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Space and Place in Alcohol Research

Christina Mair, Ph.D., MPH[1], **Jessica Frankeberger, MPH**[1], **Paul J Gruenewald, Ph.D.**[2], **Christopher N Morrison, Ph.D., MPH**[3,4], **Bridget Freisthler, Ph.D.**[5]

[1]Department of Behavioral and Community Health Sciences, University of Pittsburgh Graduate School of Public Health

[2]Prevention Research Center, Pacific Institute for Research and Evaluation

[3]Department of Epidemiology, Mailman School of Public Health, Columbia University

[4]Department of Epidemiology and Preventive Medicine, School of Public Health and Preventive Medicine, Monash University

[5]College of Social Work, The Ohio State University

Abstract

Purpose of review: To summarize the recent literature on social and physical environments and their links to alcohol use and identify empirical research strategies that will lead to a better understanding of alcohol use in contexts.

Recent findings: Recent research has continued to describe the importance of neighborhood and regional contexts on alcohol use, while a smaller emerging scientific literature assesses the impacts of contexts on drinking.

Summary: The dynamic, longitudinal, and multiscale processes by which social and physical structures affect social interactions and substance use have not yet been uncovered or quantified. In order to understand and quantify these processes, assessments of exposures (e.g., how individuals use space) and risks within specific locations are essential. Methods to better assess these exposures and risks include model-based survey approaches, ecological momentary assessment (EMA) and other forms of ecologically- and temporally-specific analyses, affiliation network analyses, simulation models, and qualitative/multi-methods studies.

Keywords

Alcohol; social epidemiology; substance use; neighborhood effects; social environment

Introduction

Heavy drinking and the prevalence of alcohol use disorders (AUDs) are believed to be affected by both micro- and macro-ecological conditions of use [1, 2]. With 57% of adults worldwide estimated to be past-year drinkers, and 40% of those engaging in past 30-day

Corresponding Author: Chrsitina Mair, 6136 Public Health, 130 DeSoto Street, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA 15261, cmair@pitt.edu.

heavy episodic drinking, alcohol has a tremendous impact on the health and wellbeing of global populations [3]. Critically, every drinking episode takes place at a specific time and in a specific place, and physical and social characteristics of these places can vary in ways that raise or lower risks for heavy drinking and subsequent experiences of harm. If characterized by careful social ecological research, a better understanding of the links between alcohol use and social and physical characteristics of environments can lead to the development of more effective environmental prevention interventions [4]. Effective prevention programs require not only the identification of what works but where, when, and among whom they work best. Without knowledge of the social and structural features that place individuals at risk for AUDs and problematic alcohol use, ecologically valid preventive programs cannot be developed or implemented. In this paper we summarize the recent literature on social and physical environments and their links to alcohol use and identify empirical research strategies that will lead to a better understanding of alcohol use in contexts.

Understanding the role of place in health research has been one of the key advances in the epidemiologic literature over the past twenty-five years [5]. Much of this research focuses on “neighborhoods and health”, where aspects of the neighborhood area where one lives are correlated with behavioral and health outcomes [6]. A set of related studies have asked similar questions, but focused on a broader spatial scale (e.g., between countries, states, or cities). More simply, descriptive epidemiologic studies that assess one or two basic differences between neighborhoods or communities, most often rural vs. urban, fill out the bulk of the “place and health” literature. A smaller, more recent set of studies have taken advantage of recent technological and analytic advances (e.g., ecological momentary assessment (EMA)) to track the movements of individuals throughout their days to better understand in-the-moment, context-specific patterns of behaviors/states [7].

Similar concerns about the role of place in the substance abuse research field was initiated somewhat earlier in the 1990s [8–13]. This work highlighted the importance of community alcohol environments and contexts to the development of harmful use and related problems [14]. The early literature largely focused on access to alcohol in community environments (e.g., through alcohol outlets [8]) and typically found that a substantial proportion of alcohol problems was attributable to conditions assessed at the neighborhood level [15]. These population-based studies were supplemented by individual level analyses of use of outlets and their implications for community health [16]. In parallel but somewhat later developments, the social epidemiology literature continued to expand to include measures of the socioeconomic environment [17], neighborhood stressors, and social environment [18]. These studies helped establish that a range of factors, which include both physical places and social spaces, are considered important risk factors for alcohol use and problematic patterns of use. Physical neighborhood characteristics that have been linked to alcohol use include measures of alcohol access (e.g., alcohol outlet densities), physical disorder/decay, and socioeconomic environments (e.g., unemployment rate, median household income). Social environmental factors include both general measures of social environments in neighborhoods, such as social capital and social cohesion, as well as the social composition of locations at specific times of alcohol use (e.g., proportion of drinkers at a party).

While the neighborhood and regional correlates of alcohol use have been and continue to be well-explored [19, 20], the measurement and tracking of individuals through these spaces has only recently begun to emerge in the epidemiology and substance use literatures. In this article we summarize the recent (i.e., since 2015) literature on place and alcohol use and some key weaknesses, describe the challenges of assessing environmental exposures and related risks, and suggest better methods for assessing exposures and risks in environments. By better enumerating and understanding the impacts of contexts on alcohol-related risk, we can develop more precise and effective preventive interventions.

Recent Literature on Space, Place, and Alcohol Use

We conducted a review of recent literature examining contextual factors and alcohol use. Articles were identified through the PubMed database using search terms for alcohol ("alcohol", "alcohol drinking") together with terms related to contextual factors ("neighborhood factors", "community factors", "contextual factors", "residence factors", "space and place", "geospatial", "spatial", "geography"). Filters were added to the search strategy to remove articles related to drinking water and animal models and articles published in languages other than English. Lastly, the search was limited to articles published from 2015 to the time of the search (June 2019).

The search strategy identified 1,826 unique articles. All abstracts were screened and the full-text of 283 articles were reviewed for eligibility. To be eligible for inclusion, articles must have provided quantitative empirical data; examined alcohol use as a dependent variable; examined a construct of space or place of a region, neighborhood, or drinking location as an independent variable; and included a sample with the majority being adults aged 18 or older. Reviews, commentaries, and study protocol papers were excluded. In total, 75 articles met inclusion criteria (See Supplemental Table).

Reviewed studies fell into three main categories, based on their use of contextual factors: 1) Neighborhood or regional-level factors, 2) a single geographic contextual factor (most commonly urban vs. rural residence), and 3) drinking locations and contexts [21].

Regional and Neighborhood Factors

The largest category of studies examined the relationship between neighborhood- and regional-level factors and alcohol use [21–75]. Of the 55 articles included in this category, 46 examined neighborhood-level characteristics [22–67], with 23 articles equating "neighborhoods" with Census tracts or similar administrative units. The most common neighborhood factors examined include alcohol outlet density, neighborhood deprivation and socioeconomic status, neighborhood disorder, education rates, and neighborhood violence and safety. Of the 9 studies examining alcohol outlets [22, 26, 27, 30, 35, 36, 59, 62, 63], 4 differentiated between on- and off-premise outlets [26, 27, 36, 59] and 2 focused exclusively on off-premise outlets [22, 35]. Similarly, 9 articles examined regional-level factors [21, 68–75], with 4 articles at the country level [68–70, 73], 2 at the state level [72, 75], and 4 at the county or smaller regional level [21, 71, 72, 74]. A variety of regional factors were examined, such as country GDP [68–70, 73], gender equality [68–70], regional unemployment [68–71], alcohol advertising restrictions [68–70], average regional price of

alcohol [21], education levels [71], average liberal/conservative vote share [72], country mass media exposure [73], and percent social media posts about alcohol [74, 75]. All but 6 studies [21, 50, 58, 64, 67, 73] in this category were in high-income countries (29 in the United States). Studies primarily measured alcohol use by problematic or binge drinking in the last 30 days, intoxication at the last drinking event, frequency and/or volume of consumption, and the number of drinking days in the last 30 days. A small subset of 8 studies measured alcohol use disorder (AUD) [22, 28, 41, 43, 45, 46, 50, 65] and 2 studies measured alcohol expenditures or purchases [47, 53]. Five studies used a population-level measure of alcohol use as the outcome [47, 68, 69, 74, 75]. Using group-based trajectory and latent growth-mixture modeling, two studies identified unique patterns of use and utilized these identified groups as primary outcomes [32, 55]. It is notable that “alcohol use” is not a coherent construct in this research literature; drinking patterns were measured in many different ways with each way known to have different relationships to drinking environments [76].

All studies in this category used survey data, including 30 articles that used national/state surveillance and/or census data [21, 23–27, 29, 32, 34, 38, 41, 43, 44, 47, 49, 52, 53, 56, 59–61, 67–75] and 25 that recruited community samples [22, 28, 30, 31, 33, 35–37, 39, 40, 42, 45, 46, 48, 50, 51, 54, 55, 57, 58, 62–66]. Seventeen articles presented longitudinal analyses [23, 24, 28, 32, 33, 36, 40, 42, 45, 46, 48, 53–55, 64, 66, 70], with seven having more than 10 years of follow-up [23, 28, 32, 45, 46, 54, 55]. Three studies examined patterns of alcohol use from adolescence through young adulthood [32, 41, 55]. Of note, one study examined the impact of neighborhood factors on the effectiveness of an alcohol-related intervention [37]. Additionally, one study used geographic ecological momentary assessments (GEMA), combining EMA and GIS data [63]. Although all samples included adults, 3 studies focused exclusively on men [34, 51, 61] and six on women [30, 33, 37, 52, 58, 64]. Of the studies focused on women, 2 studies were comprised of pregnant women [37, 64] and 1 of female sex workers [58]. One study included a sample of people living with HIV [63]. Additionally, 7 studies focused on middle-aged or older adults [24, 26, 27, 60, 68–70]. These studies also utilized a variety of analytic methods, including 22 articles with multilevel models [23–26, 31, 34, 37, 39, 40, 44, 48–50, 56, 58, 60, 64, 67–70, 73], 2 with structural equation modeling or path models [41, 65], 1 with spatial regression models [47], 1 with only latent growth mixture models [31], and 27 with generalized linear models [21, 22, 27, 29, 30, 32, 35, 36, 38, 42, 43, 45, 46, 51–55, 57, 59, 61, 62, 66, 71, 72, 74, 75]. A small subset of 2 articles utilized only bivariate analyses [33, 63].

Overall, studies in this category varied widely on their research objectives and measurements of outcomes and contextual factors. Forty-eight studies found a significant result between neighborhood/regional factors and alcohol use. Neighborhood deprivation or SES was most commonly significantly related to alcohol consumption.

Geographic Context

Fifteen articles considered associations between one simple factor of residence and alcohol use [77–91]. The vast majority of these articles (11) examined urban vs. rural residence, determined by population size or density, as a binary variable (though with different cutoff

values) [77, 78, 80, 82–88, 90], while 3 articles used three or more tiers of urbanity (e.g., urban, suburban, large rural town, isolated rural) [79, 81, 89]. Additionally, 1 article examined residence in a disaster community in the United States, defined as previously being impacted by a terrorist attack, versus non-disaster community [91]. It is noteworthy that while these articles only consider a single variable of space and place, 7 articles are focused on low and lower-middle income countries, including Cambodia [85], Ghana [77, 90], India [88], Myanmar [85], Nepal [78], Nigeria [81], and Vietnam [85, 86]. An additional five articles focus on upper-middle income countries, including Brazil [84], China [82, 83], Guatemala [87], and Namibia [80], while only three are focused on high income countries [79, 89, 91]. Twelve articles included outcomes of hazardous alcohol use, frequency, and/or volume [77–80, 82–86, 89–91], while 2 articles measured AUDs and dependence [81, 87] and 1 article included both types of outcomes [88]. Data were obtained from national or regional household surveys and surveillance programs in 12 studies [77–80, 82–84, 86–90] and surveys with community samples were used in the remaining 3 studies [81, 85, 91]. All but 3 studies in this category utilized generalized linear models [77, 78, 80–88, 90] and the remaining articles used only bivariate analyses [79, 89, 91]. Results of these studies varied greatly by geographic context and location. Overall, 10 studies found a significant relationship between alcohol use and rural/urban residence.

Drinking Locations and Contexts

In total, a small subgroup of 6 articles examined the role of microenvironments (i.e., areas smaller than neighborhoods) on alcohol consumption [21, 92–96]. For the purposes of this review, only studies that examined characteristics or types of drinking locations were included. Studies that examined only residence and housing characteristics, such as living in a dorm vs. off-campus, or interpersonal factors were excluded. Overall, all 6 studies compared alcohol use in different drinking locations (e.g., home vs. bar), 2 additionally examined characteristics of people at the location (e.g., number of intoxicated patrons) [92, 96], and 1 examined location-specific factors (e.g., presence of a keg, enforcement of legal drinking age) [92]. One study objectively measured peak blood alcohol content (BAC) using transdermal alcohol sensors [94], while the others used survey-derived measures of alcohol use.

Three studies examining microenvironments focused on the drinking habits of university students [92–94] and 1 study sample was comprised exclusively of gay and bisexual men [96]. A variety of survey sampling designs were utilized, with 2 studies based on national and household surveys [21, 95] and two based on school-based surveys [92, 93]. No studies recruited directly from drinking venues. Further, 2 studies utilized GEMA [94, 96]. One of these studies utilized GPS-enabled devices to track individual’s locations and create spatial plots of a single evening of drinking [94]. The second study tested the effectiveness of location-based GEMA within geofences, or pre-specified locations in which an individual would be asked to complete an assessment upon entering the area [96]. Analytic methods consisted of multilevel models in 2 articles [92, 96], generalized linear models in 2 articles [21, 93], and only bivariate analyses in 2 articles [94, 95]. Although these studies differed in environmental factors examined, 5 studies found significant associations between drinking locations and alcohol use.

Understanding Risks in Contexts

As summarized in the prior section, the recent literature has continued to describe the importance of neighborhood and regional contexts on alcohol use, while a smaller emerging scientific literature assesses the impacts of contexts (here defined as the places where individuals live and/or drinking-related activities take place as well as the social and physical characteristics of those places) on drinking. While these articles have made an important step forward, the dynamic, longitudinal, and multiscale processes by which social and physical structures affect social interactions and substance use have not been uncovered or quantified. In order to understand and quantify these processes, assessments of exposures (e.g., how individuals use space) and risks within specific locations are essential. In this section, we describe some of the key challenges to better understanding context-specific risks.

Assessing Exposures

The typical approach to understanding how environments and contexts impact substance use has been to assign individuals to a home location (or neighborhood), and assume that alcohol environment exposures are only relevant in that one area. In fact, 43 of the 45 neighborhood-level articles in our review of recent literature used this as their approach. While theoretical and empirical developments support the importance of this approach, a critical missing piece in understanding substance use ecology is the measurement and tracking of individuals through these spaces as they purchase and use alcohol.

Routine activities theory [97] provides the framework within which much of the recent efforts to measure social exposures that affect substance use have been developed. The emphasis of routine activities theorists is upon how the daily activity patterns of individuals are shaped by their physical and social environments, moderate exposures to neighborhood conditions, and provide opportunities for substance use and abuse. Building on these concepts, recent research has attempted to elucidate the activity spaces that underlie typical environmental exposures [98, 99]. Activity spaces are defined as that set of locations with which an individual has direct (physical) contact during their typical activities [100]. Activity spaces are most commonly operationalized using sets of “activity locations” where individuals spend time (e.g., grocery store, workplace), captured retrospectively using survey-based lists, guided interviews, geographic coordinates embedded in digital media (e.g. Twitter posts), or prospectively using travel diaries or responses to geographic ecological momentary assessments [101]. More recent work has characterized individuals’ activity spaces using full activity paths that include the precise route paths that individual take to travel between activity locations captured retrospectively (e.g., using GIS-assisted interviews [102]) or prospectively using GPS tracking [103]. Despite these considerable methodological advances, there remains some uncertainty about the best way to reduce such detailed space-time data into functional measures of individuals’ exposure to neighborhood conditions. For example, limits to battery life mean GPS tracking typically provides individuals’ latitude and longitude coordinates at regular intervals (e.g., every 20 seconds). Researchers can then measure exposure within geographic units where GPS points are located (e.g., Census tracts), within buffers around the points, or along interpolated lines

connecting the points. The methodological decisions that researchers make can materially affect estimated associations between exposure to environmental conditions and alcohol consumption [101, 104].

Still underdeveloped is the concept of routine drinking activities and drinking activity spaces. This is the “gold standard” we would like to be able to achieve in order to best understand social and physical environmental spaces that are directly linked with specific alcohol consumption patterns. This is difficult to measure, as it involves layering information specific to drinking (where, when, with who) on top of general activity spaces assessment.

Assessing Risks

In order to understand the social ecology of alcohol use, it is necessary not just to better understand and measure exposures to social and physical environments but also how those exposures lead to risk in specific spaces at specific times. While several of the studies in our review of the literature were longitudinal [32, 42, 53, 55, 70, 94], few combined information about locations and timing of both exposure and risks, which is critical. The temporal specificity of the relationships between ecological contexts and drinking behaviors is dependent on the phenomenon of interest. It seems plausible that acute harms, such as single instances of binge drinking, are related to solitary exposures to specific contexts, such as drinking heavily at an office holiday party. In contrast, the extent to which social ecological contexts influence chronic alcohol-related harms, including AUDs, is less clear [105]. Attendance at a single event, such as our proverbial holiday party, is unlikely to lead a person to develop an AUD (though it may increase risk for an acute problem such as an alcohol-related car crash). However, continued attendance at similar events over time and continued affiliation with people who drink heavily may increase one’s risks for chronic harms.

Available study designs and statistical analytic methods make it difficult to identify the location and timing of specific risky events. We typically rely on the accumulation of risks over time, with the result that analyses of different processes can look deceptively similar. The temporally-specific measurement of people within places is a critical barrier to understanding these processes and developing relevant preventive interventions. We now turn to potential solutions to these measurement issues.

Methods to Assess Exposures and Risks Related to Space and Place and Alcohol

Traditional Approaches: Individual Surveys

As detailed in the above review of the literature, recent advances have primarily focused on studying relationships between static “home” community environments and alcohol in new populations, with only a handful of studies incorporating newer methodologies to better understand spatially- and temporally-specific exposures and risks. There are important things to be learned from more traditional approaches. Survey-based approaches can be used to assess context-specific risks in large populations, and to understand risks in carefully

defined and sampled populations. When used creatively, surveys can even be used with location-based sampling, such as a portal survey of individuals entering a bar on a given night. However, while this approach is ideal conceptually, it appears to be infeasible in practice, as drinkers are hard to access before, during, and immediately after their use of contexts [106]. One alternative is to assess spatially- and temporally-specific exposures and risks retrospectively (for example, through survey-based assessments of activity spaces) [107]. This alternative approach is subject to recall bias and cannot explicate event-specific information or specific social interactions, but it at least begins to examine context-specific associations.

Model-Based Survey Approaches

Recognizing that it is difficult, and may be impossible, to assess day-to-day substance use activities and related problems in representative survey samples, one alternative is to maximize the information yield of survey data using model-based approaches. Specifying expected quantitative relationships between exposures (e.g., frequencies of going to a bar), patterns of alcohol use (e.g., heavy drinking), and problems (e.g., driving after drinking), such models guide the analysis of survey data to the elucidation of these relationships [108–110]. These approaches assume an exposure measurement model for the behavioral processes involved in use and problems, then use that model to determine the functional form relating drinking contexts to use and problems. Using one context-specific model and survey data from over 34,000 college student drinkers, Mair and colleagues [109] found that frequent drinking in many contexts (e.g., Greek or off-campus parties) was associated with greater numbers of sexual partners and unprotected sex, whereas heavier drinking selectively increased risks at bars. In another approach, Gruenewald et al. [111, 112] elucidated the personal (e.g., impulsivity) and social (e.g., outlet density) correlates of the use of drinking contexts (e.g., drinking at bars or at home) and impaired driving across 50 cities in California. They demonstrated that while bars remained a critical point source of impaired driving events, a substantial number were associated with drinking in private residences.

Ecological Momentary Assessment (EMA) and Other Forms of Ecologically- and Temporally-Specific Analyses

Methods such as ecological momentary assessment (EMA) allow us to track individuals' routine activities in (nearly) real time and begin to measure the dynamic, evolving contexts of alcohol use [7]. By this approach, study participants are sent brief surveys, often through mobile devices, regarding their behaviors at specific times. Assessing momentary exposures and outcomes substantially limits recall bias, and enables researchers to assess relationships with high temporal specificity. Adding information about participants' physical locations, either by self-report [113] or through GPS coordinates [114], also enables researchers to assess these relationships with high spatial specificity. For example, Byrnes et al. [114] followed 170 adolescents aged 14 to 16 years for one month using EMA and GPS tracking. They identified that GPS-based measures of exposure to retail alcohol outlets at 100 meters and 200 meters around their GPS activity path was associated with increased drinking frequency over that month, whereas individuals' self reports (i.e. perceived) exposure to alcohol outlets was not associated with alcohol use. Importantly, the individual behaviors assessed using EMAs (e.g., going to a bar) are often specific instances of the same aggregate

behaviors analyzed using model-based approaches (e.g., frequencies of going to a bar); in tandem, the two approaches enable elucidation of how highly stochastic individual behaviors aggregate to support neighborhood problems.

Exponential Random Graph Models and Affiliation Networks

Model-based survey approaches have successfully identified relevant contexts for drinking and related problems, which highlights the importance of understanding what happens within specific contexts to generate excessive problems. Additionally, many studies have noted the importance of social networks in both the initiation and maintenance of drinking behaviors and the processes of treatment and recovery [115, 116]. Affiliation networks are a theoretical and analytical tool to integrate social ecological contexts with social networks and processes. They involve expanding social networks from one mode of interaction (e.g., connections between people) to two modes of interaction (e.g., connections between people in places [117]). Affiliation networks can be analyzed using bipartite graphs and exponential random graph models. These methods have been successfully employed to show, for example, that among adolescents, peer influence via shared participation in organized sports/clubs with drinkers has a significant effect on adolescent drinking [118]. Very little work has taken advantage of these methods in substance use research. While it has been convincingly demonstrated that individual characteristics are strongly related to the assortment of individuals into different drinking contexts among adults [112] and youth [119]), it remains unclear how those assortative processes affect social network structures and related risks [120].

Simulation Models

The development of computational and mathematical models is a vital step in advancing alcohol preventive intervention research. Rather than assume independence among prevention strategies and their effects one-from-the-other, many computational and mathematical models enable us to account for system dependencies among the functional processes that underlie alcohol use. In particular, agent-based modeling approaches can be used to both elucidate specific mechanisms underlying alcohol-related problems and provide a framework for developing comprehensive preventive interventions at the community level [121, 122]. These models can account for significant heterogeneity of agent characteristics and spatially explicit agent interactions, and enable us to investigate the specific ecological circumstances of drinkers and the social mechanisms that facilitate alcohol problems in community settings. For example, Fitzpatrick and Martinez used an agent-based modeling framework to examine how the processes of drinkers assorting themselves into specific drinking venues due to spatial and social (niche) motivations impact the spatial patterns of alcohol-related problems [11]. Such models must be carefully calibrated so that the population of agents reflects the real population of interest for all dependent and independent variables of interest, and must adequately reflect the hypothesized dynamic, longitudinal, and multiscale social ecological processes that drive these context-specific associations, otherwise the resulting associations will merely reflect the input parameters.

Qualitative/Multi-Methods Studies

In order to collect ecologically- and temporally-specific data, combining multiple data collection approaches may be most effective. As described above, data collected via surveys or using more geographically- and temporally-specific measures (e.g., GEMA), provide information on the where, when, and sometimes the who, but motivations (the why) for using or drinking in those places are harder to ascertain. Qualitative interviews can provide valuable and in-depth information on why and how spaces and certain venues are used [123–125]. Qualitative interviews that occur before embarking on surveys can also provide information on the most frequently visited contexts to include in a survey describing activity space locations [126]. In an ongoing study, we are integrating community-level, micro-environmental, and individual behavioral-level data on off-premise alcohol outlets (events) and local residents living within two blocks of these outlets (actors). These are being further boosted by including interviews with those who work at the outlets and intensive spatial secondary data sources. By examining multi-scale mechanisms with mixed-method approaches, we enable explanations of individual risk behaviors in terms of structural, local, population-level characteristics, and provide guidance to the development of effective prevention programs.

Conclusions: Prevention in Contexts

Effective prevention programs require not only the identification of what works but where, when and among whom they work best. Without knowledge of the social and structural features that place individuals at risk for AUDs and problematic alcohol use, ecologically valid preventive programs cannot be developed or implemented. The recent literature on place and alcohol use continues to illustrate the importance of context and neighborhood for alcohol-related outcomes, but largely fails to identify the mechanisms by which these associations arise. A better understanding of the social structures that occur in certain drinking environments and subsequent alcohol use-patterns can help us identify what aspects of environments might be amenable to change to decrease the occurrence of problematic drinking. If research illustrates that specific locations (or types of locations) increase risk for all social ties that form within that location, an intervention focused on eliminating or reducing access to that location would be warranted. If specific types of social ties within contexts (e.g., two impulsive people in a bar at the same time) are risky, interventions could focus on reducing interactions or conflict between impulsive people in that specific location. Finally, if social ties in specific locations are riskier at certain times (e.g., St. Patrick's Day parties; Saturdays from 11PM to 2AM), interventions could focus on reducing risk in those critical time periods. By understanding individuals' behaviors and social ties, and how drinking environments and environmental characteristics alter these, we can develop more precise and effective preventive interventions, both individual-based (e.g., a brief intervention implemented in a specific context to reduce partner conflict) and environmentally-based (e.g., a prevention message that drinking with one's partner in a bar increases risk). Epidemiologists can contribute to this important intervention work by better measuring temporally- and spatially-specific exposures and risks and using the available methodologies being developed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Zucker RA, Hicks BM, Heitzeg MM. Alcohol Use and the Alcohol Use Disorders Over the Life Course: A Cross-Level Developmental Review. Developmental psychopathology. 2016:1–40.
2. Galea S, Nandi A, Vlahov D. The Social Epidemiology of Substance Use. Epidemiologic reviews. 2004;26(1):36–52. doi:10.1093/epirev/mxh007. [PubMed: 15234946]
3. Peacock A, Leung J, Larney S, Colledge S, Hickman M, Rehm J et al. Global statistics on alcohol, tobacco and illicit drug use: 2017 status report. Addiction (Abingdon, England). 2018;113(10):1905–26.
4. Gruenewald P, Grube J, Saltz RF, Paschall MJ. Environmental Approaches to Prevention: Communities and Contexts. In: Miller SC, Fielin DA, Rosenthal RN, Saltz R, editors. The ASAM Principles of Addiction Medicine. 6th ed.: Lippincott Williams & Wilkins; 2018. p. 368–78.
5. Macintyre S, Ellaway A, Cummins S. Place effects on health: how can we conceptualise, operationalise and measure them? Social science & medicine. 2002;55(1):125–39. [PubMed: 12137182]
6. Diez Roux AV, Mair C. Neighborhoods and health. Annals of the New York Academy of Sciences. 2010;1186:125–45. [PubMed: 20201871]
7. Shiffman S Ecological momentary assessment (EMA) in studies of substance use. Psychological assessment. 2009;21(4):486. [PubMed: 19947783]
8. Gruenewald PJ, Millar AB, Treno RJ, Yang Z, Ponicki WR, Roeper P. The geography of availability and driving after drinking. Addiction (Abingdon, England). 1996;91(7):967–83.
9. Gruenewald PJ, Treno AJ, Taff G, Klitzner M. Measuring community indicators: A systems approach to drug and alcohol problems. Sage Publications Thousand Oaks, CA.:; 1997.
10. Saltz RF, Holder HD, Grube JW, Gruenewald PJ, Voas RB. Prevention strategies for reducing alcohol problems including alcohol-related trauma. Alcohol, Cocaine, and Accidents. Springer; 1995. p. 57–83.
11. Fitzpatrick B, Martinez J. Agent-based modeling of ecological niche theory and assortative drinking. Journal of artificial societies and social simulation. 2012;15(2):4.
12. Scribner RA, MacKinnon DP, Dwyer JH. Alcohol outlet density and motor vehicle crashes in Los Angeles County cities. Journal of studies on alcohol. 1994;55(4):447–53. [PubMed: 7934052]
13. Scribner RA, MacKinnon DP, Dwyer JH. The risk of assaultive violence and alcohol availability in Los Angeles County. American journal of public health. 1995;85(3):335–40. [PubMed: 7892915]
14. Holder HD. Planning for alcohol-problem prevention through complex systems modeling: Results from SimCom. Substance use & misuse. 1998;33(3):669–92. [PubMed: 9533735]
15. Scribner RA, Cohen DA, Fisher W. Evidence of a structural effect for alcohol outlet density: a multilevel analysis. Alcoholism: Clinical and experimental research. 2000;24(2):188–95.
16. Gruenewald PJ, Millar AB, Treno AJ. Alcohol availability and the ecology of drinking behavior. Alcohol health and research world. 1993;17:39-.
17. Galea S, Ahern J, Tracy M, Vlahov D. Neighborhood income and income distribution and the use of cigarettes, alcohol, and marijuana. American journal of preventive medicine. 2007;32(6):S195–S202. [PubMed: 17543711]

18. Stockdale SE, Wells KB, Tang L, Belin TR, Zhang L, Sherbourne CD. The importance of social context: Neighborhood stressors, stress-buffering mechanisms, and alcohol, drug, and mental health disorders. Social science & medicine. 2007;65(9):1867–81. [PubMed: 17614176]
19. Jackson N, Denny S, Ameratunga S. Social and socio-demographic neighborhood effects on adolescent alcohol use: A systematic review of multi-level studies. Social science & medicine. 2014;115:10–20. doi:10.1016/j.socscimed.2014.06.004. [PubMed: 24937324]
20. Karriker-Jaffe KJ. Areas of disadvantage: A systematic review of effects of area-level socioeconomic status on substance use outcomes. Drug and alcohol review. 2011;30(1):84–95. doi:10.1111/j.1465-3362.2010.00191.x. [PubMed: 21219502]
21. Radaev V Divergent drinking patterns and factors affecting homemade alcohol consumption (the case of Russia). The international journal on drug policy. 2016;34:88–95. doi:10.1016/j.drugpo.2016.04.016. [PubMed: 27449330]
22. Ahern J, Balzer L, Galea S. The roles of outlet density and norms in alcohol use disorder. Drug and alcohol dependence. 2015;151:144–50. doi:10.1016/j.drugalcdep.2015.03.014. [PubMed: 25858787]
23. Airaksinen J, Hakulinen C, Pulkki-Raback L, Lehtimaki T, Raitakari OT, Keltikangas-Jarvinen L et al. Neighbourhood effects in health behaviours: a test of social causation with repeat-measurement longitudinal data. European journal of public health. 2016;26(3):417–21. doi:10.1093/eurpub/ckv210. [PubMed: 26568621]
24. Astell-Burt T, Feng X. Geographic variation in the impact of a type 2 diabetes diagnosis on behavioural change: A longitudinal study using random effects within-between (REWB) models. Health & place. 2018;54:164–9. doi:10.1016/j.healthplace.2018.07.007. [PubMed: 30286434]
25. Bloomfield K, Berg-Beckhoff G, Seid AK, Stock C. Area-level relative deprivation and alcohol use in Denmark: Is there a relationship? Scandinavian journal of public health. 2019;47(4):428–38. doi:10.1177/1403494818787101. [PubMed: 30101675]
26. Brenner AB, Borrell LN, Barrientos-Gutierrez T, Diez Roux AV. Longitudinal associations of neighborhood socioeconomic characteristics and alcohol availability on drinking: Results from the Multi-Ethnic Study of Atherosclerosis (MESA). Social science & medicine (1982). 2015;145:17–25. doi:10.1016/j.socscimed.2015.09.030. [PubMed: 26439763]
27. Brenner AB, Diez Roux AV, Barrientos-Gutierrez T, Borrell LN. Associations of Alcohol Availability and Neighborhood Socioeconomic Characteristics With Drinking: Cross-Sectional Results From the Multi-Ethnic Study of Atherosclerosis (MESA). Substance use & misuse. 2015;50(12):1606–17. doi:10.3109/10826084.2015.1027927. [PubMed: 26579610]
28. Cambron C, Kosterman R, Rhew IC, Catalano RF, Guttmannova K, Hawkins JD. An Examination of Alcohol Use Disorder Symptoms and Neighborhood Disorganization from Age 21 to 39. American journal of community psychology. 2017;60(1–2):267–78. doi:10.1002/ajcp.12160. [PubMed: 28940467]
29. Castillo JM, Jivraj S, Ng Fat L. The regional geography of alcohol consumption in England: Comparing drinking frequency and binge drinking. Health & place. 2017;43:33–40. doi:10.1016/j.healthplace.2016.11.007. [PubMed: 27894017]
30. Cederbaum JA, Petering R, Hutchinson MK, He AS, Wilson JP, Jemmott JB 3rd et al. Alcohol outlet density and related use in an urban Black population in Philadelphia public housing communities. Health & place. 2015;31:31–8. doi:10.1016/j.healthplace.2014.10.007. [PubMed: 25463915]
31. Chauhan P, Ahern J, Galea S, Keyes KM. Neighborhood Context and Binge Drinking by Race and Ethnicity in New York City. Alcoholism, clinical and experimental research. 2016;40(4):785–93. doi:10.1111/acer.13011.
32. Cook WK, Karriker-Jaffe KJ, Bond J, Lui C. Asian American problem drinking trajectories during the transition to adulthood: ethnic drinking cultures and neighborhood contexts. American journal of public health. 2015;105(5):1020–7. doi:10.2105/ajph.2014.302196. [PubMed: 25393183]
33. De La Rosa M, Huang H, Brook JS, Sanchez M, Rojas P, Kanamori M et al. Sociocultural determinants of substance misuse among adult Latinas of Caribbean and South and Central American descent: A longitudinal study of a community-based sample. Journal of ethnicity in substance abuse. 2018;17(3):303–23. doi:10.1080/15332640.2016.1201716. [PubMed: 27436513]

34. Foster S, Held L, Gmel G, Mohler-Kuo M. Geographical variation in the prevalence of heavy drinking in young Swiss men. European journal of public health. 2016;26(5):850–5. doi:10.1093/eurpub/ckv247. [PubMed: 26851816]

35. Foster S, Hooper P, Knuiman M, Lester L, Trapp G. Associations between proposed local government liquor store size classifications and alcohol consumption in young adults. Health & place. 2018;52:170–3. doi:10.1016/j.healthplace.2018.06.001. [PubMed: 29913358]

36 •. Foster S, Trapp G, Hooper P, Oddy WH, Wood L, Knuiman M. Liquor landscapes: Does access to alcohol outlets influence alcohol consumption in young adults? Health & place. 2017; 45:17–23. doi:10.1016/j.healthplace.2017.02.008. [PubMed: 28258014] Distinguishes between types of alcohol outlets, such on liquor stores, on-premise, and club licenses, and their relationship to alcohol use. All types of outlets were positively associated with alcohol consumption and binge drinking, but effect sizes varied by outlet type and gender.

37. Gootjes DV, van Dijk MR, Koster MP, Willemsen SP, Steegers EA, Steegers-Theunissen RP. Neighborhood Deprivation and the Effectiveness of Mobile Health Coaching to Improve Periconceptional Nutrition and Lifestyle in Women: Survey in a Large Urban Municipality in the Netherlands. JMIR mHealth and uHealth. 2019;7(4):e11664. doi:10.2196/11664. [PubMed: 30973345]

38. Izenberg JM, Mujahid MS, Yen IH. Gentrification and binge drinking in California neighborhoods: It matters how long you've lived there. Drug and alcohol dependence. 2018;188:1–9. doi:10.1016/j.drugalcdep.2018.03.018. [PubMed: 29709759]

39. Jitnarin N, Heinrich KM, Haddock CK, Hughey J, Berkel L, Poston WS. Neighborhood environment perceptions and the likelihood of smoking and alcohol use. International journal of environmental research and public health. 2015;12(1):784–99. doi:10.3390/ijerph120100784. [PubMed: 25594781]

40 •. Karriker-Jaffe KJ, Au V, Frendo M, Mericle AA. Offsetting the Effects of Neighborhood Disadvantage on Problem Drinking. Journal of community psychology. 2017;45(5):678–84. doi:10.1002/jcop.21881. [PubMed: 28943675] Exemplifies studies investigating the impact of neighborhood disadvantage on alcohol use. Disadvantaged neighborhoods were associated with increased odds of problematic alcohol use overall, but there was also an interaction between neighborhood disadvantage and an individual's social support to reduce drinking.

41. Karriker-Jaffe KJ, Lonn SL, Cook WK, Kendler KS, Sundquist K. Chains of risk for alcohol use disorder: Mediators of exposure to neighborhood deprivation in early and middle childhood. Health & place. 2018;50:16–26. doi:10.1016/j.healthplace.2017.12.008. [PubMed: 29334617]

42. Kearns A, Mason P. Regeneration, relocation and health behaviours in deprived communities. Health & place. 2015;32:43–58. doi:10.1016/j.healthplace.2014.12.012. [PubMed: 25618564]

43. Kendler KS, Ohlsson H, Bacanu S, Sundquist J, Sundquist K. The risk for drug abuse, alcohol use disorder, and psychosocial dysfunction in offspring from high-density pedigrees: its moderation by personal, family, and community factors. Molecular psychiatry. 2018. doi:10.1038/s41380-018-0111-8.

44. Kyu HH, Georgiades K, MacMillan HL, Boyle MH. Community- and individual-level factors associated with smoking and heavy drinking among Aboriginal people in Canada. Canadian journal of public health, Revue canadienne de sante publique. 2015;106(2):e22–8. doi:10.17269/cjph.106.4663. [PubMed: 25955668]

45. Lee JO, Jones TM, Kosterman R, Cambron C, Rhew IC, Herrenkohl TI et al. Childhood neighborhood context and adult substance use problems: the role of socio-economic status at the age of 30 years. Public health. 2018;165:58–66. doi:10.1016/j.puhe.2018.09.011. [PubMed: 30384029]

46. Lee JO, Jones TM, Kosterman R, Rhew IC, Lovasi GS, Hill KG et al. The association of unemployment from age 21 to 33 with substance use disorder symptoms at age 39: The role of childhood neighborhood characteristics. Drug and alcohol dependence. 2017;174:1–8. doi:10.1016/j.drugalcdep.2017.01.005. [PubMed: 28273647]

47. Leung A, Law J, Cooke M, Leatherdale S. Exploring and visualizing the small-area-level socioeconomic factors, alcohol availability and built environment influences of alcohol expenditure for the City of Toronto: a spatial analysis approach. Health promotion and chronic

disease prevention in Canada : research, policy and practice. 2019;39(1):15–24. doi:10.24095/hpcdp.39.1.02.

48. Mericle AA, Kaskutas LA, Polcin DL, Karriker-Jaffe KJ. Independent and Interactive Effects of Neighborhood Disadvantage and Social Network Characteristics on Problem Drinking after Treatment. Journal of social and clinical psychology. 2018;37(1):1–21. doi:10.1521/jscp.2018.37.1.1. [PubMed: 29657357]
49. Ng Fat L, Scholes S, Jivraj S. The Relationship Between Drinking Pattern, Social Capital, and Area-Deprivation: Findings From the Health Survey for England. Journal of studies on alcohol and drugs. 2017;78(1):20–9. [PubMed: 27936361]
50. Orozco R, Benjet C, Ruiz Velasco-Acosta S, Moreno Altamirano L, Karriker-Jaffe KJ, Zemore S et al. Area-level disadvantage and alcohol use disorder in northern Mexico. Drug and alcohol dependence. 2017;175:219–26. doi:10.1016/j.drugalcdep.2017.02.011. [PubMed: 28456100]
51. Pachankis JE, Eldahan AI, Golub SA. New to New York: Ecological and Psychological Predictors of Health Among Recently Arrived Young Adult Gay and Bisexual Urban Migrants. Annals of behavioral medicine. 2016;50(5):692–703. doi:10.1007/s12160-016-9794-8. [PubMed: 27094938]
52. Plascak JJ, Hohl B, Barrington WE, Beresford SA. Perceived neighborhood disorder, racial-ethnic discrimination and leading risk factors for chronic disease among women: California Behavioral Risk Factor Surveillance System, 2013. SSM - population health. 2018;5:227–38. doi:10.1016/j.ssmph.2018.07.001. [PubMed: 30094318]
53. Pliakas T, Egan M, Gibbons J, Ashton C, Hart J, Lock K. Increasing powers to reject licences to sell alcohol: Impacts on availability, sales and behavioural outcomes from a novel natural experiment evaluation. Preventive medicine. 2018;116:87–93. doi:10.1016/j.ypmed.2018.09.010. [PubMed: 30218723]
54. Rabinowitz JA, Musci R, Milam A, Benke K, Sisto D, Ialongo NS et al. Contributions of an Internalizing Symptoms Polygenic Risk Score and Contextual Factors to Alcohol-Related Disorders in African American Young Adults. Journal of studies on alcohol and drugs. 2019;80(1):77–85. [PubMed: 30807278]
55. Reboussin BA, Furr-Holden DM, Green KM, Ialongo NS, Rabinowitz JA, Matson PA et al. Social Influences on Drinking Trajectories From Adolescence to Young Adulthood in an Urban Minority Sample. Journal of studies on alcohol and drugs. 2019;80(2):186–95. [PubMed: 31014463]
56. Rhew IC, Kosterman R, Duncan GE, Mair C. Examination of Cross-Sectional Associations of Neighborhood Deprivation and Alcohol Outlet Density With Hazardous Drinking Using a Twin Design. Journal of studies on alcohol and drugs. 2018;79(1):68–73. [PubMed: 29227233]
57 •. Rhew IC, Kosterman R, Lee JO. Neighborhood Typologies Associated with Alcohol Use among Adults in Their 30s: a Finite Mixture Modeling Approach. Journal of urban health. 2017;94(4):542–8. doi:10.1007/s11524-017-0161-2. [PubMed: 28484960] Identifies five types of neighborhoods, based on area sociodemographics, economic indicators, and alcohol outlet availability, and examines the relationship to alcohol use. Neighborhoods with the highest levels of disadvantage were associated with increased weekly alcohol consumption and binge drinking.
58. Semple SJ, Pitpitan EV, Chavarin CV, Strathdee SA, Zavala RI, Aarons GA et al. Prevalence and Correlates of Hazardous Drinking among Female Sex Workers in 13 Mexican Cities. Alcohol and alcoholism (Oxford, Oxfordshire). 2016;51(4):450–6. doi:10.1093/alcalc/agv124.
59. Slutske WS, Deutsch AR, Piasecki TM. Neighborhood Contextual Factors, Alcohol Use, and Alcohol Problems in the United States: Evidence From a Nationally Representative Study of Young Adults. Alcoholism, clinical and experimental research. 2016;40(5):1010–9. doi:10.1111/acer.13033.
60. Son KY, Park SM, Lee J, Kim CY. Difference in adherence to and influencing factors of a healthy lifestyle between middle-aged and elderly people in Korea: A multilevel analysis. Geriatrics & gerontology international. 2015;15(6):778–88. doi:10.1111/ggi.12335. [PubMed: 25256663]
61. Studer J, Baggio S, Grazioli VS, Mohler-Kuo M, Daeppen JB, Gmel G. Risky substance use and peer pressure in Swiss young men: Test of moderation effects. Drug and alcohol dependence. 2016;168:89–98. doi:10.1016/j.drugalcdep.2016.08.633. [PubMed: 27632359]
62. Tanumihardjo J, Shoff SM, Koenings M, Zhang Z, Lai HJ. Association Between Alcohol Use Among College Students and Alcohol Outlet Proximity and Densities. WMJ : official publication of the State Medical Society of Wisconsin. 2015;114(4):143–7. [PubMed: 26436182]

63. Theall KP, Felker-Kantor E, Wallace M, Zhang X, Morrison CN, Wiebe DJ. Considering high alcohol and violence neighborhood context using daily diaries and GPS: A pilot study among people living with HIV. Drug and alcohol dependence. 2018;187:236–41. doi:10.1016/j.drugalcdep.2018.03.005. [PubMed: 29684891]
64. Tofani AA, Lamarca Gde A, Sheiham A, Vettore MV. The different effects of neighbourhood and individual social capital on health-compromising behaviours in women during pregnancy: a multi-level analysis. BMC public health. 2015;15:890. doi:10.1186/s12889-015-2213-4. [PubMed: 26369830]
65. Vaeth PAC, Caetano R, Canino G. Neighborhood factors, drinking behavior, and alcohol use disorder in San Juan, Puerto Rico. The American journal of orthopsychiatry. 2019. doi:10.1037/ort0000402.
66. Wang X, Auchincloss AH, Barber S, Mayne SL, Griswold ME, Sims M et al. Neighborhood social environment as risk factors to health behavior among African Americans: The Jackson Heart Study. Health & place. 2017;45:199–207. doi:10.1016/j.healthplace.2017.04.002. [PubMed: 28475962]
67. Yang XY. How community-level social and economic developments have changed the patterns of substance use in a transition economy? Health & place. 2017;46:91–100. doi:10.1016/j.healthplace.2017.05.009. [PubMed: 28521177]
68 •. Bosque-Prous M, Brugal MT, Lima KC, Villalbi JR, Bartroli M, Espelt A. Hazardous drinking in people aged 50 years or older: a cross-sectional picture of Europe, 2011–2013. International journal of geriatric psychiatry. 2017;32(8):817–28. doi:10.1002/gps.4528. [PubMed: 27388047] Examines the relationship between country-level social and economic indicators and hazardous drinking in eighteen countries. Alcohol advertising restrictions by country was negatively associated with hazardous drinking, while sex differences existed in the impact of country-level economic and gender equality indicators.
69. Bosque-Prous M, Espelt A, Borrell C, Bartroli M, Guitart AM, Villalbi JR et al. Gender differences in hazardous drinking among middle-aged in Europe: the role of social context and women's empowerment. European journal of public health. 2015;25(4):698–705. doi:10.1093/eurpub/cku234. [PubMed: 25616593]
70. Bosque-Prous M, Espelt A, Sordo L, Guitart AM, Brugal MT, Bravo MJ. Job Loss, Unemployment and the Incidence of Hazardous Drinking during the Late 2000s Recession in Europe among Adults Aged 50–64 Years. PloS one. 2015;10(10):e0140017. doi:10.1371/journal.pone.0140017. [PubMed: 26445239]
71. Hamad R, Brown DM, Basu S. The association of county-level socioeconomic factors with individual tobacco and alcohol use: a longitudinal study of U.S. adults. BMC public health. 2019;19(1):390. doi:10.1186/s12889-019-6700-x. [PubMed: 30971249]
72. Kannan VD, Veazie PJ. Political orientation, political environment, and health behaviors in the United States. Preventive medicine. 2018;114:95–101. doi:10.1016/j.ypmed.2018.06.011. [PubMed: 29940293]
73. Mutumba M, Schulenberg JE. Tobacco and Alcohol Use Among Youth in Low and Middle Income Countries: A Multi-Country Analysis on the Influence of Structural and Micro-Level Factors. Substance use & misuse. 2019;54(3):396–411. doi:10.1080/10826084.2018.1497063. [PubMed: 30654696]
74. Nguyen QC, McCullough M, Meng HW, Paul D, Li D, Kath S et al. Geotagged US Tweets as Predictors of County-Level Health Outcomes, 2015–2016. American journal of public health. 2017;107(11):1776–82. doi:10.2105/ajph.2017.303993. [PubMed: 28933925]
75. Nguyen QC, Meng H, Li D, Kath S, McCullough M, Paul D et al. Social media indicators of the food environment and state health outcomes. Public health. 2017;148:120–8. doi:10.1016/j.puhe.2017.03.013. [PubMed: 28478354]
76. Gruenewald PJ, Wang-Schweig M, Mair C. Sources of misspecification bias in assessments of risks related to alcohol use. Journal of studies on alcohol and drugs. 2016;77(5):802–10. [PubMed: 27588539]
77. Addo J, Cook S, Galbete C, Agyemang C, Klipstein-Grobusch K, Nicolaou M et al. Differences in alcohol consumption and drinking patterns in Ghanaians in Europe and Africa: The RODAM Study. PloS one. 2018;13(11):e0206286. doi:10.1371/journal.pone.0206286. [PubMed: 30388130]

78. Aryal KK, Thapa P, Mehata S, Vaidya A, Pandey AR, Bista B et al. Alcohol Use by Nepalese Women: Evidence from Non Communicable Disease Risk Factors STEPS Survey Nepal 2013. Journal of Nepal health research council. 2015;13(29):1–6. [PubMed: 26411705]

79. Harris DE, Aboueissa AM, Baugh N, Sarton C. Impact of rurality on maternal and infant health indicators and outcomes in Maine. Rural and remote health. 2015;15(3):3278. [PubMed: 26195158]

80. He Z, Bishwajit G, Yaya S. Prevalence of Alcohol and Tobacco Use among Men and Women in Namibia. International journal of environmental research and public health. 2018;16(1). doi:10.3390/ijerph16010059.

81. Lasebikan VO, Ayinde O, Odunleye M, Adeyefa B, Adepoju S, Fakunle S. Prevalence of alcohol consumption and alcohol use disorders among outdoor drinkers in public open places in Nigeria. BMC public health. 2018;18(1):400. doi:10.1186/s12889-018-5344-6. [PubMed: 29580226]

82. Liu R, Chen L, Zeng H, Reis C, Reis H, Yang X et al. Tobacco and Alcohol Consumption Rates among Chinese Women of Reproductive Age in 2004–2011: Rate and Sociodemographic Influencing Factors. International journal of environmental research and public health. 2019;16(56). doi:10.3390/ijerph16010056.

83. Liu R, Chen L, Zhang F, Zhu R, Lin X, Meng X et al. Trends in Alcohol Intake and the Association between Socio-Demographic Factors and Volume of Alcohol Intake amongst Adult Male Drinkers in China. International journal of environmental research and public health. 2019;16(4). doi:10.3390/ijerph16040573.

84. Machado IE, Monteiro MG, Malta DC, Lana FCF. Brazilian Health Survey (2013): relation between alcohol use and sociodemographic characteristics by sex in Brazil. Revista brasileira de epidemiologia, Brazilian journal of epidemiology. 2017;20(3):408–22. doi:10.1590/1980-5497201700030005.

85. Peltzer K, Pengpid S. Tobacco and alcohol use among chronic disease patients in Cambodia, Myanmar, and Vietnam. The Southeast Asian journal of tropical medicine and public health. 2016;47(3):536–45. [PubMed: 27405138]

86 •. Pham CV, Tran HTD, Tran NT. Alcohol Consumption and Binge Drinking Among Adult Population: Evidence From the CHILILAB Health and Demographic Surveillance System in Vietnam. Journal of public health management and practice. 2018;24, Suppl 2:S67–s73. doi:10.1097/phh.0000000000000733.Provides an example of a study examining alcohol use and urban and rural residence. Rural residence in Vietnam was associated with a higher prevalence of drinking in the last year, while urban residence was associated with a higher prevalence of binge drinking.

87. Puac-Polanco VD, Lopez-Soto VA, Kohn R, Xie D, Richmond TS, Branas CC. Previous violent events and mental health outcomes in Guatemala. American journal of public health. 2015;105(4):764–71. doi:10.2105/ajph.2014.302328. [PubMed: 25713973]

88. Rathod SD, Nadkarni A, Bhana A, Shidhaye R. Epidemiological features of alcohol use in rural India: a population-based cross-sectional study. BMJ open. 2015;5(12):e009802. doi:10.1136/bmjopen-2015-009802.

89. Samaniego-Vaesken ML, Partearroyo T, Ruiz E, Aranceta-Bartrina J, Gil A, Gonzalez-Gross M et al. The Influence of Place of Residence, Gender and Age Influence on Food Group Choices in the Spanish Population: Findings from the ANIBES Study. Nutrients. 2018;10(4). doi:10.3390/nu10040392.

90. Tampah-Naah AM, Amoah ST. Consumption and drinking frequency of alcoholic beverage among women in Ghana: a cross-sectional study. BMC public health. 2015;15:317. doi:10.1186/s12889-015-1651-3. [PubMed: 25879511]

91. Tucker P, Pfefferbaum B, Nitiema P, Wendling TL, Brown S. Do Direct Survivors of Terrorism Remaining in the Disaster Community Show Better Long-Term Outcome than Survivors Who Relocate? Community mental health journal. 2018;54(4):429–37. doi:10.1007/s10597-017-0160-5. [PubMed: 28849350]

92. Marzell M, Bavarian N, Paschall MJ, Mair C, Saltz RF. Party Characteristics, Drinking Settings, and College Students' Risk of Intoxication: A Multi-Campus Study. The journal of primary prevention. 2015;36(4):247–58. doi:10.1007/s10935-015-0393-4. [PubMed: 25976418]

93. Rodriguez LM, Young CM, Tomkins MM, DiBello AM, Krieger H, Neighbors C. Friends in low places: The impact of locations and companions on 21st birthday drinking. Addictive behaviors. 2016;52:52–7. doi:10.1016/j.addbeh.2015.08.009. [PubMed: 26363304]

94. Clapp JD, Madden DR, Mooney DD, Dahlquist KE. Examining the social ecology of a bar-crawl: An exploratory pilot study. PloS one. 2017;12(9):e0185238. doi:10.1371/journal.pone.0185238. [PubMed: 28953932]

95. Trangenstein PJ, Morojele NK, Lombard C, Jernigan DH, Parry CDH. Heavy drinking and contextual risk factors among adults in South Africa: findings from the International Alcohol Control study. Substance abuse treatment, prevention, and policy. 2018;13(1):43. doi:10.1186/s13011-018-0182-1.

96 •. Wray TB, Perez AE, Celio MA, Carr DJ, Adia AC, Monti PM. Exploring the Use of Smartphone Geofencing to Study Characteristics of Alcohol Drinking Locations in High-Risk Gay and Bisexual Men. Alcoholism, clinical and experimental research. 2019;43(5):900–6. doi:10.1111/acer.13991.Utilizes a 30-day ecological momentary assessment (EMA) and geofencing technology to assess alcohol use and microenvironmental factors when a participant is at a specific, pre-identified drinking location. While technological improvements are still needed, this study indicates that geofencing has the potential to improve data collection of location-specific contextual factors (e.g., number of intoxicated patrons) at drinking locations.

97. Cohen LE, Felson M. Social change and crime rate trends: A routine activity approach. American sociological review. 1979:588–608.

98. Freisthler B, Thomas CA, Curry SR, Wolf JP. An alternative to residential neighborhoods: An exploratory study of how activity spaces and perception of neighborhood social processes relate to maladaptive parenting. Child & youth care forum. 2016;45(2):259–77. [PubMed: 27057130]

99. Martinez AN, Lorvick J, Kral AH. Activity spaces among injection drug users in San Francisco. International journal of drug policy. 2014;25(3):516–24. [PubMed: 24374172]

100. Horton FE, Reynolds DR. Effects of urban spatial structure on individual behavior. Economic geography. 1971;47(1):36–48.

101. Morrison CN, Byrnes HF, Miller BA, Kaner E, Wiehe SE, Ponicki WR et al. Assessing Individuals' Exposure to Environmental Conditions Using Residence-based Measures, Activity Location–based Measures, and Activity Path–based Measures. Epidemiology (Cambridge, Mass). 2019;30(2):166–76.

102. Wiebe DJ, Richmond TS, Guo W, Allison PD, Hollander JE, Nance ML et al. Mapping activity patterns to quantify risk of violent assault in urban environments. Epidemiology (Cambridge, Mass). 2016;27(1):32.

103. Zenk SN, Schulz AJ, Matthews SA, Odoms-Young A, Wilbur J, Wegrzyn L et al. Activity space environment and dietary and physical activity behaviors: a pilot study. Health & place. 2011;17(5):1150–61. [PubMed: 21696995]

104. Freisthler B, Lipperman-Kreda S, Bersamin M, Gruenewald PJ. Tracking the when, where, and with whom of alcohol use: Integrating ecological momentary assessment and geospatial data to examine risk for alcohol-related problems. Alcohol research: current reviews. 2014;36(1):29. [PubMed: 26258998]

105. Gilmore W, Chikritzhs T, Stockwell T, Jernigan D, Naimi T, Gilmore I. Alcohol: taking a population perspective. Nature reviews: Gastroenterology & hepatology. 2016;13(7):426. [PubMed: 27188823]

106. Morrison C, Lee JP, Gruenewald PJ, Marzell M. A critical assessment of bias in survey studies using location-based sampling to recruit patrons in bars. Substance use & misuse. 2015;50(11):1427–36. [PubMed: 26574657]

107. Freisthler B, Thomas CA, Curry SR, Wolf JP, editors. An alternative to residential neighborhoods: An exploratory study of how activity spaces and perception of neighborhood social processes relate to maladaptive parenting. Child & youth care forum; 2016: Springer.

108. Gruenewald PJ, Johnson FW, Ponicki WR, LaScala EA. A dose–response perspective on college drinking and related problems. Addiction (Abingdon, England). 2010;105(2):257–69.

109. Mair C, Lipperman-Kreda S, Gruenewald PJ, Bersamin M, Grube JW. Adolescent drinking risks associated with specific drinking contexts. Alcoholism: Clinical and experimental research. 2015;39(9):1705–11.
110. Huckle T, Gruenewald P, Ponicki WR. Context-specific drinking risks among young people. Alcoholism: Clinical and experimental research. 2016;40(5):1129–35.
111. Gruenewald PJ, LaScala EA, Ponicki WR. Identifying the Population Sources of Alcohol Impaired Driving: An Assessment of Context Specific Drinking Risks. Journal of studies on alcohol and drugs. 2018;79(5):702–9. [PubMed: 30422783]
112. Gruenewald PJ, Remer LG, LaScala EA. Testing a social ecological model of alcohol use: the California 50-city study. Addiction (Abingdon, England). 2014;109(5):736–45.
113. Collins RL, Kashdan TB, Gollnisch G. The feasibility of using cellular phones to collect ecological momentary assessment data: Application to alcohol consumption. Experimental and clinical psychopharmacology. 2003;11(1):73. [PubMed: 12622345]
114. Byrnes HF, Miller BA, Morrison CN, Wiebe DJ, Woychik M, Wiehe SE. Association of environmental indicators with teen alcohol use and problem behavior: Teens' observations vs. objectively-measured indicators. Health & place. 2017;43:151–7. [PubMed: 28061392]
115. Rosenquist JN, Murabito J, Fowler JH, Christakis NA. The spread of alcohol consumption behavior in a large social network. Annals of internal medicine. 2010;152(7):426. [PubMed: 20368648]
116. Valente TW, Gallaher P, Mouttapa M. Using social networks to understand and prevent substance use: A transdisciplinary perspective. Substance use & misuse. 2004;39(10–12):1685–712. [PubMed: 15587948]
117. Borgatti SP, Halgin DS. Analyzing affiliation networks. The Sage handbook of social network analysis. 2011;1:417–33.
118. Fujimoto K, Valente TW. Alcohol peer influence of participating in organized school activities: A network approach. Health psychology. 2013;32(10):1084. [PubMed: 22924449]
119. Lipperman-Kreda S, Mair CF, Bersamin M, Gruenewald PJ, Grube JW. Who drinks where: Youth selection of drinking contexts. Alcoholism: clinical and experimental research. 2015;39(4):716–23.
120. Gruenewald PJ. The spatial ecology of alcohol problems: niche theory and assortative drinking. Addiction (Abingdon, England). 2007;102(6):870–8.
121. Dray A, Mazerolle L, Perez P, Ritter A. Policing Australia's 'heroin drought': using an agent-based model to simulate alternative outcomes. Journal of experimental criminology. 2008;4(3):267–87.
122. Gorman DM, Mezic J, Mezic I, Gruenewald PJ. Agent-based modeling of drinking behavior: a preliminary model and potential applications to theory and practice. American journal of public health. 2006;96(11):2055–60. [PubMed: 17018835]
123. Sommer M, Parker R, Msacky G, Kajula L, Kaaya S. How Alcohol, Space, and Time Influence Young People's Sexual Encounters in Tanzania: A Qualitative Analysis. Archives of sexual behavior. 2019:1–11. [PubMed: 30635817]
124. Dilkes-Frayne E, Fraser S, Pienaar K, Kokanovic R. Iterating 'addiction': Residential relocation and the spatio-temporal production of alcohol and other drug consumption patterns. The International journal on drug policy. 2017;44:164–73. doi:10.1016/j.drugpo.2017.05.024. [PubMed: 28578915]
125. Wilkinson B, Ivsins A. Animal house: University risk environments and the regulation of students' alcohol use. The International journal on drug policy. 2017;47:18–25. doi:10.1016/j.drugpo.2017.06.002. [PubMed: 28668342]
126. Wolf JP, Freisthler B, Kepple NJ, Chavez R. The places parents go: understanding the breadth, scope, and experiences of activity spaces for parents. GeoJournal. 2017;82(2):355–68. [PubMed: 28392621]