing attention as a potential health care cost containment strategy. Although outside the scope of our analysis, separately published reports from both RCTs included in our review found that public spending on the examined housing interventions for people with HIV was cost-effective or even cost-saving after taking into account associated reductions in avoidable health care and averted HIV infections.^{187,188} Both interventions employed “housing first” approaches, placing formerly homeless or unstably housed persons directly in permanent housing with access to support services, regardless of earlier housing history or co-occurring behavioral health issues.

Recent evidence on Housing First indicates that such housing approaches achieve stability and service use outcomes comparable to more traditional models that require passing through a sequence of transitional housing arrangements. Both US and Canadian housing policy now support Housing First as a best practice strategy to assist homeless persons with multiple complex needs, including people with HIV.^{189,190} In the United States, agencies that manage publicly funded health insurance are investing in housing as health care as part of a larger Medicaid redesign process that aims to improve care delivery and reduce costs through innovation made possible by the Affordable Care Act.¹⁹¹

Homelessness and housing challenges are the result of complex interactions between individual vulnerabilities and broader economic, political, and legal structural determinants of health.^{8–10} Broader structural processes sustaining social exclusion and inequality would seem beyond the immediate reach of HIV interventions; however, changing housing and residential environments is both possible and promising. **AJPH**

CONTRIBUTORS

A. A. Aidala led the writing, contributed to developing the review and quality assessment processes, and analyzed study results. M. G. Wilson and V. Shubert contributed to the writing. M. G. Wilson, V. Shubert, D. Gogolishvili, J. Globerman, S. Rueda, A. K. Bozack, M. Caban, and S. B. Rourke assisted with developing the review process and reviewed study results. All authors reviewed articles and performed quality assessments.

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HUMAN PARTICIPANT PROTECTION

Human participant protocol review was not required because this study was a review of previously published research; no original research involving human participants was involved.

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