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Original Research

Longitudinal impacts of two causal drivers of alcohol demand on outlet concentrations within community settings: Population size and income effects☆

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ABSTRACT

We analyzed counts of licensed bars, restaurants and off-premise alcohol outlets within 53 California cities from 2000–2013. Poisson models were used to assess overall space-time associations between outlet numbers and population size and median household income in local and spatially adjacent block groups. We then separated covariate effects into distinct spatial and temporal components ("decomposed" models). Overall models showed that densities of all outlet types were generally greatest within block groups that had lower income, were adjacent to block groups with lower income, had greater populations, and were adjacent to block groups that had greater populations. Decomposed models demonstrate that over time greater income was associated with increased counts of bars, and greater population was associated with greater numbers of restaurants and off-premise outlets. Acknowledging the many negative consequences for populations living in areas of high outlet density, these effects are a predictable and powerful social determinant of health.

1. Introduction

This paper is concerned with two very general questions in the assessment of public health problems related to alcohol use: (1) Are there detectable long-term effects of alcohol demand on alcohol markets within cities and communities of the US? If so, (2) can we estimate the relative magnitude of these effects? This will hopefully allow us to begin to predict some of the known long-term health consequences for populations living in and near to such markets. If the answer to both questions is "yes," then we can use this information to inform simulation models used to predict health outcomes related to alcohol markets across community areas (Holder, 1998; Fitzpatrick and Martinez, 2012). These, in turn, can be used to help guide regulatory policies intended to ameliorate some of the most significant problems related to these markets in community settings (Gruenewald, 2011). One difficult problem for such models is the representation of reciprocal relationships between alcohol supply and demand at the large-scale

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community and fine-scale neighborhood levels; it is expected that alcohol outlets will open to sell alcohol and meet market demand, that subsequent greater supply will induce yet greater demand, and this system will come to equilibrium at some new level of use. The dynamics are, on-the-face-of-it, trivial. That is, in any case, until one realizes that both supply and demand are expressed across neighborhoods and communities linked by transportation systems that provide greater or lesser access to markets and populated by drinkers who will travel greater or lesser distances to obtain alcohol (Gruenewald, 2007). At that point, the problem becomes more complex, requiring comparative static geographic models applied in urban economics to help elucidate the causal factors that determine market locations relative to sources of demand (O' Sullivan, 2007; Hanson, 2005).

To keep some of this complexity at bay it is helpful to consider some basic theoretical ideas and empirical observations that have been used to analyze the geography of alcohol markets across community areas. Deriving their hypotheses from urban economic and economic geographic theory, Morrison et al. (2015a,b, 2016) used community level data to empirically assess expected impacts of population size and income on alcohol market locations: In both metropolitan and rural areas, outlets locate near to residential neighborhoods with high alcohol demand (e.g., high income areas with large populations); outlets locate in areas with low land and structure rents (to minimize costs of operation); outlets are excluded from residential areas with high land and structure rents (the 'not in my backyard' phenomenon); and outlets locate near to one another (to share resources, economic agglomeration). While there are some minor distinctions as to effects across outlets of different types (i.e., bars, restaurants and off-premise establishments), over time these processes concentrate outlets in low income, often minority, areas of communities near to high income residential neighborhoods, a fact long known in the alcohol research literature (Gorman and Speer, 1997; LaVeist and Wallace, 2000).

The work of Morrison and colleagues also established, first, that expected demand and land rent effects can be observed in cross-sectional data and, second, that population size and income are differently related to outlet locations: While demand across community areas is strongly related to population size and income, land and structure rents are reflected in income alone. Population size has one effect, to increase the volume of demand. Income has two effects, to increase demand and, to the degree that income acts a surrogate for land and structure rents, exclude alcohol markets. More critically, it appears that the effects of income are expressed at two different spatial scales with the demand effects operating across larger geographic areas (e.g., cities) and rent effects operating locally (e.g., within Census block group areas). Importantly, population and income effects are spatially separable. Finally, as these economic forces shape locations of alcohol markets, over-concentrations of outlets, especially bars, lead to greater harms like violent assaults, accidents and injuries (Popova et al. 2009; Campbell et al. 2009). Thus, as we come to better understand the social and economic forces that affect the development of alcohol markets in community settings we also come to identify those neighborhoods and communities most affected by problems related to those outlets.

In this study we consider the extent to which population and income effects are sustained across spatially adjacent units over time. As motivation, we note individual consumers may purchase alcohol either near to their homes or across broader adjacent neighborhood and city areas as they travel as part of their routine daily activities. Thus, concentrations of alcohol markets may be affected by population and area characteristics of a local geographic region, nearby regions, and broader retail market areas such as a city. Because alcohol licenses require some effort to obtain and are not easily moved, outlets in a given location may respond slowly to temporal changes in alcohol demand and may be related to spatial variations in demand at differing resolutions (i.e., local, nearby and city areas). To-date, a major weakness of all studies of community level impacts of alcohol outlets on public health problems has been the failure to assess these multi-scale spatio-temporal effects (Morrison et al. 2015c). Thus, the main contribution of the current study is to utilize a statistical modeling approach that decomposes multilevel spatial and temporal influences of two key drivers of alcohol demand – income and population – as they relate to densities of alcohol outlets in 53 California cities from 2001 to 2013. The covariate decomposition approach detailed in the sections below provides a method to separate the *overall* spatiotemporal association of population size and income with alcohol outlets into different spatial and temporal scales. Cross-sectional spatial components of the model reflect the impacts of long-term spatial segregation of alcohol outlets into specific community areas (e.g., population segregation into wealthy and poor areas) at different spatial-scales (e.g., neighborhood versus city). Temporal components reflect relatively short-term impacts of income and population on locations of outlets over the 13 years of available data.

2. Methods

We collected data on alcohol retail outlets and other variables for 53 medium-sized cities in California over the years 2001 through 2013. As part of a larger study of the social ecology of alcohol outlets and related problems in the state, these non-adjacent cities were randomly selected from a universe of 138 incorporated municipalities with between 50,000 and 500,000 residents as of the 2000 Census. Block groups were included in these analyses if their geographic centroids were within the outer boundaries of one of these 53 cities. U.S. counties are subdivided into census tracts of approximately 3,000–6,000 people, which in turn are subdivided into block groups of approximately 600–3,000 people. The 53-city data set included 3870 of the statewide total of 22,132 block groups, with the individual cities ranging from 23 block groups in Temecula to 328 in Sacramento.