Disadvantage, Disorder, and Distress in Everyday Life: Results from a Smartphone-Based Study in New York City

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ABSTRACT
Research shows that socioeconomic disadvantage and disorder in the residential neighborhood context threaten health and well-being, particularly in later life. But less is known about the relevance of non-residential locations of daily activity and social interaction. This paper uses data from a smartphone-based study of 61 older adults in three New York City neighborhoods to examine how disadvantage and disorder in real-time environments is associated with physiological and psychological distress. Respondents were provided with iPhones, which captured their GPS locations in 5-minute intervals and administered four surveys per day. I use these data to examine variation in exposure to non-residential social contexts, and to consider how exposure to disadvantage and disorder during daily activities affects real-time fluctuations in symptoms of distress. I conclude by discussing next steps for the development of this method and its potential for research on social context and health.

Social scientific research investigating the effects of neighborhood conditions on health and well-being has grown rapidly in the past few decades. This work points to the relevance of neighborhood socioeconomic characteristics (Browning & Cagney 2003), physical features of the built environment (Sallis, et al. 2009), neighborhood-level social cohesion and collective efficacy (Cagney & Browning 2004; Morenoff 2003), and neighborhood disorder (Ross & Mirowsky 2001). An important consideration is the extent to which inequalities in residential neighborhoods contribute to persistent racial/ethnic disparities in health (Robert 1999).

The neighborhood context can be particularly consequential for older adults. Later life is often marked by social and physiological changes such as retirement, bereavement, and the development of functional impairments. These shape access to resources and social engagement, and render older adults especially vulnerable to – and dependent upon – characteristics of their social environments (Cagney & York Cornwell 2010; Robert & Li 2001).

However, the large body of research on how neighborhood context affects morbidity and mortality among older adults has focused on the residential neighborhood. The implicit assumption is that the residential context is the only – or the most consequential – social space in everyday life of older adults. Conventional empirical approaches to studying residential neighborhood context often narrow the focus even further by relying on the residential Census tract as a proxy for the residential neighborhood. Such approaches do not capture the full range of individuals’ exposures to social contexts as they move beyond their local environments for daily activities and social interactions.

The goal of this paper is to consider the potential of real-time data collection for the assessment of how disadvantage and disorder in social environments – including, but not limited to, the residential neighborhood – shape health and well-being in later life. I focus on the association between the social environment and physiological and psychological indicators of distress. Previous research suggests that socioeconomic disadvantage and disorder in the residential context is associated with indicators of both physiological distress (e.g., pain, nausea, weakness) and psychological distress (e.g., feelings of stress and fear) (Hill, Ross, and Angel 2005). Taken together, these forms of distress may lead to impaired physical function as well as increased risks of infectious disease, respiratory illness, depression, and mortality.
I focus on two central research questions:

1) Is the association between residential neighborhood disadvantage and disorder and distress conditioned by the relevance of other social spaces in individuals’ daily lives?

2) How do conditions of the spaces of daily life affect short-term fluctuations in indicators of psychological and physiological distress?

To explore these questions, I use unique data from a smartphone-based study of older adults in three New York City neighborhoods. Over the course of a week, iPhones carried by respondents captured their GPS locations in 5-minute intervals and allowed completion of ecological momentary assessments (EMAs). Preliminary results indicate wide variation across respondents in the relevance of residential neighborhood contexts in daily life; further analyses will explore how these variations affect distress. I also find early evidence that exposure to disorder in spaces of daily activities is associated with greater likelihood of reporting pain and fatigue, which are indicative of physiological distress. After reviewing results from this pilot study, I will conclude by discussing next steps for the development of this method and consider its potential for further research on social context and health in later life.

Data

I use data from Real-time Neighborhoods and Social Life Study (RNSLS), which was funded by small grants from the Cornell Population Center (CPC) and the Institute for Social Sciences, and conducted in collaboration with Older Adults Technology Services (OATS), a non-profit organization in New York City. Respondents were recruited through convenience sampling at four senior centers in three New York City neighborhoods: Corsi Senior Center in East Harlem, Stein Senior Center in Gramercy Park, and Quincy Senior Center and Fort Greene Senior Center in Bedford-Stuyvesant (Brooklyn). The neighborhoods were selected to maximize racial/ethnic and socioeconomic diversity in the sample. In total, 61 individuals, ages 60 and over, participated in the study.

During the October-November 2014, 61 respondents were provided with iPhones to carry for seven days. On Days 1-7, the iPhones captured GPS locations at 5-minute intervals. On Days 3-6, respondents were “pinged” via text message four times per day to complete brief Ecological Momentary Assessments (EMAs), for a total of 17 EMAs per respondent. Each EMA captured information about the respondent’s real-time location and self-reported health status. More than 96% of the EMAs were completed, and the majority of them within 10 minutes of the ping. GPS locations also had good accuracy (with median radius of 10 meters) and very little missing data.

Preliminary Results

First, I will consider how overall levels of distress are associated with disadvantage and disorder in the residential context – and whether this association is conditioned by the relevance of the residential context in daily life. I will assess the relevance of the residential context using measures such as: a) the percentage of time spent in the residential Census tract; b) the total distance traveled from the residential Census tract; and 3) the extent to which social activities occur within the residential Census tract.

Early analysis of the GPS data shows substantial variation in relevant social spaces of daily life across individual respondents. Figure 1 presents respondents’ GPS locations mapped onto Census tracts in New York City. Panels 1a and 2a show all GPS locations captured from respondents who were recruited in two different neighborhoods: Gramercy Park (1a) and Bedford-Stuyvesant (2a). Panels 1b and 1c show GPS locations from two separate respondents who live in Gramercy Park and Panels 2b and 2c show GPS locations from two respondents who live in Bedford-Stuyvesant. In Panel 1b, the respondent stays close to Gramercy, with locations clustered in midtown Manhattan. But the respondent in panel 1c...
travels much further north (around Central Park), as well as further south toward lower Manhattan, and over to Brooklyn. Panel 2b shows a pattern of daily activities that are clustered around a main thoroughfare (Fulton Street) or bus route along that thoroughfare, while the respondent in Panel 2c travels much more widely in Brooklyn, lower Manhattan, and Queens. The next step will be to consider how the extent to which daily life is centered in the residential tract shapes the relevance of the residential neighborhood for overall levels of psychological and physiological distress.

To address my second research question, I will consider how characteristics of the local social environment are associated with real-time reports of physiological and psychological distress. For this portion of the paper, I will draw on data from the EMAs. I focus on reports of stress and fear as indicators of psychological distress and reports of pain and fatigue as indicators of physiological distress. Because each respondent completed EMAs at up to 17 time points across four days (mean = 16.3 completed EMAs), I estimate multilevel models with observations nested within respondents. Preliminary results are presented in Table 1 below. Respondents who observed more disorder in their immediate environment were more likely to report experiencing pain (OR = 1.578; p < .01) or feeling fatigued (OR = 1.404; p < .05). Disorder also seems to be positively associated with fear, although the relationship does not achieve statistical significance (OR = 1.298; p = .07). Further analyses will incorporate characteristics from the Census tract or block group for each of these daily locations, which will allow me to assess the role of localized socioeconomic disadvantage in physiological and psychological distress.

### Table 1. Coefficients from Multilevel Logistic Regression Models Predicting the Experience of Physiological and Psychological Distress

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Stress(^a) (OR) (SE)</th>
<th>Fear(^b) (OR) (SE)</th>
<th>Pain(^c) (OR) (SE)</th>
<th>Fatigue(^d) (OR) (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disorder(^e) (range = 0, 7)</td>
<td>1.072 (.148)</td>
<td>1.298(\dagger) (.187)</td>
<td>1.578** (.267)</td>
<td>1.404* (.200)</td>
</tr>
<tr>
<td>At home (yes = 1, no = 0)</td>
<td>1.343 (.319)</td>
<td>.185 (.050)</td>
<td>1.157 (.348)</td>
<td>1.801* (.410)</td>
</tr>
<tr>
<td>Time of day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning (ref.)</td>
<td>---</td>
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</tr>
<tr>
<td>Early afternoon</td>
<td>1.934* (.583)</td>
<td>.710 (.221)</td>
<td>.588 (.224)</td>
<td>1.896* (.570)</td>
</tr>
<tr>
<td>Late afternoon</td>
<td>1.075 (.328)</td>
<td>1.122 (.349)</td>
<td>.687 (.257)</td>
<td>3.271*** (.975)</td>
</tr>
<tr>
<td>Evening</td>
<td>1.450 (.408)</td>
<td>.907 (.265)</td>
<td>.644 (.230)</td>
<td>3.279*** (.926)</td>
</tr>
<tr>
<td>N of respondents</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td>N of observations</td>
<td>995</td>
<td>990</td>
<td>993</td>
<td>993</td>
</tr>
</tbody>
</table>

\(\dagger p < .10; *p < .05; **p < .01; ***p < .001\) (two-tailed tests)

\(^a\) Respondent reports feeling at least "slightly stressed" (28.09% of observations).

\(^b\) Respondent reports feeling less than "extremely safe" (71.64% of observations).

\(^c\) Respondent reports feeling "a little" or "a lot" of pain (32.50% of observations).

\(^d\) Respondent reports feeling "somewhat" or "very" tired (33.70% of observations).

\(^e\) Count of features of disorder in current location, as reported by respondent (mean = .996)
Figure 1. GPS Data from Respondents in Gramercy Park (Manhattan) and Bedford-Stuyvesant (Brooklyn), Mapped on Census Tracts

1a. GPS points from respondents at Stein Senior Center in Gramercy Park (Manhattan)
1b. GPS locations and residential Census tract of Respondent A (Gramercy Park)
1c. GPS locations and residential Census tract of Respondent B (Gramercy Park)

2a. GPS points from respondents at Fort Greene Senior Center in Bedford-Stuyvesant (Brooklyn)
2b. GPS locations and residential Census tract of Respondent C (Bedford-Stuyvesant)
2c. GPS locations and residential Census tract of Respondent D (Bedford-Stuyvesant)