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# Syndemic Preparedness as a Public Health Imperative: Integrating Clinical Practice, Social Policy, and Data Intelligence for Sustainable and Equitable Health Systems

Asogwa, Thaddeus Chijioke

Department of Community Medicine & Primary Healthcare, Enugu State University College of Medicine (ESUCOM), Enugu, Enugu State, Nigeria.  
Email: asogwatc@gmail.com

## ABSTRACT

The syndemic paradigm describes how multiple diseases interact biologically while existing within conditions of adverse social, economic and environmental factors. This commentary evaluates the way syndemic interactions expose structural inequalities while strengthening system vulnerabilities through empirical data analysis from COVID-19, climate-related health impacts and non-communicable disease centroids. Systemic health management requires models that actively connect between health-related silos since complex integrated crises need solutions beyond traditional isolated approaches. Our proposition supports an adaptive health system readiness model called syndemic readiness that unifies health provision, policy development, community outreach and advanced data processing services. Health systems research combined with global case studies demonstrates that health organizations must build multidisciplinary care groups and incorporate syndemic parameters into electronic medical records while deploying ethical AI systems and performing cross-disciplinary policy reforms. The development of syndemic resilience demands resources for equity-based structures along with health system integration between housing arrangements, educational services, environmental protection measures and civic input recognition. This commentary advocates for developing an international preparedness agenda for syndemics to drive substantial institutional modifications that shift public health directions toward equal treatment and unified systems along with sustainable actions.

Keywords: Syndemics, Public Health Systems, Social Determinants of Health, Health Equity, Non-Communicable Diseases (NCDs) and Health-in-All-Policies (HiAP)

## INTRODUCTION

Medical anthropologist Merrill Singer first introduced the syndemic concept in the 1990s to describe health conditions that both interact biologically and grow worse because of social economic and environmental conditions as shown in Table 1 [1]. The COVID-19 pandemic revealed systemic weaknesses when individuals with diabetes or cardiovascular disease experienced mortality rates which were 2–3 times higher than the general population based on The Lancet (2021) meta-analysis [2]. The standard public health approach using isolated disease management tools does not capture how multiple health threats connect with each other [3]. Health system resilience depends on implementing a syndemic preparedness structure that unites medical treatment with policy vision and information analysis [4].

### Core Characteristics of Syndemics

Syndemics consist of three fundamental aspects which include biological interactions together with adverse social determinants and ecological/geopolitical instability [5]. The PLOS Medicine 2018 study demonstrated how HIV/AIDS and tuberculosis (TB) create a reciprocal relationship that shows how HIV makes people more vulnerable to TB yet TB speeds up HIV disease progression [6]. This biological interaction between conditions becomes worse due to social determinants which primarily affect disadvantaged communities [7]. The study

published in Nature Climate Change during 2022 demonstrated how heatwaves boost cardiovascular death rates by 12% yearly in poor urban communities specifically affecting older people with underlying medical issues [8].

#### **Illustrative Global Examples**

The COVID-19 pandemic has clearly shown how Non-Communicable Diseases (NCDs) and infectious diseases intersect with each other [9]. The World Health Organization reports that hypertension patients accounted for 46% of all COVID-19 deaths while diabetes patients made up 37% and individuals with COPD represented 21% of fatalities [10]. A recent Environmental Research Letters study confirmed that East African malaria transmission rates have surged by 30% since temperature increases became prominent over the last decade while these changes primarily impact rural populations who depend on farming [11]. The WHO reports that depression and anxiety rates worldwide have increased by 25% since the pandemic in urban areas following the pandemic [12].

#### **Critique of Conventional Models**

Traditional public health approaches choose biomedical interventions to tackle structural problems in society [13]. The millions of lives saved by vaccines did not solve the basic health disparities which exposed vulnerable people to increased COVID-19 risks [14]. Research conducted by Health Affairs in 2020 showed that U.S. health care fragmentations caused delayed testing and treatment among minority populations so their rates of infection were 2.8 times higher and death rates reached 2.3 times higher than White populations [15].

#### **Operationalizing Syndemic-Informed Care**

Healthcare facilities serving primary care patients need to implement screening methods that identify social determinants of health including food insecurity and housing instability and domestic violence [16]. Research published in JAMA Internal Medicine during 2021 revealed that standard healthcare assessments for social determinants of health helped lower readmission rates by 15% for poor patients dealing with chronic conditions [17]. Studies at Kaiser Permanente demonstrate that combined care structures decrease medical emergency room use by 20% and boost drug adherence rates by 30% [18].

#### **Multidisciplinary Care Teams in Action**

Sustainable multidisciplinary collaboration exists between community health workers (CHWs) who work together with nurse practitioners alongside social navigators [19]. Research from BMJ Global Health (2022) demonstrated CHW-led neighborhood interventions which resulted in a 25% increase in diabetic patient glycemic control together with an 18% decrease in hospital admissions [20]. The integration of syndemic education into medical curricula allows future healthcare providers to grasp disease-social factor relationships while Harvard Medical School now delivers courses about syndemic theory and practice [21].

#### **Innovations and Delivery Modalities**

Telehealth platforms now provide wider healthcare access especially for patients in rural regions [22]. The research published in Telemedicine and e-Health during 2022 demonstrated that telehealth adoption resulted in a 35% rise of primary care services for patients who resided beyond 50 miles from health facilities [23]. Real-time health issue monitoring through syndemic dashboards featured in electronic health record systems (EHRs) helped pilot projects at California's San Francisco General Hospital detect 40% more patients at high risk by using algorithm notifications [24].

#### **Systems-Oriented Health Governance**

Health-in-All-Policies (HiAP) stands as an effective strategy for managing syndemics [25]. The Finnish HiAP strategy launched in 2015 successfully lowered social disparities in life expectancy through policy connections between health strategies and urban development with educational reforms [26]. Recent research in Health Services Research published in 2021 revealed that housing subsidy programs helped reduce asthma-related emergency hospital stays among children from low-income families by 22 percent [27].

#### **Tackling Structural Inequities**

A Social Science & Medicine published study documented how Universal basic income (UBI) pilots in Stockton, California demonstrated that monthly stipends of \$500 dollars cut the rate of food insecurity by 30% and enhanced mental health results among low-income residents [28]. Healthcare equality initiatives must undergo detailed reform since research from JAMA Network Open demonstrated that bias training helped decrease medication inequality between races by 15 percent during the study period [29]. Community advisory boards function as essential components in the response to pandemic situations [30]. Residents in Brazilian cities who participated in budgeting decisions spent funds on local vaccination campaigns which led to Global Public Health reporting a 25% higher immunization rate in tested areas in 2021 [31].

#### **Syndemic Surveillance Systems**

Health systems which integrate multiple data layers enhance the capability to find early signs of syndemic outbreaks [32]. Scientific Reports published a 2022 research showing that using combined clinical social and environmental data sets enhanced outbreak predictions by 45% [33]. Real-time heat maps built for New York City

locations enabled officials to determine areas most vulnerable to COVID-19 together with NCD comorbidities while directing investments for intervention [34].

### Machine Learning & AI in Public Health

Syndemic risk modeling occurs through application of machine learning algorithms [35]. A team of researchers at Stanford University created an AI system which detected cardiovascular events in diabetic patients with depression with 85% precision according to Nature Digital Medicine [36].

### CONCLUSION

Syndemics represent more than biological overlaps since they emerge directly from societal injustice combined with ecological damage and governmental underreaction. The COVID-19 pandemic confirmed how limited approach to healthcare required by reductionist models and demonstrated the vital need for connective and social justice-focused healthcare that looks beyond current problems. Public health institutions need to develop fundamental healthcare frameworks which connect medical treatments to policy improvements along with innovative social policies and digital health monitoring systems to establish syndemic-resistant cultures. The establishment of syndemic preparedness needs three fundamental structural changes which include moving from traditional reactive public health traditions toward anticipatory governance along with crossing boundaries between separate care providers toward multistakeholder strategic partnerships and transitioning from non-actionable data collection into predictive AI tools that operate ethically. The integration of health services into housing and labor systems and climate and education frameworks enables both syndemic reduction and fundamental condition improvement. The future calls for worldwide unity between local decision-makers and moral and strategic recognition of health equity. Syndemic preparedness represents an essential transformation that public health needs today and will need in the future.

**Table 1: Syndemic Preparedness as a Public Health Imperative, Integrating Clinical Practice, Social Policy, and Data Intelligence**

Preparedness Pillar	Clinical-Practice Components	Social-/Policy Components	Data-Intelligence Components	Equity-Driven Outcomes & Metrics	Illustrative Evidence and References
Early Syndemic Surveillance	Routine comorbidity screening (e.g., diabetes + COVID-19); Point-of-care rapid tests for co-infections	Mandatory reporting of syndemic indicators to local health authorities	Linked EHR + public-data dashboards for real-time heat-maps	Time-to-out break alert; % high-risk cases detected pre-hospitalisation	The Lancet 2021; Scientific Reports 2022
Multidisciplinary Care Teams	Co-located NCD-ID clinics (e.g., TB-HIV services); Case-conferencing with social workers	Payment bundles that reward team outcomes	Shared care-plans embedded in EMR	30-day readmission ↓ ≥ 15 %; ER use ↓ ≥ 20 %	BMJ Global Health 2022; Kaiser Permanente data
Social-Determinant Screening & Referral	SDOH checklists (food, housing, violence) at every visit	On-site legal/benefit navigators; housing vouchers	Flag unmet needs; auto-refer via EHR	SDOH issue resolved within 60 days; Readmission ↓ 15 %	JAMA Internal Medicine 2021
Health-in-All-Policies (HiAP)	— (clinicians advocate)	Cross-sector task-forces (transport, climate, housing); Living-wage & UBI pilots	Integrated policy dashboards linking health & city data	Life-expectancy gap ↓ 5 yrs (decade goal); Asthma ED visits ↓ 22 %	Finnish HiAP 2015; Health Services Research 2021; Social Science & Medicine
Ethical AI & Predictive Analytics	AI triage for syndemic risk (e.g., depression + diabete	Algorithmic-bias audits & transparency	Federated-learning models; secure data	Algorithm precision ≥ 85 %; bias	Nature Digital Medicine;

	s → CVD)	laws	lakes	gap <5 pp	JAMA Network Open
Community Engagement & Empowerment	CHW-led home visits; peer educators	Participatory budgeting for local health funds	Mobile apps for citizen reporting	Glycaemic control ↑ 25 %; vaccination uptake ↑ 25 %	Global Public Health 2021
Telehealth & Rural Access	Virtual chronic-care follow-up; e-consults	National broadband subsidies	Tele-EHR integration; remote monitoring wearables	Rural primary-care encounters ↑ 35 %; missed-appointments ↓ 20 %	Telemedicine and e-Health 2022
Education & Workforce Development	Syndemic modules in medical/nursing curricula	CPD credits for inter-professional training	e-Learning analytics to tailor content	≥80 % graduates competent in syndemic care	Harvard Medical School curriculum
Financing & Governance for Resilience	Value-based reimbursement tied to equity metrics	Catastrophe-bond or resilience-fund mechanisms	Public dashboards on spending vs. outcomes	Fiscal sustainability index > 0.8; inequity index ↓	WHO Building Blocks; Health Affairs 2020

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Not applicable.

**Data sharing statement**

Additional data are available from the author, upon reasonable request.

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**REFERENCES**

1. Singer M, Bulled N, Leatherman T. Are there global syndemics?. *Medical Anthropology*. 2022 Jan 2;41(1):4-18.
2. Wang H, Paulson KR, Pease SA, Watson S, Comfort H, Zheng P, Aravkin AY, Bisignano C, Barber RM, Alam T, Fuller JE. Estimating excess mortality due to the COVID-19 pandemic: a systematic analysis of COVID-19-related mortality, 2020–21. *The Lancet*. 2022 Apr 16;399(10334):1513-36.
3. Budd J, Miller BS, Manning EM, Lamos V, Zhuang M, Edelstein M, Rees G, Emery VC, Stevens MM, Keegan N, Short MJ. Digital technologies in the public-health response to COVID-19. *Nature medicine*. 2020 Aug;26(8):1183-92.
4. Okyere DO, Lomazzi M, Peri K, Moore M. Investing in health system resilience: a scoping review to identify strategies for enhancing preparedness and response capacity. *Population Medicine*. 2024 Feb 19;6(February):1-21.
5. Mackenzie JS, Smith DW. COVID-19—a novel zoonotic disease: a review of the disease, the virus, and public health measures. *Asia Pacific Journal of Public Health*. 2020 May;32(4):145-53.
6. Zvonareva O, van Bergen W, Kabanets N, Alliluyev A, Filinyuk O. Experiencing syndemic: disentangling the biosocial complexity of tuberculosis through qualitative research. *Journal of biosocial science*. 2019 May;51(3):403-17.

7. Hill-Briggs F, Adler NE, Berkowitz SA, Chin MH, Gary-Webb TL, Navas-Acien A, Thornton PL, Haire-Joshu D. Social determinants of health and diabetes: a scientific review. *Diabetes care*. 2020 Nov 2;44(1):258.
8. De Vita A, Belmusto A, Di Perna F, Tremamunno S, De Matteis G, Franceschi F, Covino M. The impact of climate change and extreme weather conditions on cardiovascular health and acute cardiovascular diseases. *Journal of Clinical Medicine*. 2024 Jan 28;13(3):759.
9. Pan XF, Yang J, Wen Y, Li N, Chen S, Pan A. Non-communicable diseases during the COVID-19 pandemic and beyond. *Engineering*. 2021 Jul 1;7(7):899-902.
10. Escobedo-de la Peña J, Rascón-Pacheco RA, de Jesús Ascencio-Montiel I, González-Figueroa E, Fernández-Gárate JE, Medina-Gómez OS, Borja-Bustamante P, Santillán-Oropeza JA, Borja-Aburto VH. Hypertension, diabetes and obesity, major risk factors for death in patients with COVID-19 in Mexico. *Archives of medical research*. 2021 May 1;52(4):443-9.
11. Endo N, Eltahir EA. Increased risk of malaria transmission with warming temperature in the Ethiopian Highlands. *Environmental Research Letters*. 2020 Apr 23;15(5):054006.
12. Santomauro DF, Herrera AM, Shadid J, Zheng P, Ashbaugh C, Pigott DM, Abbafati C, Adolph C, Amlag JO, Aravkin AY, Bang-Jensen BL. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *The Lancet*. 2021 Nov 6;398(10312):1700-12.
13. Brown AF, Ma GX, Miranda J, Eng E, Castille D, Brockie T, Jones P, Airhihenbuwa CO, Farhat T, Zhu L, Trinh-Shevrin C. Structural interventions to reduce and eliminate health disparities. *American journal of public health*. 2019 Jan;109(S1):S72-8.
14. Escobedo-de la Peña J, Rascón-Pacheco RA, de Jesús Ascencio-Montiel I, González-Figueroa E, Fernández-Gárate JE, Medina-Gómez OS, Borja-Bustamante P, Santillán-Oropeza JA, Borja-Aburto VH. Hypertension, diabetes and obesity, major risk factors for death in patients with COVID-19 in Mexico. *Archives of medical research*. 2021 May 1;52(4):443-9.
15. Bassett MT, Chen JT, Krieger N. Variation in racial/ethnic disparities in COVID-19 mortality by age in the United States: A cross-sectional study. *PLoS medicine*. 2020 Oct 20;17(10):e1003402.
16. O'Brien KH. Social determinants of health: the how, who, and where screenings are occurring; a systematic review. *Social work in health care*. 2019 Sep 14;58(8):719-45.
17. Evans WN, Kroeger S, Munnich EL, Ortuzar G, Wagner KL. Reducing readmissions by addressing the social determinants of health. *American Journal of Health Economics*. 2021 Jan 1;7(1):1-40.
18. Maeda JL, Lee KM, Horberg M. Comparative health systems research among Kaiser Permanente and other integrated delivery systems: a systematic literature review. *The Permanente Journal*. 2014 Jun 9;18(3):66.
19. Afzal MM, Pariyo GW, Lassi ZS, Perry HB. Community health workers at the dawn of a new era: 2. Planning, coordination, and partnerships. *Health Research Policy and Systems*. 2021 Oct;19:1-7.
20. Rawal L, Dahal P, Paudel G, Biswas T, Shrestha R, Makaju D, Shrestha A, Yadav U, Sahle BW, Iwashita H, Masuda G. Community-based lifestyle intervention for diabetes (Co-LID study) management in rural Nepal: study protocol for a clustered randomized controlled trial. *Trials*. 2023 Jul 5;24(1):441.
21. Kyere E, Boddie S, Lee JE. Visualizing structural competency: moving beyond cultural competence/humility toward eliminating racism. In *Dual Pandemics 2023* Aug 30 (pp. 83-95). Routledge.
22. Sutarsa IN, Kasim R, Steward B, Bain-Donohue S, Slimings C, Dykgraaf SH, Barnard A. Implications of telehealth services for healthcare delivery and access in rural and remote communities: perceptions of patients and general practitioners. *Australian Journal of Primary Health*. 2022 Aug 3;28(6):522-8.
23. Singh S, Kumar P, Rehman F, Vashishta P. Telemedicine, Telehealth, and E-health: A digital transfiguration of standard healthcare system. In *Cloud IoT 2022* Dec 30 (pp. 143-161). Chapman and Hall/CRC.
24. Gallifant J, Kistler EA, Nakayama LF, Zera C, Kripalani S, Ntatin A, Fernandez L, Bates D, Dankwa-Mullan I, Celi LA. Disparity dashboards: an evaluation of the literature and framework for health equity improvement. *The Lancet Digital Health*. 2023 Nov 1;5(11):e831-9.
25. Ramirez-Rubio O, Daher C, Fanjul G, Gascon M, Mueller N, Pajín L, Plasencia A, Rojas-Rueda D, Thondoo M, Nieuwenhuijsen MJ. Urban health: an example of a "health in all policies" approach in the context of SDGs implementation. *Globalization and health*. 2019 Dec;15:1-21.
26. Godziewski C. What Is 'Health in All Policies'?. In *The Politics of Health Promotion: In the European Union 2022* May 21 (pp. 19-56). Cham: Springer International Publishing.

27. Pate CA, Qin X, Johnson C, Zahran HS. Asthma disparities among US children and adults. *Journal of Asthma*. 2023 Dec 2;60(12):2214-23.
28. Wilson N, McDaid S. The mental health effects of a Universal Basic Income: A synthesis of the evidence from previous pilots. *Social science & medicine*. 2021 Oct 1;287:114374.
29. Fontanarosa PB, Flanagan A, Ayanian JZ, Bonow RO, Bressler NM, Christakis D, Disis ML, Josephson SA, Kibbe MR, Öngür D, Piccirillo JF. Equity and the JAMA Network. *JAMA oncology*. 2021 Aug 1;7(8):1119-21.
30. Colman E, Wanat M, Goossens H, Tonkin-Crine S, Anthierens S. Following the science? Views from scientists on government advisory boards during the COVID-19 pandemic: a qualitative interview study in five European countries. *BMJ global health*. 2021 Sep 1;6(9):e006928.
31. Flynn MB, Fonseca EM. Dependency, Capacity, and Agency: Austerity and Leadership Failures in Brazil's Homegrown COVID-19 Vaccine Efforts. *Studies in Comparative International Development*. 2023 Sep;58(3):457-83.
32. Jackson-Morris A, Masyuko S, Morrell L, Kataria I, Kocher EL, Nugent R. Tackling syndemics by integrating infectious and noncommunicable diseases in health systems of low-and middle-income countries: A narrative systematic review. *PLOS Global Public Health*. 2024 May 16;4(5):e0003114.
33. Fritz C, Dorigatti E, Rügamer D. Combining graph neural networks and spatio-temporal disease models to improve the prediction of weekly COVID-19 cases in Germany. *Scientific Reports*. 2022 Mar 10;12(1):3930.
34. Canfell OJ, Davidson K, Woods L, Sullivan C, Cocoros NM, Klompas M, Zambarano B, Eakin E, Littlewood R, Burton-Jones A. Precision public health for non-communicable diseases: an emerging strategic roadmap and multinational use cases. *Frontiers in Public Health*. 2022 Apr 8;10:854525.
35. Yedinak JL, Li Y, Krieger MS, Howe K, Ndoye CD, Lee H, Civitarese AM, Marak T, Nelson E, Samuels EA, Chan PA. Machine learning takes a village: assessing neighbourhood-level vulnerability for an overdose and infectious disease outbreak. *International Journal of Drug Policy*. 2021 Oct 1;96:103395.
36. Avoke D, Elshafeey A, Weinstein R, Kim CH, Martin SS. Digital health in diabetes and cardiovascular disease. *Endocrine research*. 2024 Jul 2;49(3):124-36.

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