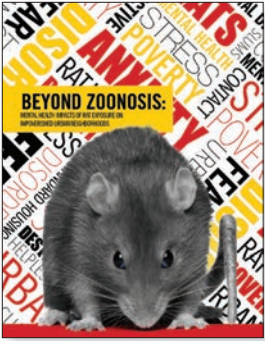


▶ SPECIAL REPORT



Beyond Zoonosis: The Mental Health Impacts of Rat Exposure on Impoverished Urban Neighborhoods

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Abstract Rats are a common problem in cities worldwide. Impoverished urban neighborhoods are disproportionately affected because factors associated with poverty promote rat infestations and rat-human contact. In public health, most studies have focused on disease transmission, but little is known about the nonphysical consequences of this environmental exposure. Mental health often is neglected but is receiving increasing attention in public health research and practice. The objective of this study was to use a systematic review and narrative synthesis of the published literature to explore the effect of rat exposure on mental health among residents in impoverished urban neighborhoods. Although the literature addressing this topic was sparse, the results of this review suggest that rat exposure consistently has a negative impact on mental health. These effects can be elicited directly (e.g., fear of rat bites) or indirectly (e.g., feeling of disempowerment from inability to tackle rat problems). By developing a better understanding of potential rat-related health risks, both mental and physical, public health officials can better evaluate, refine, and develop their policies regarding rats.

Introduction

Society has a negative perception of rats (*Rattus* spp.). From a health perspective, they are the source of a number of zoonoses (diseases transmitted to people from animals) that have caused considerable human morbidity and mortality around the world (Himsworth, Parsons, Jardine, & Patrick, 2013). From a sociological perspective, rats have become symbolic of filth and destitution (Edelman, 2002).

Rats thrive in urban centers where human environments provide easy access to harborage (places where pests seek shelter) and

food (Clinton, 1969). Aging infrastructure, poor sanitation, high population/housing density, and poverty have been consistently associated with urban rat infestations (Himsworth et al., 2013; Johnson, Bragdon, Olson, Merlino, & Bonaparte, 2016). Many of these conditions are characteristic of impoverished urban neighborhoods in developed countries (Bashir, 2002; Himsworth et al., 2013) and are beyond the control of individual residents, with control resting in the hands of municipalities or landlords. Residents of impoverished urban

neighborhoods are often ill-equipped to deal with rat infestations because of low education and income, as well as fear of landlord reprisal (Bashir, 2002).

Although the majority of concerns regarding urban rat infestations are centered around the risk of disease transmission, the incidence of rat-associated illness in developed cities is relatively low (Battersby, Hirschhorn, & Amman, 2008; Battersby, Parsons, & Webster, 2002). In the absence of immediate and obvious public health threats, governmental bodies can become apathetic and/or reactive to rats and rat-related issues (McBride, 2013; Staley, 2014). The potential nonphysical consequences of living with rats, however, have been largely ignored.

This blindspot is problematic because current cultures of complacency regarding rat infestations could inadvertently be contributing to a growing incidence and prevalence of mental health issues among already vulnerable populations. A lack of recognition regarding the potential mental health impacts of living with rats can, in turn, create a burden on the healthcare system when the root cause of the problem can potentially be addressed more effectively and efficiently upstream.

Mental health has been a neglected problem in the field of environmental health (Gong, Palmer, Gallacher, Marsden, & Fone, 2016). To address this, the World Health Organization has launched the *Comprehensive Mental Health Action Plan 2013–2020*, with prevention and research as two of its main objectives (Saxena, Funk, & Chisholm, 2013). Given the ubiquity of rats in the urban environment, and the fact that rat infestations



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disproportionately affect populations that are already marginalized and disadvantaged, it is important to understand the full scope of potential rat-related health risk in terms of both physical and mental effects. The goal of this review is to synthesize the published literature regarding the potential mental health impacts of rat infestations on residents living in impoverished urban neighborhoods.

Methods

To conduct this study, we reviewed articles in the following databases: Medline, Embase, Web of Science, PubMed, PsycINFO, and Cinahl. We conducted word searches using a combination of keywords and Medical Subject Headings (MeSH) pertaining to three main concepts: rats (rats, rodents, rat infestation, rodent infestation, rodentia, *Rattus norvegicus*, *Rattus rattus*, black rat, Norway rat, brown rat), psychological effects (mental health, mental disorder, anxiety, stress, psychological stress), and impoverished urban populations (urban, poor, poverty, poverty areas, socioeconomic factors, slums, social class). The Boolean operators OR and AND were used to combine keywords/MeSH terms within and between concepts, respectively. Reference chaining and manual citation searching of reference lists were used to supplement results. Two reviewers, R. Lam and C. Himsworth, screened this step to ensure the search scope was refined to the research question.

We further limited the search scope to literature that discussed the impact of rat infestations (including as part of general rodent infestations) on mental/psychological health

in residents of urban neighborhoods. We excluded literature focusing on the mental health impact of other pest species (e.g., mice), studies that did not pertain to urban centers (e.g., rural settings), and papers written in languages other than English. Additionally, R. Lam screened titles and abstracts to determine relevancy and then reviewed full text articles to determine if the inclusion criteria were met.

Results

Our search yielded 756 articles, of which 8 fulfilled the inclusion criteria; of these, 6 evaluated rat infestations (as part of rodent infestations) as one component of a spectrum of housing and neighborhood factors affecting health, including mental health. One article examined the psychological consequences of having pest infestations (including rats) within the home. Another paper examined the impact of urban rat exposures as a community stressor.

Rat Exposure Has a Negative Impact on Mental Health

In substandard housing, pest infestations have been cited as one of many mental health stressors (Duvall & Booth, 1978). Even being cognizant of an infestation in their dwelling without any direct contact can be a source of anxiety for residents (Battersby et al., 2008). A 3-year longitudinal study in Waterbury, Connecticut, evaluated the effects of residential pest infestations on the mental health of minority women residing in multiunit dwellings using six psychiatric assessment scales (Zahner, Kasl, White, & Will, 1985). Among

household pests (rats, mice, and cockroaches), only rats had a significant negative impact on mental health; moreover, residents with rat infestations had poorer mental health than those without rat infestations. In the study, rat exposure specifically triggered somatization (headaches, dizziness, and stomach aches), among other measures such as depression and hostility (Zahner et al., 1985).

Some studies have suggested that residents in impoverished urban neighborhoods develop passive acceptance of rats as part of their environment (Battersby et al., 2002; Zahner et al., 1985). In 2016, however, researchers examined perceptions of rats and the mental health effects of rat exposure on several impoverished Baltimore, Maryland, neighborhoods (German & Latkin, 2016). Residents reported that in general, rat sightings were bothersome and that the level of disturbance was also proportional to the degree of exposure. Specifically, those who reported daily rat sightings perceived infestations to be most problematic and reported greater depressive symptoms compared with those exposed to rats less frequently. These associations did not vary among demographic characteristics such as ethnicity, age, and education. In fact, resident attitudes towards rats were even more negative in areas with high rates of infestations compared with less problematic areas (German & Latkin, 2016).

Causes of Rat-Related Mental Health Impacts

The negative mental health impacts of rat infestations can be either directly or indi-

rectly related to rat exposure. Fear of disease exposure and/or physical trauma (Clinton, 1969; German & Latkin, 2016) can induce stress through concern for personal or family health and safety. It is of note that numerous cases of rat bites have been documented in substandard housing (Battersby et al., 2008; Clinton, 1969).

With regard to indirect impacts, the inaction of landlords to address maintenance issues, such as rodent infestations, has been shown to elevate tenant stress levels; conflicts arising from the infestations can result in the threat of eviction or verbal abuse directed at the tenants (Bachelder, Stewart, Felix, & Sealy, 2016; Bashir, 2002).

Finally, it is important to note that rat infestations are one of a constellation of environmental stressors experienced in impoverished urban neighborhoods. For example, German and Latkin (2016) found that residents who perceived rat infestations as problematic also lived on blocks that had other indicators of neighborhood disorder, such as vacant properties and unkempt trash—even after adjusting for socioeconomic factors such as education and number of children. Moreover, initial qualitative studies they performed identified rats, specifically, as a commonly cited issue within “stressful” neighborhood environments in Baltimore. Therefore, rats indeed can be a significant and independent environmental risk factor in these neighborhoods.

Discussion

Summary of Findings

The results of this review suggest that exposure to rats and rat infestations can result in negative mental health consequences for residents in impoverished urban neighborhoods. This negative effect is associated with both exposures at home (Zahner et al., 1985) and as part of the general neighborhood environment (German & Latkin, 2016). Although rat exposure can trigger stress directly, stress can also be elicited and exacerbated by indirect variables such as landlord inaction (Bachelder et al., 2016; Bashir, 2002), feelings of helplessness (Mirowsky & Ross, 1986; Seeman, 1959), and concurrent neighborhood disorder (German & Latkin, 2016). Mental health impacts can be compounded by the fact that impoverished

residents have limited resources to address rat infestations themselves (Mirowsky & Ross, 1986). This helplessness undermines the residents’ control over their own lives, which has been recognized as a key parameter for distress (Mirowsky & Ross, 1986; Seeman, 1959).

Mental Health Impacts of Other Pests

Results from studies on the mental health effects of other urban pests are mixed. Bed bug infestations have been associated with posttraumatic stress disorder (Goddard & deShazo, 2012) and even the development of paranoid schizophrenia due to the social isolation experienced when others distance themselves for fear of acquiring the infestation (Rieder et al., 2012). Zahner and coauthors (1985), however, did not find that cockroach infestations had a significant impact on mental health. It is likely that the mental health effects of infestations vary among pest species based on factors such as the nature of interaction between the pest and humans, persistence of the infestation, and social perceptions of the pest.

Even among pests that have negative mental health impacts, the nature and mechanism of those impacts are likely to be different because of the different characteristics of the pests and associated infestations. For example, compared with rats, bed bugs are inconspicuous, localized to an infestation site, and are not traditionally affiliated with disease transmission (Goddard & deShazo, 2009). In this context, rats have a more significant impact on mental health given they are conspicuous, destructive, and affiliated with disease transmission and filth.

Knowledge Gaps and Priorities for Future Study

Currently there is only a very small body of literature regarding the impact of rats on mental health; therefore, the nuances of this relationship remain unclear. We suggest that the following are the most significant knowledge gaps and therefore should be priorities for future study:

- **Why does rat exposure negatively impact mental health?** The above background information gives us some ideas regarding the potential direct and indirect causes of rat-related distress, but a more detailed understanding of why this distress is

evoked will be important for efficiently and effectively preventing and addressing the resulting distress. For example, dealing with fears regarding disease transmission would be quite different from dealing with feelings of helplessness related to poverty. Panti-May and coauthors (2017) highlighted that active participation of community members is necessary for implementation of successful rodent-control initiatives. Understanding the concerns of residents will allow program administrators to better engage communities by addressing their worries. On the other hand, if resident concerns are neglected, people can become disenfranchised towards control efforts (Lambropoulos et al., 1999). For example, if distress arises from concern for children’s safety, communication can focus on measures that reduce the likelihood of children’s exposure to rats.

- **How does rat exposure negatively impact mental health?** Specifically, what symptoms, conditions, etc., does this exposure contribute to and what are the long-term consequences? The existing literature suggests that the nonphysical consequences of rat exposure can be highly variable, perhaps as a result of different causes of distress. For example, the manifestations of fears around disease transmission differ from those stemming from feelings of helplessness. Thus, it will be important to understand the full range of potential mental health effects in order to help healthcare professionals identify and care for people suffering from these effects.
- **Are different demographics affected differently?** There is evidence that residents in impoverished urban neighborhoods are likely disproportionately affected by rat-related mental health issues. It remains to be determined, however, whether more affluent demographics are similarly affected and whether relative affluence is a protective factor. Also, within disadvantaged communities, perhaps there are specific groups that are particularly at risk. For example, people in poor health, older residents, or parents of young children might be further sensitized to the negative impacts of rat exposure. This deeper understanding will help to identify groups that should be a priority or focus for interventions.

- **Is there a dose-response relationship between rat exposure and mental health impacts?** If there is a link between the frequency and/or intensity of rat exposure, then rat-control campaigns could be effective at reducing mental health impacts. Additionally, if repeated and/or chronic exposure is a risk factor, then this finding might highlight the need for prompt action and diligent monitoring for recurrence of infestations.
- **Are rats an independent risk factor for poor mental health?** Given that rat infestations often are associated with general neighborhood disorder, the potential for confounding must be considered. It could be that the negative mental health impacts are due to associated environmental stressors, such as substandard housing or crime, rather than exposure to rats themselves. If that is the case, then addressing overall neighborhood disorder might be more important than addressing the infestations themselves.
- **Do rat infestations interact with other environmental factors to impact mental health?** Alternatively, rats and other environmental factors might have an interactive effect similar to how smoking and radon are carcinogens on their own, but

when found together, the risk of lung cancer is greater than the sum of their individual effects (Lantz, Mendez, & Philbert, 2013). This effect would highlight the need to address rats specifically, even within a disordered neighborhood.

- **Are there interventions that can make people more resilient to rat exposure?** Given that rat infestations often are difficult to fully eliminate or prevent, it will be important to determine whether residents have the ability to adapt to and cope with rat infestations, or whether chronic exposure leads to progressive mental health deterioration. Identifying factors that make residents more resilient to rat-related mental health impacts could help to improve overall public health alone or in combination with interventions that reduce rat exposure.

Conclusion

Currently, health concerns regarding rat exposure are almost entirely based on the perceived threat of infectious diseases. Given the nonphysical impacts of rat exposure, this approach might lead to the neglect of a far greater rat-related public health impact. Information on how and why rats evoke mental stress could allow environmental health

professionals to develop a better understanding of the full scope of rat-related health risks and impacts.

On a broader social context, this relationship between rat infestations and overall health impacts can be used as a lever for public health action to improve vulnerable neighborhoods. That is, this understanding could in turn provide a different perspective from which policy makers, urban planners, and government officials can develop more effective and holistic public health strategies—ones that encompass not only the physical but also the mental and social well-being of urban residents (World Health Organization, 1948). 🐀

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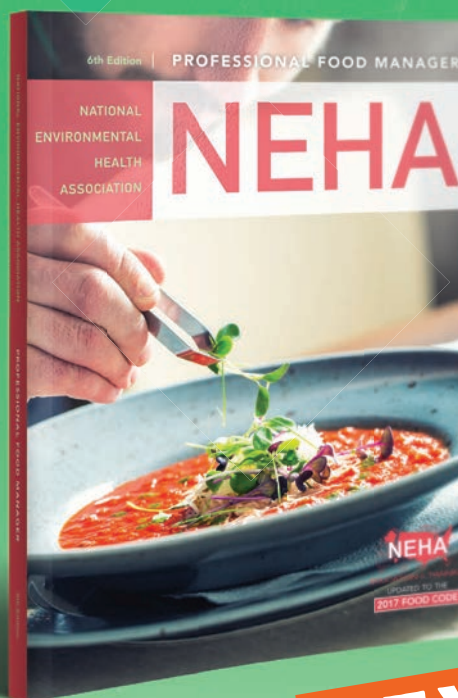
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