Precarious Working Life and Population Health: A Crude Look at a Pragmatic Epidemiology of Hotel Housekeeping

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ABSTRACT
The COVID-19 pandemic has refocused attention on work as an important determinant of population health. Hotel housekeepers, who were among the populations most significantly affected by the pandemic, have a precarious working life with disproportionate health ramifications (e.g., musculoskeletal diseases, hypertension). These excess health consequences are largely determined by, embedded in, and/or operate as complex, dynamic, and randomly determined systems with interacting components. Yet, prevailing epidemiology has not adequately delineated the complex and evolving etiology of these far-reaching and multifaceted health risks of hotel housekeepers. This paper draws on accumulating evidence indicating that the health and safety challenges of working people can be more efficiently understood as comprehensive wholes with interacting components, and that it is the combination of interacting mixtures of exposures acting together that induce health-related phenotype changes. Grounded in our own evolving work and these assumptions, we introduce an emerging epidemiological discourse for hotel housekeeping based on integrative exposome and network epistemologies and methodologies. This new look at a pragmatic epidemiology of hotel housekeeping is anchored in the working life exposome and network perspectives and, despite varied challenges, has the potential to substantively enhance both science and prevention for disadvantaged service-sector and other categories of working populations.

Keywords: Precarious working life, epidemiology of hotel housekeeping, working life exposome, multilayered networks, hotel housekeepers, service-sector working populations

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INTRODUCTION

The COVID-19 pandemic shed new light on the role of work in people's health—especially for the more vulnerable socioeconomic strata (1). Like many disadvantaged service-sector workers, hotel housekeepers (HHKs)—who were particularly affected by the pandemic due to travel restrictions and resulting impacts on the lodging sector—experience a precarious working life with disproportionate health ramifications (2). Despite an array of protracted, interrelating, and multilevel work and nonwork exposures, prevailing hotel housekeeping epidemiology has been overly narrow with far-reaching implications (3). Herein, grounded in our ongoing work (4, 5) and exposome and network epistemologies, we introduce a novel discourse for a pragmatic epidemiology of hotel housekeeping to more fully delve into hotel housekeepers' health challenges.

PRECARIOUS WORKING LIFE AND HEALTH

Since the 1980s, globalization has driven fierce competition especially among industrialized nations with accompanying efforts to reduce production and labor costs and reluctance to keep higher-cost employees in full-time jobs with benefits (6-8). Fewer legal and social protections for the unemployed, increases in temporary jobs, reduced bargaining power of labor, growing immigration, and weaker government regulations and oversight have created a perfect storm of greater risks to workers (7-9). Aside from significant increases in precarious work globally (9), COVID-19 underscored increasing work precarity, particularly among women and people of color (10).

Precarious work denotes insecure employment, harsh working conditions, low pay, limited opportunities and benefits, unpredictable scheduling, inadequate worker rights and protections, and low level of worker control over wages and processes (9, 11, 12). Examples of precarious work include agency, temporary "just-in-time," contract, "on-call," and seasonal work, work at home and self-employment requiring workers to do the work in their free time, and part-time irregular shiftwork (6, 7, 9). Recently, we have seen a flourishing "gig economy" (9)—a new labor market characterized by short-term contracts where workers are subjected to last-minute scheduling.

These work arrangements regularly endanger workers' physical and mental health and overall workplace wellbeing (12, 13). Yet, precarious work extends beyond the workplace spilling over to a precarious working life. It includes work-life conflicts, limited control over professional and personal lives, socioeconomic deprivation, parental exposure to unstable work schedules and associated childcare problems, and other adverse impacts on social and family wellbeing (12, 13). Precarious working life has also been associated with increases in risk of premature death (13).

HOTEL HOUSEKEEPERS' WORKING LIFE AND WELLBEING

HHKs are the largest segment of the hotel industry (14), predominantly women, minorities, and immigrants, many of whom have limited education or struggle with English proficiency (15). They clean guestrooms, including making beds, cleaning bathrooms, emptying trash, vacuuming and mopping floors, pushing heavy furniture and supply carts, and replenishing supplies (16). Full-time HHKs typically work eight-hour shifts, five days a week, and clean an average of 12-16 guestrooms per shift (17). Ongoing hazardous work conditions, unpredictable work schedules, other adverse workplace exposures, low pay, limited health and other fringe benefits, scarce opportunities for paid time off, inadequate employee protections, and adverse psychosocial exposures (e.g., bullying, sexual harassment) collectively create work precarity (18-24).

Immersed in these work milieux for extended periods, HHKs face excessive physical and psychological strains and risks with far-reaching ramifications (22). HHKs change their body postures approximately 8,000 times per shift, exposing them to a heightened risk of repetitive-motion injuries, and exhibiting the highest rate of musculoskeletal diseases (MSDs) among hotel employees (18). Severe MSDs that HHKs endure are common in the lower back, shoulders, and wrists/hands (18). HHKs are also exposed to biological and chemical hazards, leading to skin and respiratory problems (14, 17). Because they often work under intense time constraints,

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they regularly experience high levels of stress (19, 22) as well as workplace accidents and injuries (21, 23). Notably, the nonfatal illness and injury rate for HHKs (5.4%) exceeds the national average for all other professions (24). HHKs' work conditions place them at mental and physical health disadvantages, increasing their risk for chronic migraines, depression, mental health disorders, hypertension, cardiovascular diseases, and mortality (25-33).

As a result of these protracted, multiple, and interrelated work exposures, HHKs' working life is marked by strain from balancing work and family concerns (i.e., household responsibilities, caregiving obligations), household economic insecurity, financial difficulties, transportation and housing problems, increased psychological distress, and diminished sleep quality—all representing carryover effects from work and further exacerbated by documentation concerns for immigrant populations (12, 14, 34). These consequences of a precarious working life underscore the need for actions to address HHKs' persistent health challenges and inequities.

PREVAILING HOTEL HOUSEKEEPING EPIDEMIOLOGY CAN ONLY GO SO FAR

Considering the large numbers of HHKs, multiplicity and interdependability of their diverse exposures, and their excessive health challenges, there exists a dearth of comprehensive epidemiological research (1). Current science has underestimated the complexity and interdependability of a multitude of multilayered work and related nonwork domains influencing HHKs' wellbeing throughout their working years and beyond (3). This underestimation has shaped epidemiological research in many ways.

Theoretical foundations mainly utilize atheoretical, linear, individual-level, hotel-based, reductionist, and static conceptualizations (35). These narrow approaches have led to research designs that are heavily individual-level, deterministic, and cross-sectional, with surveys being the main data collection method (24, 31). Accordingly, analytical approaches delve into associations between predetermined single, common hotel-based, individual-centered exposures—treating others as confounders or effect modifiers—and single, common hotel housekeeper health outcomes at a time (16).

Adherence to these assumptions—while entrenched in both hotel companies' and HHKs' hesitation, albeit for disparate reasons, to fully collaborate with researchers—has hampered the implementation of comprehensive, longitudinal, and rigorous epidemiological research. Subsequently, this has resulted in a suboptimal understanding of HHKs' intractable health challenges.

TOWARD A PRAGMATIC EPIDEMIOLOGY OF HOTEL HOUSEKEEPING

The indispensable whole of work-health-wellbeing

Evidence supports that it is the collection of interacting exposures acting together that induces health-related phenotype changes, and that the properties of these interactions are essential for understanding health outcomes (36, 37). We assume that the health challenges themselves of working people can be described as multilayered networks, and that their delineation requires the inclusion of all relevant exposures as risk factors and effect modifiers—or the working life exposome—in epidemiological models (4). Based on these assumptions, synergistic exposome and network sciences can provide the foundation for a more pragmatic epistemological framework to understand HHKs' working life and its effects on their wellbeing.

Grounded in this logic, as well as syndemic, lifecourse, and ecosocial theories (38-40), Figure 1 depicts a simplified portrayal of HHKs' health challenges as hybrid *multilayered networks* centered on the *working life exposome of hotel housekeeping* (WLE-HHK). Expanding our own evolving work (4, 5), we understand the WLE-HHK as the totality of heterogeneous, multifactorial and interdependent work, work-related, and in-/directly-related nonwork exposures and associated biological responses and endogenous processes that concurrently and/or sequentially affect HHKs' wellbeing from conception onwards, throughout and beyond their working lifetime. Key components include: (a) *HHK exposures* falling under

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the nature, conditions, organization, exposures, and remuneration of work (16); (b) *HHK-defining exposures* including government labor and related policies; employment-based policies, benefits, and rights; labor union rights and protections; and labor market characteristics (16); (c) *HHKs' broad nonwork exposures* involving socioeconomic, educational, labor, housing, health, and environmental forces, policies, and practices that influence all exposures; (d) *HHKs' work-dependent nonwork exposures*—shaped by foregoing, interacting exposures—and including socioeconomic resources, neighborhood and housing conditions, and physical and chemical exposures outside work; and (e) *HHKs' biological and related responses to exposures* (as cumulative endogenous embodiment of exposures) encompassing, among others, inflammatory, chronobiological, and oxidative processes, allostatic load, chemicals and metabolites, and epigenetics, which can induce biological mechanisms. It is the combination of these interrelating exposures that largely shape HHKs' health-related behaviors unfolding in both work and nonwork milieux. A comprehensive account of the WLE is readily available for interested readers (4, 5, 41).

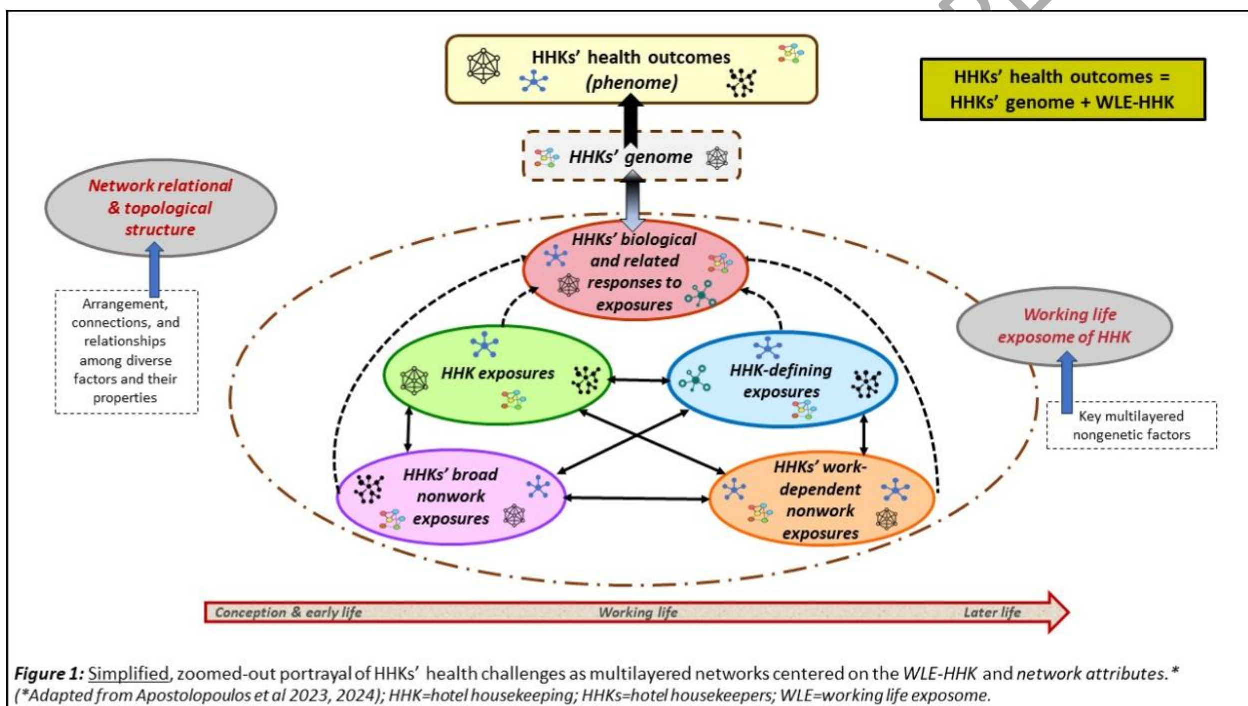

Figure 1: Simplified, zoomed-out portrayal of HHKs' health challenges as multilayered networks centered on the *WLE-HHK* and *network attributes.** (**Adapted from Apostolopoulos et al 2023, 2024); HHK=hotel housekeeping; HHKs=hotel housekeepers; WLE=working life exposome.*

These diverse, multilayered WLE-HHK components interact among themselves in complex, evolving ways, as well as with HHKs' genome. It is the relational and topological arrangement, connections, and relationships among multilayered WLE-HHK components (42), HHKs' genome, and their emergent properties (e.g., various types of centrality) (43) that produce HHKs' health outcomes (phenome). This can be exemplified by the established simplified equation *HHKs' health outcomes* = *HHKs' genome* + *WLE-HHK*, as per exposomic conventions (44). Yet, while genetics are crucial, they are not equally important or as well understood for all types of health-related phenotypes (e.g., cardiometabolic diseases vs. MSDs) (45). Of course, this evolving WLE-HHK definition assumes that hotel housekeeping as an occupation lasts for several years.

Paradigm shift: Integrative exposome and network epistemologies

Foregoing discussion points toward a paradigm shift in hotel housekeeping epidemiology. This shift both epitomizes HHKs' actual health challenges and substantiates how integration of

exposome and network theories, epistemologies, and methods, along with relevant technological advances discussed below, can more efficiently explain the dynamic complexity of issues at hand. This integrative framework can catalyze significant enhancements in all phases of epidemiological research by extenuating the multiplicity, temporality, and variability of the indispensable whole of HHKs' health challenges.

At the theoretical level, integrative exposome-/network-based frameworks can enable the understanding of HHKs' health challenges as complex and dynamic, comprehensive wholes with interacting multifactorial components. This conceptualization will define types of collected data and hypotheses tested and contribute toward the development of a necessary theory framing HHKs' wellbeing.

At the methodological level, integrative exposome-/network-based frameworks can allow the: (a) systematic implementation of comprehensive longitudinal designs underpinned by the ubiquitous complexity of HHKs' health challenges over their lifecourse, and (b) employment of data collection methods beyond surveys, grounded in exposure biomarker technologies, geographical mapping and remote sensing technologies, personal exposure sensors, and high-throughput molecular omics, among others.

At the analytical level, especially due to ongoing, extensive knowledge gaps, integrative exposome-/network-based frameworks can facilitate both discovery- and hypothesis-driven analytical approaches. Because traditional biostatistical approaches are not designed to delineate compound effects of multilayered components, combinations of novel analytical methods—taking advantage of primarily stochastic analytical breakthroughs grounded in mathematical, statistical, and computational innovations—can advance understanding of HHKs' health challenges over their lifecourse. These approaches can facilitate the delineation of relational patterns and topological properties as well as the identification of those sociostructural exposures that trigger biological perturbations leading to undesirable health outcomes, with an emphasis on sources, early markers, routes, combinations, and critical phases prior to, during, and beyond HHKs' working lifetime.

Especially because HHKs' health challenges are firmly embedded in, determined by, and/or operate as large complex systems, such as multilayered networks, we cannot successfully analyze them by predetermining a set of factors, relationships, or properties that are studied separately and then recombining those partial approaches in an attempt to form an understanding of the whole. Instead, it is necessary to look at the whole network of entangled entities, even if it means taking a crude look, and then allowing possible simplifications to emerge from this approach. This integrative exposome/network framework affords us this crude look at a pragmatic epidemiology of hotel housekeeping.

Last, this emerging framework can face methodological and analytical challenges (46-48) that relate to: (a) measurement of multiple, heterogeneous exposures over the lifecourse; (b) collection and analysis of large, complex datasets over long periods; and (c) assessment of causality due to multiple uncertainties. However, evolving scientific and technological developments can provide significant breakthroughs to tackle and largely offset these types of perplexing challenges (49-52).

NEXT STEPS

We have been seeing an increasing entrenchment of precarious working arrangements leading growing numbers of people into precarious working lives with far-reaching health and wellbeing ramifications. Emerging integrative epistemologies, garnered insights from exposome and network sciences and technological advances, can substantively enhance hotel housekeeping epidemiology. Expansion of this evolving discourse can gradually lead to the emergence of a new, pragmatic HHK epidemiology that both adheres to scientific and technological breakthroughs and generates more comprehensive and accurate results. This epidemiological discourse can enrich government and corporate policies and related actions

that can synergistically improve the long-term health of disadvantaged HHKs. Finally, this emerging discourse can have applications in the examination of health of other precarious working populations as well.

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