Obesity, Biased Mental Models, and Stigma in the Context of the Obesity COVID-19 Syndemic

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Introduction to Syndemics and Systems Thinking

Obesity is a complex disease associated with a multitude of genetic, behavioral, and environmental factors, and therefore addressing it effectively requires a nuanced and strategic approach that appreciates this complexity and leverages contextual factors. In January 2020, the National Academy of Sciences, Engineering, and Medicine's Roundtable on Obesity Solutions (ROOS) used group model building [1,2,3] to support the strategic planning efforts of the Roundtable and its work to address obesity solutions and health inequities in obesity prevention, treatment, and management. During this collaboration, ROOS members generated a system map of drivers of obesity. Using the obesity system map as a discussion guide, the authors of this manuscript convened online starting in April 2020 to consider how COVID-19 might impact their work. In this commentary, the authors argue that the interaction between COVID-19 and obesity is an emergent syndemic that will significantly impact efforts to address obesity prevalence in coming years.

Syndemics are characterized as two or more interacting epidemics giving rise to an emergent pattern of disease and population health outcomes where large-scale social forces cause geographic clustering or concentration of disease [4]. The hallmark of a syndemic is the adverse interaction of epidemics, negatively affecting the mutual course of each disease trajectory, and enhancing vulnerability—outcomes made worse by experienced inequities. Efforts to clarify the concept of syndemics include the development of more explicit criteria for considering a population health phenomenon as a syndemic by calling out the specific mechanisms of interactions and the emergent patterns [5].

More recently, the concept has been extended in *The Lancet* to characterize obesity as part of a global syndemic that includes undernutrition and climate change [6], as well as part of a syndemic with COVID-19 through metabolic mechanisms [7]. However, in their recent review on what constitutes a syndemic, Mendenhall and Singer [4] critique efforts to restrict the interactions quantitatively. Specifically, they indicate that some approaches may systematically exclude interactions of social forces such as marginalization, oppression, and stigma that characterize disease clustering.

In this commentary, the authors of this manuscript use the ROOS system map to detail the feedback mechanisms and their interactions in population health. Specifically, this commentary focuses on the implications for prevention, treatment, and management of obesity, biased mental models, and stigma as impacted by COVID-19. Grounded in system dynamics [8,9], group model building provides a formal set of visual conventions for representing feedback systems. As ROOS focused on health inequities, the group model building effort elicited structures pre-COVID-19 that highlighted feedback mechanisms related to stigma, biased mental models, and structural racism central to the notion of a syndemic. Especially relevant to the quantified notion of interactions that Mendenhall and Singer [4] propose, this representation using system dynamics can be used to capture the shifting influence of feedback mechanisms as an emergent characteristic of syndemics [10].

Interactions Between Obesity and COVID-19

Figure 1 highlights a subset of the feedback mechanisms identified in the systems map. It was clear from early epidemiological studies [11,12,13] that obesity

was a risk factor for COVID-19 complications and mortality (reinforcing loop R2 in Figure 1). More recent studies have pointed to biological mechanisms in people with obesity that may increase the incidence and severity of COVID-19 infections (reinforcing loop R1) [7]. The increased risk of complications and mortality has also influenced people seeking treatment for obesity and decreased disengagement (balancing loop B4). This led to concerns of increased stigma because of the portrayal of obesity in the media during COVID-19 [14] with potential implications for changes in payer policies in terms of coverage and reimbursement (balancing loop B2) based on biased mental models (reinforcing loop R3) with potential implications for changes in payer policies in terms of coverage and reimbursement (balancing loop B2) based on biased mental models (reinforcing loop R3a) that drives the availability of evidence-based interventions. Factors such as food insecurity, healthier behavior, and structural racism, as impacted by COVID-19, am-

There was already a shortage of trained obesity care providers pre-COVID-19, so the increase in demand for providers related to COVID-19, combined with increased demand to seek care related to obesity (as a means to reduce risks associated with COVID-19) conspire to limit quality of care, especially given the additive systemic effects of racism (balancing loop B5). These feedback effects are likely to have longer-term dynamic consequences that reinforce biased social norms and biased mental models (reinforcing loop R3), which influence funding (reinforcing loop R4c) that drives the availability of evidence-based interventions. Factors such as food insecurity, healthier behavior, and structural racism, as impacted by COVID-19, am-

FIGURE 1 | Subset of Feedback Mechanisms Driving the Obesity COVID-19 Syndemic

SOURCE: Developed by authors

NOTES: The box represents prevalence as an accumulation or stock, which is disaggregated by population demographics (e.g., children and adults, gender, racial/ethnic social groups). Circles represent rates of change including obesity incidence, treatment, and mortality, which are also disaggregated by population demographics. Clouds represent population boundaries of the system as sources or sinks. Lines with arrows represent hypothesized causal relationships between key variables. Arcs with labels identify feedback mechanisms or loops where labels with "B" prefixes represent balancing feedback loops and "R" prefixes denote reinforcing feedback mechanisms.

plify the feedback interactions between obesity and COVID-19.

The obesity COVID-19 syndemic is likely to have three major dynamic consequences on persons living with obesity:

1. access and barriers to treatment for obesity;
2. societal bias and stigma; and
3. obesity prevention over the longer term along with their financial well-being.

Figure 2 highlights some of the additional feedback mechanisms identified by ROOS tied to prevention, including challenges related to existing inequities in healthy food and activity systems, healthier behavior, adverse childhood experiences, and food insecurity—all issues tied to significant existing health inequities that have been impacted and exacerbated by COVID-19.

In already resource-constrained systems—with shortages of a trained workforce, biased mental models and stigma, barriers to implementing evidenced-based policy, and environmental prevention strategies—multiple systems may fall into a set of nested capability traps [15]. These limitations, in turn, create

a greater effort needed to fight multiple crises without the resources available to address the underlying systems perpetuating health inequities in the obesity COVID-19 syndemic. Furthermore, as obesity and COVID-19 form a syndemic, intersectionality demands that multiple oppressed identities (such as race, gender, sexual orientation, and geographic origin) also interact with obesity, and thus cannot be ignored [16].

Conclusion

It has been 26 years since Singer first identified syndemics and 13 years since obesity was recognized as a complex system [17]. It is possible to identify multiple leverage points for action using systems thinking to examine the complexity driving the obesity COVID-19 syndemic. There is no need to wait any longer to respond to the obesity COVID-19 syndemic and work to prevent the resulting health inequities. Unlike the past, today we have tools available to halt the structural harms [18] inflicted by the obesity COVID-19 syndemic.

FIGURE 2 | Overall System Map of Obesity Prevalence from the ROOS Group Model Building Workshop in January 2020

SOURCE: Developed by authors

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Peter S. Hovmand served as a consultant to the Roundtable on Obesity Solutions from January 2020–June 2020. Nicolaas P. Pronk is the current chair of the Roundtable on Obesity Solutions, and Theodore K. Kyle, Joseph Nadglowski, and Patricia M. Nece are members.

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Disclaimer

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