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Areas of disadvantage: A systematic review of effects of area-level socioeconomic status on substance use outcomes

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Abstract

Issues—This review examines whether area-level disadvantage is associated with increased substance use and whether study results are impacted by the size of the area examined, definition of socioeconomic status (SES), age or ethnicity of participants, outcome variables, or analytic techniques.

Approach—Five electronic databases and the reference sections of identified papers were searched to locate studies of the effects of area-level SES on substance use published through the end of 2007 in English-language, peer-reviewed journals or books. The 41 studies that met inclusion criteria included 238 effects, with a subsample of 34 studies (180 effects) used for the main analyses. Study findings were stratified by methodological characteristics and synthesised using generalised estimating equations to account for clustering of effects within studies.

Key Findings—There was strong evidence that substance use outcomes cluster by geographic area, but there was limited and conflicting support for the hypothesis that area-level disadvantage is associated with increased substance use. Support for the disadvantage hypothesis appeared to vary by sample age and ethnicity, size of area examined, type of SES measure, specific outcome considered and analysis techniques.

Implications—Future studies should use rigorous methods to yield more definitive conclusions about the effects of area-level SES on alcohol and drug outcomes, including composite measures of SES and both bivariate and multivariate analyses.

Conclusion—Further research is needed to identify confounds of the relationship between area-level SES and substance use and to explain why the effects of area-level SES vary by outcome and residents' age.

Keywords

socioeconomic disadvantage; neighbourhood; community; alcohol and drugs; review

Some neighbourhoods are good places to live, but others are not. Many studies have examined the contribution of neighbourhoods to patterns of substance use. An important subset of these investigations has focused on effects of area-level socioeconomic status (SES). Theories of social exclusion and relative deprivation [see, for example, 1, 2] suggest that areas with low SES suffer from differential development of social structures such as policing and schools that help sanction social behaviour and maintain social order [3, 4], and physical resources such as housing and employment opportunities. These inequalities negatively impact health and behaviour directly through environmental exposures and

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through psychosocial mechanisms [5, 6] related to residents' relative social position in society [7, 8]. Theories of stress and coping suggest that exposure to stressors such as neighbourhood disadvantage deplete residents' coping resources [9], which may lead to substance use in response to stress or strain [10]. Other features of disadvantaged neighbourhoods that may place residents at risk of substance use include targeted marketing of alcohol [11, 12] or prevalence of drug-related crime [13].

Many studies have shown associations between area-level disadvantage and health risk behaviours [for a review, see 14] and poor health status [for a review, see 15], but there has been no systematic review describing the effects of area-level SES on substance use. A preliminary investigation of the extant literature suggests that there is conflicting evidence about direct effects of area-level SES on substance use outcomes. Several studies conducted in the United States (US) with national samples of adults support the disadvantage hypothesis in relation to levels of alcohol consumption [16], heavy drinking [17] and alcohol-related problems [18], and other large US studies have linked neighbourhood disadvantage with increased illicit drug use among adults [19] and adolescents [20]. Other studies show the opposite, suggesting a relationship between area-level affluence and alcohol use [21]. Some discern no effects of area-level SES on alcohol use [22], and others show mixed results depending on the measure of SES [20, 23] or the outcome examined [24–26]. The primary aims of this review are to summarise the effects of area-level SES on residents' substance use and to test a disadvantage hypothesis to determine whether the majority of published evidence suggests that area-level disadvantage is associated with increased substance use.

In addition to examining the relationship between area-level disadvantage and substance use, another issue investigated is whether the wide variation in results of prior research is due to fundamental differences between studies. Researchers have examined area-level effects using geographies ranging in size from US Census block groups to postal code sorting areas and even larger community or regional subdivisions. They have operationalised SES using single-item and composite indicators, and they have focused on a variety of substance use outcomes ranging from abstinence to heavy use, dependence and other consequences of use. Studies have used samples that vary in terms of age, ethnicity and nationality, and analyses have treated control variables and multi-level data differently. Thus, a secondary aim is to establish whether study results vary systematically based on the size of the area, definition of SES, sample characteristics, outcome, study design or analytic techniques. Studies of individual-level SES and health outcomes [see, for example, 27] suggest that variability in methods and definitions across studies could substantially influence the conclusions drawn about the relationships between area-level SES and substance use outcomes. Thus, this review addresses three questions: (1) Are residents in a given area similar in their substance use outcomes? (2) Are study characteristics related to findings of significant effects of area-level SES on substance use outcomes? (3) Do study attributes influence support for the disadvantage hypothesis?

Approach

Data sources

This review includes quantitative studies of neighbourhood and community effects on substance use published through the end of 2007 in English-language, peer-reviewed journals or books. Five electronic databases were searched to identify eligible studies: PsycInfo, Family and Society Studies Worldwide, PubMed, ETOH (Alcohol & Alcohol Problems Science Database), and Web of Science. All studies with outcomes of alcohol or illicit drug use were targeted using keywords and wild-card terms (alcohol*, drink*, drunk*, drug use, drug abuse, substance use and substance abuse), which were combined with

limiting keywords (neighborhood/neighbourhood, census, area-based, multi-level/multilevel, context, ecological, ecology, environment*, and community-level). Resulting citations were manually searched for studies including area-based measures of SES measured by indicators of income, economic resources, employment, or education. Reference sections of identified papers and the Social Sciences Citation Index were used to find additional studies.

Article selection

Based on database, reference list and citation searches, 93 articles published between 1944 and 2007 were reviewed. Studies combining substance use with behaviours such as violence were excluded, since other reviews have focused on delinquency and general antisocial behaviours [28]. Studies assessing the impact of income inequality on substance use also were excluded, because income inequality is most effectively measured at the state or national level [29]. In all, 52 articles were excluded from detailed review: 32 were studies of other neighbourhood attributes (such as consumerism and social disorder), 16 examined outcomes that were not measures of substance use *per se* (such as riding with a drunk driver and alcohol-related arrests), and 2 were unpublished reports (one in draft form). Two additional articles used cluster analysis techniques and were excluded because it was impossible to isolate the effects of area-level SES. Thus, 41 articles were included.

Sample description

The sample included 29 individual- or multi-level studies, 5 ecological studies, and 7 multi-level studies that only presented information on area-level clustering of substance use outcomes. Seven multi-level studies presented information on clustering of substance use outcomes as well as effects of neighbourhood SES. The unit of analysis in this review is an *effect*, rather than a *study*, because many studies reported results for several outcomes or for multiple indicators of area-level SES. Statistical adjustment to account for clustering of multiple effects within studies is described below.

Effects from the full sample of articles were used to assess whether residents in a given area are similar in their substance use outcomes. Studies that only reported random effects were not included in most analyses. Thus, the main sample included 34 studies and 180 effects. The median sample size was 478 (range: 36 to 42,650) and the median number of aggregate units in multi-level studies was 55 (range: 4 to 1,784). Respondents ranged in age from 10 to 65 years (M=25.3), with the average age substantially lower for studies of substance use (defined by alcohol *or* drug use; M=15.5 years) than for studies of illicit drug outcomes (including non-prescription use of marijuana, cocaine, barbiturates, inhalants, tranquilizers, amphetamines, analgesics or LSD (lysergic acid diethylamide or “acid”), and problems related to use; M=27.8 years) or alcohol use (including various patterns of use, abuse, dependence and other negative consequences of use; M=25.9 years).

Data synthesis

It was not possible to use meta-analytic procedures to synthesise the data due to the wide variety of outcomes and predictors used across studies, as well as a paucity of reported standardised measures of effect sizes. In addition to meta-synthesis to develop a narrative summary of evidence, to address the principal aims, analyses examined random effects and intraclass correlation coefficients [ICCs;30] for evidence of significant area-level clustering of substance use (Question 1), as well as overall statistical significance of the effect of area-level SES on substance use (Question 2) and support for the disadvantage hypothesis (Question 3). Bivariate generalised estimating equations (GEE), which adjust for the clustering of multiple effects within a given study [31], were used with a logit link function to determine whether the study findings (significant effect of area-level SES vs. non-

significant effect; support for disadvantage hypothesis vs. not) varied as a function of methodological characteristics.

The methodological characteristics of interest, which were specified *a priori* and then refined based on data available in the reviewed studies, included the following: (1) size of the area (census tract or smaller vs. ZIP code area or school catchment area vs. community-level or larger); (2) definition of SES (composite vs. single item); (3) respondent age (adolescent vs. adult); (4) ethnicity/nationality (US predominantly white sample vs. US mixed or minority sample vs. non-US white sample); (5) type of outcome (alcohol vs. illicit drugs vs. substance use); (6) level of analysis (ecological vs. individual or multi-level); (7) longitudinal designs (vs. cross-sectional); (8) multi-level analysis (appropriate vs. ignoring clustered data structure); and (9) multivariate analyses (vs. bivariate). Findings from multivariate models also were coded for (10) inclusion of possible mediators (such as affiliation with delinquent peers, which may be on the causal pathway between neighbourhood disadvantage and substance use outcomes) and (11) inclusion of individual-level sociodemographic control variables (including individual or household SES and other key predictors of substance use, such as age, sex and race/ethnicity).

Key Findings

The studies represented all of the methodological characteristics of interest (see Table 1), but they included primarily cross-sectional effects, limited data from older adults, several samples of unknown racial/ethnic background, few effects on alcohol or drug problems, and limited effects examining area-level indicators of education (such as % residents without high school education). The ecological studies differed from the individual- and multi-level studies in that they appeared primarily to be studies that aggregated data from predominantly white samples of US adolescents and that used ZIP codes as the level of analysis.

Are residents in a given area similar in their substance use outcomes?

The first step in assessing relationships between area-level SES and substance use was to determine whether studies suggested that residents in a given area are similar in their substance use outcomes. Based on random effects and ICCs reported from multi-level studies, there was strong evidence that substance use outcomes cluster by geographic area. Almost all (93.3%) random effects at the block group or tract level were significant, and about half were significant when measured at the ZIP code or school level (50.0%) or for larger aggregations (56.4%).

Are study characteristics related to findings of significant effects of area-level SES on substance use outcomes?

The next analysis examined whether study findings varied systematically as a function of methodological characteristics. Overall, 32% of effects showed a significant relationship between area-level SES and a substance use outcome (68% were not statistically significant). Results varied slightly by outcome, with 35% of the 94 effects on alcohol, 30% of the 66 effects on illicit drugs and 25% of the 20 effects on combined substance use outcomes (either alcohol *or* drug use) being significant. There was no clear pattern of particular outcomes (such as user status, heavy use, problems or dependence) within each of the substance use domains that suggested types or levels of use that were more (or less) likely to be related to the area's SES.

GEE models suggested that only a few characteristics were reliably associated with detection of significant effects of area-level SES (see Table 2). Significant effects were more likely for adult samples (vs. adolescents, $p<.05$), in bivariate analyses (vs. multivariate, $p<$.

01), and in multivariate analyses that did not include possible mediating variables in the model (vs. analyses that included possible mediators, $p<.05$).

Do study attributes influence support for the disadvantage hypothesis?

Final analyses addressed whether area-level disadvantage is associated with increased substance use. For alcohol outcomes, 89 effects reported the direction of the relationship. Of these, 18.0% supported the disadvantage hypothesis, and 13.5% were significant in the opposite direction (that is, they suggest neighbourhood *affluence* was associated with increased substance use). The remainder (68.4%) were not significant. For drug use outcomes ($n=62$ effects), 19.4% of the effects supported the disadvantage hypothesis, 6.5% were significant in the opposite direction, and 74.1% were not significant. The substance use outcomes that combined any alcohol *or* drug use ($n=20$ effects, all from samples of adolescents) demonstrated a different pattern of results, with 5.0% of effects supporting the disadvantage hypothesis and 20.0% significant in the opposite direction.

As shown in Table 2, support for the disadvantage hypothesis was more likely in bivariate analyses ($p<.01$) and in multivariate analyses that did not include possible mediating variables in the model ($p<.05$). Results were not reliably impacted by the measure of SES, nationality/ethnicity of the sample, type of outcome, level of analysis, study design or use of multi-level analysis.

A subsample of rigorous individual- or multi-level studies of alcohol and illicit drug outcomes among adults provided multivariate effects with adequate control for individual-level demographic characteristics (12 studies and 40 effects; indicated in bold text in Table 3). Adjustment for individual SES, in particular, is critical when assessing the role of area-level SES on health and behaviour due to the strong associations between the two types of SES exposures. Examination of this restricted sample of studies a revealed several interesting patterns. First, effects of SES from models including possible mediating variables were significantly more likely to be non-significant (87.5%) than those from models that did not include mediators (31.3%), OR (95% CI) = 0.06 (0.01, 0.33), $p < .01$, which suggests that the effects of area-level SES on substance use outcomes may be indirect. Second, upon elimination of those mediated effects from the sample of studies, the remaining 16 direct effects of area-level SES showed differences by outcome. Among the 4 drug effects, both effects on marijuana use were significant in the direction opposite that predicted by the disadvantage hypothesis, while both effects on other illicit drug use (such as cocaine or heroin) supported the disadvantage hypothesis. Among the 12 alcohol effects, the pattern of effects was less clear: Area-level disadvantage was significantly positively related to the single effect on alcohol use disorders, while both effects on any alcohol use in the past month were significant in the opposite direction. None of the 3 effects on regular alcohol use (such as monthly alcohol volume consumed) supported the disadvantage hypothesis, but the 6 effects on heavy use (including more than 5 drinks “almost every day”) did not exhibit a consistent pattern.

Discussion

Although there was strong evidence that substance use outcomes cluster by geographic area, there was mixed support for the hypothesis that area-level disadvantage is associated with increased substance use. Effects from samples of adults were more likely than effects from samples of adolescents to show a significant relationship between area-level SES and the substance use outcome, and they also were more likely to support the disadvantage hypothesis. This finding may be related to lower power in adolescent samples to detect area effects on relatively rare substance use outcomes, or it could signal that adolescent alcohol and drug use may not be a product of stress induced by exposure to disadvantaged

environments. Relatively few effects from samples outside of the US showed significant effects of area-level SES on substance use. The increasingly stratified nature of the US socioeconomic context may create gradient effects on substance use outcomes that are not seen in other cultural contexts. Finally, the small subsample of the most rigorous studies of adults suggest that the disadvantage hypothesis applies primarily to heavy alcohol use and to the use of illicit drugs other than marijuana. These patterns would be compatible with a stress model, as hypothesised. In contrast, effects on substance use (defined as use of either alcohol or drugs) were more likely to be significant in the opposite direction, suggesting that neighbourhood *advantage* may be associated with more substance use among adolescents. Neighbourhood affluence may influence behaviour through exposure to social norms supportive of light, frequent alcohol use or through individual-level SES and disposable income that enables substance use during adolescence. Because there were few longitudinal studies included in the review, these cross-sectional associations should be interpreted with caution, however.

Studies that did present evidence for the disadvantage hypothesis were quite diverse. Support for the hypothesis was seen in 13 studies using national and local samples—both large and small—that included adults and adolescents who were predominantly white, ethnically diverse or predominantly minority or from outside the US. Neighbourhood disadvantage was associated with both alcohol and illicit drug use, using levels of aggregation that included smaller geographic areas such as block groups and census tracts, as well as postal code and school catchment areas, and with different indicators of neighbourhood SES ranging from composite measures to indicators of education, employment and wealth. Thus, the premise that social exclusion and relative deprivation contribute to alcohol and illicit drug use still appears to be plausible, particularly for drinking patterns characterized by heavy use or for consequences of such use, as well as for use of illicit drugs such as cocaine or heroin.

The findings from most of the studies supporting the disadvantage hypothesis were not unequivocal, however. Three studies also reported other effects that were significant in the opposite direction, suggesting that neighbourhood affluence was associated with increased substance use, and seven studies also reported null results. In these studies, the findings varied by the outcome and the definition of SES utilised. Variations in documented neighbourhood SES effects according to outcome are compatible with research on individual-level SES that suggests higher SES is associated with more frequent alcohol use, but lower SES is associated with greater quantities of alcohol consumed per drinking occasion [27]. A few of these studies also had different findings in bivariate and multivariate analyses, in cross-sectional and longitudinal analyses, or for different subsamples. Systematic examination of these methodological factors within future studies would permit more definitive conclusions to be drawn about the nature of the effects of area-level SES on substance use outcomes. In addition, attention to possible moderators of area-level SES effects, such as gender or ethnicity, also would be informative.

This review has some limitations. Most studies contributed more than one effect to the analysis, and all effects were weighted equally, regardless of magnitude. The findings from a particular study would be weighted more heavily as the number of reported effects increases, which could compound the effect of study flaws such as low response rates or non-representative samples. Using GEE models to synthesise the study findings accounted for similarities between effects from the same study, but some problems may have overlapped (such as issues with study design and sampling). Meta-analytic strategies to synthesise data from studies with similar exposures and similar outcomes would be helpful for effectively estimating the effect size for area-level SES while adjusting for study quality. This review was limited to examining area-level SES, so it ignores effects of neighbourhood

social processes that may not covary with SES (such as social capital, social disorganization or crime). It also does not examine regulatory or policy differences between areas that may impact pricing or availability of alcohol or other drugs. A final caveat is that the review only includes peer-reviewed, English-language publications that were indexed in major public health and alcohol studies databases. It is possible that studies of area-level effects conducted outside the US would be published in the local language due to national interest and relevance for policy development and prevention programming.

Implications

Despite the limitations, there are implications for future research. Studies should consider composite measures of SES, although if many disparate indicators are combined, the exact mechanism of effect may be obscured [1]. As suggested by studies of other health outcomes as well [32], smaller areas of aggregation may be more likely to reveal significant area-level effects. Analyses should assess both bivariate and multivariate associations, authors should present main effects models before adding possible mediating variables, and analysts should carefully attend to the issue of individual-level sociodemographic controls. The majority of studies reviewed here were cross-sectional, observational studies. Because few studies used quasi-experimental designs or presented longitudinal effects, future investigations should include the long-term effects of neighbourhood SES on substance use to explicitly examine the causal processes at work, particularly due to the likely “downward drift” of people with drug and alcohol problems into disadvantaged neighbourhoods over time [33]. Additionally, further research is needed to identify confounds and mediators of the relationship between area-level SES and substance use and to explain why the effects of area-level SES vary by outcome and residents' age. At a minimum, examinations of neighbourhood effects for subgroups of residents would be invaluable for guiding appropriate interventions for those residents most at risk. Finally, more studies of the effects of area-level disadvantage on patterns and consequences of addictive substances other than alcohol also would be worthwhile.

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Table 1

Characteristics of effects of area-level SES on substance use identified in review

	Effects from ecological studies (*N*=5 studies, 56 effects)	Effects from individual- or multi-level studies (*N*=29 studies, 124 effects)	Random effects from multi-level studies (*N*=14 studies, 58 effects)[a]
Longitudinal effects	0.0%	21.0%	1.7%
Age			
15 and under	19.6%	18.5%	0.0%
16-19	75.0%	29.8%	51.7%
30s and 40s	3.6%	42.7%	39.7%
50s and 60s	1.8%	8.9%	8.6%
Race/ethnicity of sample			
Predominantly white (non-US)	80.4%	32.3%	25.9%
Predominantly white (US)	12.5%	12.9%	37.9%
Mixed or minority (US)	0.0%	48.4%	36.2%
Unknown race/ethnicity (US)	7.1%	6.5%	0.0%
Outcome			
Alcohol use	25.0%	54.0%	50.0%
Alcohol problems	17.9%	2.4%	12.1%
Illicit drug use	32.1%	32.3%	34.5%
Drug problems	12.5%	0.8%	0.0%
Substance use[b]	12.5%	10.5%	3.4%
Area of aggregation			
Block group	3.6%	19.4%	1.7%
Census tract	0.0%	30.6%	24.1%
ZIP code	75.0%	21.8%	6.9%
School catchment area	19.6%	14.5%	0.0%
Community	1.8%	8.1%	44.8%
County	0.0%	4.8%	19.0%
Region	0.0%	0.8%	3.4%
Area-level SES variable			
Education	30.4%	8.9%	N/A
Employment	17.9%	21.0%	N/A
Wealth	42.9%	29.8%	N/A
SES composite	8.9%	40.3%	N/A

[a] Some studies contributed neighbourhood effects and random effects, and others only contributed one type of effect.

[b] Substance use was an indicator of any alcohol or illicit drug use.

N/A, not applicable.

Table 2

Study characteristics impacting findings about effect of area-level SES on substance use

	Significant effect of SES		Supports disadvantage hypothesis	
	N=180 effects	OR (95% CI)	N=171 effects	OR (95% CI)
Area size				
Census tract or smaller area	39.1%	0.51 (0.11, 2.28)	25.4%	0.74 (0.16, 3.37)
ZIP code or school catchment area	21.4%	0.29 (0.06, 1.40)	9.4%	0.25 (0.05, 1.30)*
Community or larger	66.7%	---	33.3%	---
Measure of SES				
Composite	47.3%	1.34 (0.52, 3.48)	25.0%	1.62 (0.59, 4.48)
Single-item measure	25.6%	---	13.8%	---
Age of respondents				
Adolescents	23.9%	0.37 (0.14, 0.94)**	11.2%	0.40 (0.14, 1.09)*
Adults	46.3%	---	26.6%	---
Nationality/ethnicity of sample				
US white	52.2%	1.98 (0.49, 8.01)	26.1%	1.36 (0.31, 5.97)
US mixed or minority	41.7%	1.88 (0.59, 5.93)	20.8%	1.31 (0.38, 4.51)
Non-US white	22.4%	---	12.1%	---
Type of outcome				
Alcohol use	35.1%	0.99 (0.35, 2.80)	18.0%	2.47 (0.44, 13.77)
Illicit drug use	30.3%	1.52 (0.54, 4.30)	19.4%	3.81 (0.70, 20.79)
Substance use	25.0%	---	5.0%	---
Level of analysis				
Ecological	21.4%	1.06 (0.24, 4.68)	16.1%	3.30 (0.63, 17.24)
Individual- or multi-level	37.1%	---	17.4%	---
Study design				
Longitudinal	30.8%	0.28 (0.06, 1.24)*	11.5%	0.35 (0.06, 1.98)
Cross-sectional	32.5%	---	17.9%	---
Type of analysis				
Bivariate	58.8%	3.29 (1.42, 7.68)***	41.2%	4.45 (1.77, 11.21)***
Multivariate	26.0%	---	11.0%	---
Multi-level analysis				
Ignored clustering in data	31.0%	0.53 (0.16, 1.73)	22.4%	1.23 (0.45, 3.65)
Appropriate analysis	32.8%	---	14.2%	---
Multivariate models: Control variables[a]				
Inadequate controls	22.7%	1.21 (0.34, 4.34)	7.5%	0.42 (0.15, 1.10)*
Appropriate controls	29.6%	---	14.3%	---
Multivariate models: Mediators[a]				
Possible mediators included	19.4%	0.30 (0.10, 0.88)**	6.6%	0.29 (0.09, 0.90)**
No mediators included	39.6%	---	19.6%	---

*$P < .10$;

**$P < .05$;

***$P < .01$.

[a]Sample sizes for analyses of effects from multivariate models only = 146 and 137.

---, reference group; CI, confidence interval; OR, odds ratio from bivariate generalised estimating equation model.

Table 3

Findings from studies examining effects of area-level socioeconomic status on alcohol and drug outcomes

Citation	Sample and setting	Neighbourhood measure(s)	Outcome(s) and results
Akers & LaGreca (1991) [34]	1,410 adults ages 60+ from 4 communities in FL & NJ, US	Source: Respondent data Composite: Advantage	Outcome: Factor score based on past year and past month frequency of alcohol use. Main results: No direct effect of community SES on drinking
Allison et al. (1999) [35]	114 students from 18 clusters of block groups, US	Source: 1990 Census Composite: Disadvantage	Outcome: Index of substance use based on self-reported alcohol and illicit drug use Main results: No effect of disadvantage on substance use
Boardman et al. (2001) [19]	1,101 adults from 139 census tracts in Detroit, MI, US	Source: 1990 Census Composite: Disadvantage	Outcome: Illicit drug use past 12 months Main results: **Association between disadvantage and illicit drug use (+*)**
Breslin & Adlaf (2005) [36]	8,080 youth in 136 regions in Canadian Community Health Survey	Source: Respondent data Single item: % low income	Outcome: Heavy episodic drinking (5+ drinks) Main results: No relationship between community income and heavy episodic drinking.
Brown et al. (2005) [37]	3,489 people from 112 census block units, New Zealand	Source: Census data Single item: Mean income	Outcome: Moderate drinking (> 1 drink every 30 days) Main results: Mean household income not related to moderate drinking.
Buu et al. (2007) [33]	206 men, MI, US	Source: 1980 Census tract data Composite: Disadvantage	Outcome: Alcohol use disorder (AUD) in past 3 years (averaged across 4 waves) Main results: **Baseline disadvantage associated with 12-year AUD symptoms (+*).**
Chuang et al. (2005) [21]	959 youth across US	Source: 1990 Census tract data Composites: Low and high SES	Outcome: Drinker status (baseline, 3 months, and 12 months) Main results: Correlations of low SES with child (-*) and parent (-*) drinking and of high SES with parent drinking (+*). Indirect multivariate effects on child drinking.
Ecob & Macintyre (2000) [22]	2,974 youth and adults from 52 post code sectors in Scotland, UK	Source: Census data Composite: Carstairs-Morris deprivation index	Outcomes: Drinking 14+ units for women/ 21+ units for men; units of alcohol past week Main results: **Deprivation index NS for both alcohol outcomes.**
Ennett et al. (1997) [38]	36 elementary schools in US	Source: 1990 Census block group data Composite: Deprivation	Outcomes: Rates of lifetime and past month alcohol and marijuana use Main results: Correlations between deprivation and all outcomes NS.
Fauth et al. (2004) [39]	173 women moved, 142 women stayed in old neighbourhood, Yonkers, NY, US	Source: 1990 Census tract data Composite: Lower SES in old neighbourhoods	Outcomes: Alcohol abuse; drug abuse Main results: 2-year follow-up showed small effect of moving on alcohol abuse (-). NS effect for drug abuse.
Fauth et al. (2007) [40]	128 youth moved, 93 youth stayed in old neighbourhood, Yonkers, NY, US	Source: 1990 Census tract data Composite: Lower SES in old neighbourhoods	Outcome: Number of drugs used in past year (alcohol, marijuana and tobacco) Main results: At 7-year follow-up no impact of moving on youth ages 8-11, slightly more substance use for ages 12-14 (+) and significantly more for ages 15-18 (+*).
Ford & Beveridge (2006) [26]	42,650 youth and adults across US	Source: 1990 Census tract data Composite: Disadvantage	Outcome: Use of marijuana, cocaine, barbiturates, inhalants, tranquilisers, amphetamines, analgesics and LSD in past 12 months Main results: Disadvantage related to barbiturate use (+*) and amphetamine use (+**).

Citation	Sample and setting	Neighbourhood measure(s)	Outcome(s) and results
Forsyth et al. (1994) [41]	691 adults from 4 neighbourhoods in Glasgow, Scotland, UK	Source: West of Scotland Twenty-07 Study Composite: Neighbourhood SES	Outcome: Excessive alcohol use (14+ units/ week for women; 21+ units/week for men) Main results: Significantly more alcohol consumption in highest ($^{+*}$) and lowest ($^{+*}$) SES neighbourhoods than in middle SES neighbourhoods.
Galea et al. (2007a) [42]	1,355 adults from 59 districts, New York City, NY, US	Source: 2000 Census Single item: Mean education	Outcome: Past month drinking, marijuana use, number of drinks Main results: **Mean education associated with alcohol use ($^{+*}$) and marijuana use ($^{+*}$). Number of drinks per month (drinkers only) NS.**
Galea et al. (2007b) [25]	1,355 adults from 59 districts, New York City, NY, US	Source: 2000 Census Single item: Median income	Outcome: Past month drinking, marijuana use, number of drinks Main results: **Higher income associated with alcohol use ($^{+*}$), marijuana use ($^{+*}$), and number of drinks per month among drinkers ($^{+*}$)**.
Giggs et al. (1989) [43]	97 basic data zones in Greater Nottingham, England, UK	Source: 1983 Nottinghamshire County Disadvantage Study Composite: Multiple deprivation Single item: Unemployment	Outcome: Rate of class A drug use per 1000 people Main results: Drug use correlated with multiple deprivation ($^{+**}$) and unemployment ($^{+**}$).
Hoffmann (2002) [20]	11,749 youth from 1,784 ZIP codes in 1990 & 1992 National Education Longitudinal Study	Source: 1990 Census Single items: % jobless males, poverty	Outcome: Illicit drug use (baseline, 2-year follow-up) Main results: Baseline association of illicit drug use with jobless males ($^{+*}$) and poverty ($^{-*}$). Both effects NS in longitudinal models.
Jones-Webb et al. (1997) [18]	744 male drinkers in 1992 National Alcohol Follow-up Survey	Source: 1990 Census block group data Single item: % below poverty	Outcome: Alcohol-related problems Main results: Interaction of race and poverty: Black men in poor neighbourhoods had more problems than White men, but no racial differences in non-poor neighbourhoods
Karvonen & Rimpelä (1996) [44]	9,121 youth in 460 municipalities in Finland	Source: Statistics Finland Single items: Educational structure, employment sufficiency	Outcome: Weekly alcohol use Main results: Alcohol use by males associated with employment sufficiency ($^{-*}$). Alcohol use by females positively associated with educational structure ($^{+*}$).
Karvonen & Rimpelä (1997) [45]	1,048 youth in 33 city sub-areas in Helsinki, Finland	Source: Census data Single items: % white collar jobs, unemployment, prolonged unemployment, owner-occupied housing, housing provided by employer	Outcome: Weekly alcohol use, monthly intoxication Main results: Prolonged unemployment associated with monthly drunkenness among males ($^{+*}$).
Kulis et al. (2007) [24]	3,721 youth in 35 middle schools, Phoenix, AZ, US	Source: 2000 Census Single item: % below poverty	Outcome: Drinks in past month, frequency of marijuana use Main results: Bivariate association between poverty and marijuana use ($^{+**}$). No multivariate effect of poverty in combined or stratified samples (Whites, English-speaking Latinos, bilingual Latinos, Spanish-speaking Latinos).
Lo et al. (2006) [46]	73,782 youth from 67 counties, AL, US	Source: Alabama Social Indicators Study Composite: Disadvantage	Outcome: Lifetime and 30-day frequencies of alcohol use, marijuana and illicit drug use Main results: Difficult to interpret main effects from MV models in the context of multiple interactions with risk and protective factors, but all effects significant.

Citation	Sample and setting	Neighbourhood measure(s)	Outcome(s) and results
Luthar & Cushing (1999) [47]	77 children of drug users in 55 census tracts, New Haven, CT, US	Source: 1990 Census Single items: % low income, managerial or professional occupations	Outcome: Substance use (2-year follow-up) Main results: Professional occupations associated with substance use ($^{+*}$).
Monden et al. (2006) [48]	8,000 adults from 86 administrative units in Eindhoven, Netherlands	Source: Respondent data Composite: Disadvantage	Outcome: Heavy alcohol consumption (6+ glasses 3+ times/week, or 4+ glasses 5+ times/week) Main results: Disadvantage not related to alcohol use.
Pollack et al. (2005) [49]	8197 adults from 82 census tracts or block groups in CA, US	Source: 1980 or 1990 Census Composite: Townsend deprivation index	Outcome: Heavy drinking (7+ drinks/week for women, 14+ drinks/week for men) Main results: **Least deprived had higher odds of heavy drinking than moderately deprived. No difference for most vs. moderately deprived neighbourhoods.**
Rootman & Oakey (1973) [50]	45 communities, Alberta, Canada	Source: Student data Single items: % unemployment, high school education, low education	Outcomes: Rate of alcohol use, rate of alcohol abuse Main results: Prevalence of low maternal education associated with alcohol use ($^{+*}$).
Schroeder et al. (2001) [23]	324 adults, Baltimore, MD, US	Source: 1990 Census block group data Single items: % below poverty, adults without diploma, unemployed, renters	Outcome: Continued cocaine or heroin use (6-, 12-, 18-month follow-ups) Main results: Poverty and low education predicted continuing drug use in unadjusted models. No SES variables met stepwise criteria for inclusion in adjusted models.
Shaper et al. (1981) [51]	7,727 adult men from 24 towns in Britain, UK	Source: Respondent data Single item: % manual workers	Outcome: Proportion of heavy drinkers (6+ drinks daily or on each day of weekend) Main results: Manual workers correlated with proportion of heavy drinkers ($^{+*}$).
Smart et al. (1994) [52]	79 postal code areas in Ontario, Canada	Source: Statistics Canada 1986 Single items: % university degree, low education, young adult unemployment rate, homeowners, mean cost of dwellings, low income, mean income	Outcomes: Average number of drugs used, average frequency of use in past year (alcohol, cannabis, cocaine), rate of alcohol problems, rate of drug problems Main results: Average number of drugs used related to home ownership ($^{+*}$). Cannabis use related to home ownership ($^{+*}$) and low income ($^{+**}$). Drug problems related to high education ($^{+**}$) and home costs ($^{-*}$).
Steptoe & Feldman (2000) [53]	658 adults from 37 post codes in London, England	Source: Census and University/ College Admissions Service Composite: High vs. low SES	Outcome: Heavy drinking (4+ units on 3+ days per week) Main results: No association between SES and heavy drinking.
Stimpson et al. (2007) [17]	20,050 adults in NHANES III	Source: 1990 Census tract data Composite: Singh composite index of neighbourhood deprivation	Outcome: Heavy alcohol use (5+ drinks "almost every day") Main results: **Disadvantage increased odds of heavy alcohol use in 3rd and 4th quartiles of deprivation. Effect for 2nd quartile NS.**
Twigg et al. (2000) [54]	16,000 youth and adults from 720 post code sectors in 170 health districts in England	Source: Respondent data Single items: % no car, 2+ cars, high social class, private rent	Outcome: Problem drinking Main results: Main effect for 2 or more cars ($^{+*}$). Significant cross-level interactions of social class with single and male and of private rent with single and male.
Waitzman & Smith (1998) [16]	10,161 adults in NHANES I	Source: 1960 & 1970 Census tract data Composite: Disadvantage	Outcome: Ounces of ethanol consumed daily Main results: Disadvantaged areas had significantly higher alcohol consumption for both age cohorts (25-54, 55 and older; unadjusted estimates).
Williams & Latkin (2007) [55]	1,305 adults in 249 block groups, Baltimore, MD, US	Source: 1990 Census dataComposite: Disadvantage Single items: median household income, % below poverty, on public assistance, renters, low education,	Outcome: Use of heroin, cocaine or crack in past year Main results: **Poverty was significantly associated with more drug use.**

Citation	Sample and setting	Neighbourhood measure(s)	Outcome(s) and results
		unemployed, not in labour force, blue collar workers, professionals	

+ marginal positive association, $P < .10$;

+* positive association, $P < .05$;

+** positive association, $P < .01$;

- marginal negative association, $P < .10$;

-* negative association, $P < .05$.

Studies and results indicated in bold text were considered in rigorous sub-sample. LSD, lysergic acid diethylamide or “acid”; NS, not significant; SES, socioeconomic status.