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Activity spaces of men who have sex with men: An initial exploration of geographic variation in locations of routine, potential sexual risk, and prevention behaviors

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ABSTRACT

Theory and research on HIV and among men who have sex with men (MSM) have long suggested the importance of non-residential locations in defining structural exposures. Despite this, most studies within these fields define place as a residential context, neglecting the potential influence of non-residential locations on HIV-related outcomes. The concept of activity spaces, defined as a set of locations to which an individual is routinely exposed, represents one theoretical basis for addressing this potential imbalance. Using a one-time online survey to collect demographic, behavioral, and spatial data from MSM, this paper describes activity spaces and examines correlates of this spatial variation. We used latent class analysis to identify categories of activity spaces using spatial data on home, routine, potential sexual risk, and HIV prevention locations. We then assessed individual and area-level covariates for their associations with these categories. Classes were distinguished by the degree of spatial variation in routine and prevention behaviors (which were the same within each class) and in sexual risk behaviors (i.e., sex locations and locations of meeting sex partners). Partner type (e.g. casual or main) represented a key correlate of the activity space. In this early examination of activity spaces in an online sample of MSM, patterns of spatial behavior represent further evidence of significant spatial variation in locations of routine, potential HIV sexual risk, and HIV prevention behaviors among MSM. Although prevention behaviors tend to have similar geographic variation as routine behaviors, locations where men engage in potentially high-risk behaviors may be more spatially focused for some MSM than for others.

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1. Introduction

Despite recent global and national declines in new HIV infections, HIV incidence has increased among young MSM and both geographic and racial/ethnic disparities remain (Centers for Disease Control and Prevention, 2015a; Lieb et al., 2011; Prejean et al., 2011). These continued disparities suggest that, relative to other high-risk groups, large-scale HIV prevention efforts focusing on individual behavior change have been less effective in slowing the HIV epidemic among MSM (Sullivan et al., 2012). In response, the role of place, including network and structural factors, in patterning risk and prevention behaviors has received renewed attention (Baral et al., 2013; Buot et al., 2014; Frye et al., 2006; Millett et al., 2012).

However, most studies within the HIV literature define place as a residential context, neglecting the potential influence of non-residential locations on HIV-related outcomes (Bowleg et al., 2014; Buttram and Kurtz, 2013; Carpiano et al., 2011; Jeffries et al., 2013; Latkin et al., 2013; Surratt et al., 2015; Vaughan et al., 2014). Place-based theory and research on HIV and among MSM have long suggested the importance of non-residential locations in defining structural exposures (Baral et al., 2013; Buot et al., 2014; Frye et al., 2006; Lansky et al., 2000; Verghese et al., 1989). Non-residential locations may be especially critical in health research

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among MSM, for whom routine behaviors may be separate from HIV risk and prevention behaviors due to either stigmatization or the spatial distribution of resources (Carrel et al., 2014; Oster et al., 2013, 2011; Rothenberg et al., 2005; Sibley, 1995; Tobin et al., 2014, 2013).

In response, the concept of activity spaces, defined as a set of locations to which an individual is routinely exposed, has been developed. This concept formally acknowledges the potential influence of non-residential locations (Inagami et al., 2007; Matthews and Yang, 2013; Perchoux et al., 2013) and has recently entered the MSM health literature (Duncan et al., 2014a; Koblin et al., 2013). With these initial descriptions, these studies employed the geographic overlap of neighborhoods to show that MSM largely socialize and have sex outside of their residential neighborhoods. The natural next step in this emerging body of research is to more fully describe spatial patterns in these locations. That is, given the existence of this geographic overlap in these behaviors, we may now explore *where* this geographic overlap of behaviors occurs.

Describing these spatial patterns may inform the geographic targeting of interventions to where relevant behaviors occur, rather than where individuals live (Aral et al., 2015; Lasry et al., 2012; Nunn et al., 2014). Additionally, this descriptive work sets the stage for future research into potential associations with non-residential contexts and activity spaces on HIV sexual risk and prevention behaviors of MSM. Therefore, using a one-time survey to collect demographic, behavioral, and spatial data from an online sample of MSM, this analysis describes activity spaces of MSM and examines correlates of these spatial patterns.

2. Methods

2.1. Recruitment

Participants were recruited using Facebook banner ads targeted to users based on geography and interests, with ads running from September 21 through October 5, 2015 (Appendix A). This method yields samples similar to venue-based methods of recruiting MSM (Hernandez-Romieu et al., 2014; Sullivan et al., 2014, 2011). A $3 donation to a charity the participant selected from a pre-defined list was provided as incentive.

Eligible participants were required to be: male at birth, aged 18 + years, report at least one male sex partner in the past 6 months, able to read and write English, and to reside in one of nine metropolitan statistical areas (MSA) with the largest numbers of new diagnoses in 2013 (New York City, Miami, Los Angeles, Washington, DC, Atlanta, Chicago, Houston, Dallas, and Philadelphia). In the United States, these MSAs represent half of all new HIV cases (Centers for Disease Control and Prevention, 2015a) and approximately 35% of the MSM population (Grey et al., 2016). MSA boundaries were defined using the U.S. Census Bureau's 2013 delineations.

2.2. Collection of place-based data

Consenting participants completed an online survey containing demographic and behavioral questions, including residential ZIP code at the time of data collection. In addition to these questions, participants indicated specific locations by dropping a pin onto a Google map embedded within the survey. This tool is valid and reliable for a broad sample of MSM (Dasgupta et al., 2014; Vaughan et al., 2016). The requested locations may be grouped into those associated with routine behaviors, with potential HIV sexual risk behaviors, and with HIV prevention behaviors as follows (Appendix B):

- Routine locations: Home; work or school location (if the participant reported working at least part time or being a student); two socialization locations; primary care physician (if the participant reported having a regular primary care physician); pharmacy (if the participant reported having a regular pharmacy).
- Potential sexual risk locations: For the past three sex partners within the past six months, the location where the participant met the partner and the location of the most recent sexual encounter. The locations of meeting sex partners are included in this category since these types of locations may connect sexual networks and be associated with high-risk sexual behaviors (Kelly et al., 2012; Oster et al., 2013; Tobin et al., 2014). Participants were allowed to report meeting sex partners online or using a mobile app. Since these are not physical locations, they were not considered in this analysis.
- Prevention locations: Location of last HIV test, within the past year; location of last test for another sexually transmitted infection (STI), within the past year; primary care physician and pharmacy (if the participant reported currently receiving HIV treatment or regularly taking pre-exposure prophylaxis (PrEP)). Pharmacy and physician locations included as prevention locations were excluded as routine locations.

2.3. Covariate measures

2.3.1. Individual-level covariates

As an individual's activity space may be defined by either the individual's choices or by constraints placed upon the individual (Matthews and Yang, 2013), covariates included in the study represented demographic variables, transportation-related variables, HIV-related variables, and geographic factors that could spatially influence an individual's activity space. Demographic variables were: age, race, education, and recent immigration. Age was categorized into three groups with breaks at ages 30 and 51, with the age 30 representing the age division between increasing and stable rates of new HIV diagnosis and age 51 reflecting the Centers for Disease Control and Prevention's reporting of HIV surveillance data (Centers for Disease Control and Prevention, 2015a; 2015b). Self-reported race/ethnicity was categorized as Hispanic/Latino, non-Hispanic black ("black"), non-Hispanic white ("white"), or non-Hispanic other ("other"). Education was categorized as high school diploma or less, any college, or college degree. Participants were also asked when they moved to their current town.

Transportation-related variables included primary mode of transportation and transportation instability. Primary mode of transportation was dichotomized into primarily using a car or primarily using other, non-car transportation. Transportation instability was defined as any reported instance within the past six months of being unable to do something necessary because of not having a way to get there.

HIV-related factors included HIV-status, partner type, and outness. HIV status was self-reported. Participants were allowed to respond to questions about up to three sex partners in the last six months. Each sex partner was identified as a main or casual partner. The degree to which the participant's sexual orientation was known to others ("outness") was assessed using a seven-point scale, with values of 6 or 7 categorized as highly out (Pachankis et al., 2008).

2.3.2. Area-level covariates

We also included geographic factors that represent higher-level social context and the spatial distribution and availability of resources. MSA was defined as the MSA where the participant

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