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Applying System Thinking to Solve Dental Public Health Problems

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"Complex problems require complex solutions" [1] and the population's oral health is a typical –and still unresolved- complex problem. There are some reasons why oral diseases are considered as a major and complex global public health problem. Over three billion people in the world suffer from these diseases[2], and their economic burden on individuals and societies is considerable[3], but the current treatment-oriented (rather than preventive)[4] high-technology approach has proved inefficient and has failed to address the underlying causes of these diseases as well as the existing inequalities in oral health. Even the most cited proposed models applied to understand the determinants of oral health are mostly linear and do not adequately consider the interaction of behavioral, psychological, sociological and structural factors. Thus, a fundamentally different approach is required for a 'radical action', i.e., a system change to reduce the burden of oral diseases.[5]

In this commentary, we introduce "system thinking" (ST) as the required approach to address this hugely complex problem. We will start with a brief introduction to the definition and characteristics of ST. Then, we discuss how this approach might help policy makers to develop new and effective solutions for some specific problems in the dental public health domain.

System thinking could be considered as an initiative or approach aimed at examining how things interact with each other within their respective contexts as a whole entity.[6] This approach has been emerged in the public health literature with impressive growth in the recent years and its implications in solving public health problems ranging from obesity to tobacco have been discussed. Public health interventions usually deal with complex issues that are multifactorial and multilevel. The recognition of such complexity has encouraged public health practitioners and researchers to experiment with systems sciences techniques to shift their focus from individual behavior changes to societal, environmental and policy interventions.[7] Thoughtful engagement with complexity, including capturing and understanding nonlinear cause and effect relationships, differing time scales, identification and management of unintended consequences, and transdisciplinary thinking can be regarded as the key strengths of systems approaches that could be adopted to solve public health problems.[8]

Different theories and methods in ST have been designed to aid the analysis and address complex public health problems for which simple blueprint approaches have limited success.[9] Some tools are developed to facilitate reaching a common understanding of an issue, thus prompting further inquiry and action among a group of people. For example, "systems archetypes", including causal loop diagrams (CLD), can help teams to understand the generic patterns of interaction that can be applicable to their "story", rather than using the pre-existing templates. [10] CLD has the potential to promote our understanding of the broader political, institutional, and cultural contexts. It could be helpful in improving the currently accepted causality models in dentistry, which have commonly categorized determinants as structural, intermediate and proximal ones, with direct, linear and mostly unidirectional relations. [2] For example, understanding the current visible trend toward cosmetic dentistry in many high-income and even middle-income countries could be seen as a typical case that requires a system-thinking approach. Reduction of the trend to only a moral or financial issue is clearly insufficient. The interaction of a series of cultural, structural, economic and psychological causes could explain over-utilization or over-provision of aesthetic dental services. However, even when analyzing the commercial determinants of dental diseases, as an emerging approach in dental public health, its interactions seem to follow the same causality approach. Therefore, a system science approach might be helpful in identifying how unhealthy commodity industries market their products, gain control over policy, and legitimize their increasing presence in public health. Thus, identification of the connection circles for dental disease causes that would otherwise be missed in more individualized behavior approaches could be achieved by using such qualitative-quantitative methods as CLDs.

One of the concerns of health planners has been the inquiry that whether interventions shown to be effective in a research setting would be simply replicated at the large scale or in the real world. The concept of "Effectiveness Decay" contributes the 'effective coverage' of an intervention to contextual and operational determinants. The process of using or utilizing an intervention begins with the questions asking whether patients access care and whether and how services are administered, received and

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adhered to.[11] Therefore, based on this concept, the real effectiveness of a community-based intervention might differ from the expected efficacy illustrated in small-scale research settings. For example, in the field of dental public health, based on a Cochrane systematic review of Fluoride Varnish (FV) application in ideal settings for clinical trials, it is suggested that this intervention can reduce the worsening of caries in the primary dentition with a prevention fraction of 37%. However, applying FV in wider public health programs has shown a modest and nonsignificant anti-caries effect. [12] The potential area for case loss in these interventions, or 'node', as a function of many concurrent forces between actors, context and structure of health systems might be discovered.[13]

While effectiveness decay models highlight areas of deficiency requiring targeted attention, they do not reveal the underlying causes of such a decay. There are a number of other tools including network mapping, social network analyses and process mapping that are used to map out events or show how things are connected. Thus, it is possible to examine critical processes that are associated with the potential supply and demand-side determinants underlying the nodes indicated in the effectiveness decay models.[11]

Application of ST in designing and evaluating the system-wide upstream policies seems to be another enormously important but overlooked issue. To design system-wide policies, the emphasis would be on some kind of multi-disciplinary and multi-stakeholder involvement. It is recommended that for a collective brainstorming on the possibly system-wide effects of the proposed upstream policies, the representative of each relevant sub-system (considering the relationships and dynamics among these sub-systems) is required.[14] The current unacceptable state of global oral health is rooted not only in external factors as competing disease priorities or scarcity of resources, but also in the inadequate coalescence among oral health actors and their disconnection with the wider global health mainstream. Therefore, to improve the populations' oral health, it is highly recommended that upstream policy interventions, such as legislation, regulation and fiscal change, focus more on the involvement of stakeholders from private and public sectors in oral health and other NCDs systems, industry, non-health sectors such as education councils, mass media, etc. We then need to focus on maximizing the synergy of efforts. Involvement of a wide range of stakeholders is crucial in conceptualizing the pathway of dynamic interactions in sub-systems or building blocks of the oral health system.

Furthermore, system thinking can be beneficial for designing the methods to evaluate the implemented system-wide interventions. The emphasis in this approach is mainly upon incorporating plausibility designs such as "interrupted time-series", which use mixed methods to provide estimates of adequacy, processes, contexts, effects and economic analyses of the interventions. They could complement and upgrade the traditional evaluation methods commonly used in health systems, i.e., probability designs such as randomized controlled trials with high internal validity but insufficient in evaluating system-wide interventions.

Finally, it is worth mentioning that while the dental public health could benefit from system thinking approach to solve its special problems, the application of the such approach is emerging slowly in the oral health sector and mostly limited to the behavioral and psychological acculturation of dental habits such as tooth brushing.[15] The use of systems science within DPH is crucial to understanding and promoting good oral health for all, as well as to better understanding the complexity associated with the systems.

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References

1. Ward PR, Meyer SB, Verity F, Gill TK, Luong TC. Complex problems require complex solutions: the utility of social quality theory for addressing the Social Determinants of Health. BMC Public Health. 2011;11:630.
2. Peres MA, Macpherson LM, Weyant RJ, Daly B, Venturelli R, Mathur MR, et al. Oral diseases: a global public health challenge. Lancet. 2019; 394:249-60.
3. Listl S, Galloway J, Mossey P, Marcenes W. Global economic impact of dental diseases. J Dent Res. 2015;94(10):1355-61.
4. Muñoz DC, de Savigny D, Sorchik R, Bo KS, Hart J, Kwa V, et al. Better data for better outcomes: the importance of process mapping and management in CRVS systems. BMC Med. 2020; 18(1):67.

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5. Watt RG, Daly B, Allison P, Macpherson LM, Venturelli R, Listl S, et al. Ending the neglect of global oral health: time for radical action. Lancet. 2019; 394(10194):261-72.
6. Adam T, de Savigny D. Systems thinking for strengthening health systems in LMICs: need for a paradigm shift. Health Policy Plan. 2012:27 Suppl 4:iv1-3.
7. Chughtai S, Blanchet K. Systems thinking in public health: a bibliographic contribution to a meta-narrative review. Health Policy Plan. 2017; 32(4):585-94.
8. Mutale W, Balabanova D, Chintu N, Mwanamwenge MT, Ayles H. Application of system thinking concepts in health system strengthening in low-income settings: a proposed conceptual framework for the evaluation of a complex health system intervention: the case of the BHOMA intervention in Z ambia. J Clin Pract. 2016; 22(1):112-21.
9. Paina L, Peters DH. Understanding pathways for scaling up health services through the lens of complex adaptive systems. Health Policy Plan. 2012; 27(5):365-73.
10. Leischow SJ, Best A, Trochim WM, Clark PI, Gallagher RS, Marcus SE, et al. Systems thinking to improve the public's health. Am J Prev Med. 2008; 35(2 Suppl):S196-203.
11. Karim A, Cobos Munoz D, Mäusezahl D, de Savigny D. A systems approach to assessing complexity in health interventions: an effectiveness decay model for integrated community case management. Glob Health Action. 2020; 13(1):1794106.
12. McMahon AD, Wright W, Anopa Y, McIntosh E, Turner S, Conway DI, et al. Fluoride Varnish in Nursery Schools: A Randomised Controlled Trial–Protecting Teeth@ 3. Caries Res. 2020; 54(3):274-82.
13. Tahani B, Asgari I, Saied Moallemi Z, Azarpazhooh A. Fissure sealant therapy as a portable community-based care in deprived regions: Effectiveness of a clinical trial after 1 year follow-up. Health Soc Care Community. 2021; 29(5):1368-77.
14. Peters DH. The application of systems thinking in health: why use systems thinking? Health Res Policy Syst. 2014;12:51.
15. Broomhead T, Baker S. Systems science and oral health: implications for dental public health. Community Dent Health. 2019; 36(1):55-62.

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