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Integrating Environmental Health into Clinical Practice: A Collaborative Model for Chronic Disease Prevention

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Abstract

Chronic diseases are the leading causes of death and disability in Canada and worldwide. Scientific investigations have established that harmful environmental exposures increase chronic disease risk. Emerging evidence has begun to quantify the environmental contribution to chronic disease burden. Primary care practice represents an important entry point for addressing chronic disease risk and the environmental determinants of health because of its extensive reach.

Alberta Health Services developed an ecological model of chronic disease prevention to guide its chronic disease prevention framework (Raine et al., 2006). This framework explicitly recognizes the environment and supports an integrated collaborative approach to the chronic disease prevention role of Alberta Health Services and partnered organizations. Preventing chronic disease by reducing exposure to harmful environmental substances and pollutants is consistent with this model and clearly positioned within the ecological

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framework. Within this context, a collaborative model is proposed to support the integration of environmental health into the clinical diagnosis, care, and management of chronic disease (E. Sears & J. Genuis, 2012). This approach encompasses multiple levels of activity at the individual, population, and systems levels and can readily be adapted to diverse jurisdictions, populations, conditions, and associated health professions.

Environmental health includes the study of environmental hazards, such as chemicals, radiation, and biological agents, and their interactions with the human biological system and other contextual features of human habitation, including food, work, and shelter. Elements or conditions of the environment that are associated with interactions between an exposure, a biological system, and a health outcome are referred to as environmental determinants of health. Chronic diseases commonly cited in the environmental health literature include cancers, cardiovascular disorders, developmental disorders, diabetes, infertility, kidney disorders, mental health conditions, neurological disorders, obesity, reproductive disorders, respiratory diseases, skin conditions, and urinary tract disorders (Reis et al., 2015).

Keywords: Community engagement Collaborative model Chronic disease prevention Environmental health Integrated practice Primary health care Quality improvement

1. Introduction

The burden of chronic disease is rising globally, with noncommunicable diseases contributing 71% of deaths. They negatively affect economic productivity, education, social participation, and mental well-being, resulting in an estimated $47 trillion in lost economic output by 2030. Sustainable development requires a shift in thinking and strategies to address and prevent chronic disease. Environmental conditions, including climate change, influence the emergence, distribution, and prevention of chronic disease. However, clinical practitioners lack training and resources to address environmental health; consequently, they rarely implement relevant interventions (Reis et al., 2015). Guided by the prioritization of chronic disease prevention, the scholarly and practitioner literature increasingly encourages health care professionals to adopt an active role in addressing environmental determinants of chronic disease.

2. Background and Rationale

Individual health is inextricably linked to planetary health. Since the late 20th century, the detrimental effects of humanity on the environment have created alarming conditions for health and well-being. Pollution and chemicals in air, water, soil, and food systems adverse health outcomes such as cardiovascular disease, cancer, asthma, and neurobehavioral deficits.

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These conditions have been particularly burdensome for marginalized communities, with environmental health disparities further exacerbated by disparities in housing quality, green space accessibility, and exposure to climate change.

In response to the urgent need for a systematic approach to addressing environmental health issues, there is a compelling rationale to integrate environmental health into clinical care (Reis et al., 2015). Such integration can catalyze a shift in clinical practice from an exclusive focus on medical care to a broader view of health promotion targeting the modification or elimination of environmental risk factors linked to chronic disease in both clinical and community settings. Addressing the root environmental determinants of health could help clinicians promote individual and community health, thus fulfilling the social contract of the health-care profession.

3. Environmental Health and Chronic Disease: Evidence and Mechanisms

Most major chronic diseases do not have a single cause. Environmental factors are linked to the development of chronic diseases. Chemicals, air pollution, heavy metals, and endocrine disrupting substances are involved. Early-life exposures can impair development and influence health later in life. Gene-environment interactions are plausible, such as interactions between genetic factors and heavy metals or mercury. Epigenetics is also relevant; environmental exposures alter DNA methylation and gene expression without changing the genetic code, affecting susceptibility to disease. Improving environmental regulation, public education, and research reduce avoidable exposures and promote health (E. Sears & J. Genuis, 2012).

Reduced physical activity due to environment-related factors, such as compact neighborhoods with accessible transportation, infrastructure for walking and cycling, and mixed land use, prevents chronic diseases. The risk of physical inactivity is higher in the United States than globally, contributing significantly to disease burden. Many common chronic diseases are triggered or worsened by exposure to pollutants in ambient, home, or workplace environments. Identifying environmental factors is critical for effective treatment and management. Systematic history-taking approaches assess environmental and occupational risks, including questions about exposure at home or work and exercise habits, to determine the role of environmental factors in patients' health (MacDonald Gibson, 2017).

4. Framework for Integrated Practice

The concept of integrated chronic disease prevention (CDP) has evolved in Alberta, Canada, targeting multiple risk factors, disease outcomes, influence levels, disciplines, research

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methods, and societal sectors. It emphasizes populations rather than individuals and introduces key concepts such as the ecological perspective, intersectoral action, multilevel intervention, and collaboration. The ecological perspective underscores the interdependence between individuals and social-environmental contexts, linking lifestyle behaviors to social determinants of health such as education, employment, culture, income, and social supports. Effective action requires participation from sectors beyond health—including transportation, housing, and education—encompassing both public and private organizations. Collaboration, networking, and partnerships strengthen existing relationships and foster new links across sectors and levels, thus improving coordination, reducing duplication, and supporting policy development. Developing and maintaining collaborative networks is therefore a priority (Raine et al., 2006).

4.1. Roles and Responsibilities of Clinicians

Clinicians are well-positioned to address chronic diseases related to environmental exposures as they frequently assess patients in early clinical stages of disease. Although many clinicians acknowledge the link between exposure and disease, they generally do not screen or intervene (Daddy Massaquoi & Christine Edwards, 2015). Clinicians should, thus, obtain an environmental history at the first visit and at periodic intervals thereafter, assist in risk communication, and offer clinical management when appropriate.

4.2. Roles and Responsibilities of Environmental Health Specialists

Environmental health specialists (EHSs) are responsible for assessing, preventing, and controlling the adverse health effects of environmental hazards across various contexts, including residential, recreational, school, and occupational settings. Consistent with the core competencies identified in the Environmental Health Competencies Framework (2015), the role of EHSs in relation to chronic disease and environmental health comprises seven key areas: their contributions to health equity; their understanding of the social determinants of health and the built environment; their ability to obtain, analyze, and interpret environmental health data; their application of multi-level intervention frameworks to address socially and geographically patterned health problems; their knowledge of health-risk assessment principles and methodologies; their understanding of ways to reduce or prevent environmental risk exposure and their familiarity with legal and regulatory frameworks governing toxic substance management (Reis et al., 2015).

4.3. Multidisciplinary and Interprofessional Collaboration

Integrated chronic disease prevention requires multidisciplinary collaboration between medicine, epidemiology, environmental health, toxicology, building science, and other fields connected by the principles of environmental stewardship and ecological sustainability (Walpole et al., 2017). Such multidisciplinary involvement promotes healthy space design,

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preventative toxin guidance, and the reduction of waste generation and associated releases. Specializing in disease prevention and/or wealth generation, public health departments, community and grassroots associations, and businesses also play relevant roles.

Interprofessional collaboration across the healthcare team improves quality, decreases errors, and achieves better health outcomes. Sustainable prevention of chronic disease enhancement—including through environmental, lifestyle, and/or agent exposures—requires interventions targeting the upstream sources of delay and unwanted presence in the ecosystem, community, or household. Public health, community activism, business development, and health-related firms contribute to leading the responsible design, formation, supply, exposure, and/or continued presence in the local space, which cumulatively becomes affordable, available, and competitive.

Emerging agencies that neither public health nor the medical sector currently sufficiently support yet which still impact chronic disease include community clustering of the buildings of proscribed corporations at distance. The now-prospective residential development built around food-miles-shortage-contributing corporations constitutes another example of an undesired, unwarranted, yet socially-adopted ordering of local property developers. مقام الى زيد استضافه الله.

4.4. Information Systems and Data Sharing

Electronic health records (EHRs) and other information systems are essential enablers of practice integration and interdisciplinary collaboration (R Vest et al., 2014). The careful selection of EHRs across various health services has significant implications for chronic-disease prevention and other social determinants of health (Mayston et al., 2020). An important focus of integrated practice for environmental health is the sharing of information captured in screening assessments, analyses, and treatment plans.

EHRs should allow clinicians and community health workers to identify process goals for individual patients or the population and to monitor their achievement over time. The objectives should support the sustainable improvement of individual or population health. EHRs should provide a user-friendly interface for the documentation of community engagement and related data. Community-engagement data should reflect the number and diversity of stakeholders involved, an analysis of the context driving interest in environmental health, the main health issues discussed by diverse stakeholders, and the mode of engagement chosen (e.g. community dialogue, focus group, public forum workshop). The documentation of community engagement should ideally be explicit in the EHR of environmental-health specialists but remain separately visible to all practitioners from different disciplines. Community-engagement data should also be exportable without written permission for sharing with diverse community stakeholders involved in open promotion.

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5. Core Competencies and Training

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A needs assessment conducted with 120 clinical, public health, and environmental health providers and stakeholder organizations across the U.S. and Canada in 2020 identified four core priorities for integrating environmental health into clinical practice: core competencies and training, screening, assessment, and intervention practices, community engagement and public health integration, and policy and advocacy (K. Lee et al., 2021).

Core competencies and training required in order to systematically address environmental health concerns in clinical settings include knowledge of and proficiency in the following: (a) the health impacts of environmental exposures, especially chronic disease-related, and resources for further information (Daddy Massaquoi & Christine Edwards, 2015) ; (b) the social determinants of health that define an individual's exposure and vulnerability; (c) principles of equity, social justice, and environmental justice related to chronic diseases; (d) methods for collecting, storing, analyzing, and sharing individual- and community-level exposure data; (e) the role of climate change and its relationship to chronic diseases; (f) understanding what constitutes an environmental exposure; (g) options for consultation, referral, and collaboration with environmental health specialists; (h) factors influencing exposures across the lifespan; (i) clinical guidelines for prevention and treatment of chronic diseases impacted by environmental exposures; (j) strategies for mobilizing communities and the health sector to address chronic disease-related environmental exposures; and (k) the legislative and regulatory mechanisms through which chronic disease-focused environmental health can be addressed at local, regional, national, and international levels.

6. Screening, Assessment, and Intervention in Primary Care

Environmental exposure history taking involves understanding the patient's interactions with their environment that may contribute to disease. The Clinical Environmental Health history enables identification of suspect connections between environmental and health concerns. Patterns of illness triggered by exposure to certain chemicals, allergens, or microbes may assist in determining relevant exposures, especially when exposure is suspected to motivate the medical visit or recur unnoticed (Daddy Massaquoi & Christine Edwards, 2015). These elements may be corroborated by data collected prior to the visit through an exposure history questionnaire (L. Rose et al., 2015). Application of well-established frameworks for gathering past and present environmental exposure information may increase both the efficiency and the success rate of detecting important environmental influences (B. Perales et al., 2022).

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Information on potential connections is generally prefaced by a clear statement of its provisional nature, the manner in which it has been identified, and any action needed from the patient. A risk occurs whenever someone is reading or hearing about a possible exposure, yet it remains uncertain whether that particular exposure plays a role in their situation. Risk communication and counseling address the large gaps in knowledge about environmental factors prevalent today, which may be a common source of concern.

6.1. Environmental Exposure History Taking

Environmental exposure history taking involves systematic approaches to identify potential environmental factors contributing to chronic diseases. Key questions focus on exposure to pollutants at home or work and changes in symptoms during vacations. Screening also includes assessing physical activity levels, given evidence linking modern environments to reduced activity. This process proceeds from broad questions to more detailed inquiries, aiding healthcare providers in uncovering environmental origins of illnesses and informing effective treatment strategies (MacDonald Gibson, 2017).

Environmental exposure affects human health and should be part of regular clinical practice. Counselling patients on environmental exposures can help reduce exposures. Including routine environmental exposure history taking and counselling in practice is important, and referring cases associated with environmental exposures to specialists is advised. Practitioners need to be sufficiently informed on environmental exposures to effectively take environmental health histories (Daddy Massaquoi & Christine Edwards, 2015).

6.2. Risk Communication and Counseling

Those exposed to environmental contaminants often view chronic ailments, including allergies, obesity, diabetes, autoimmune syndromes, and most types of cancer, as inevitable; healthcare professionals, too, often succumb to this belief. Consequently, it is crucial to proactively alleviate uncertainty through risk communication and counseling. At a minimum, clinicians ought to provide reassurance rooted in general health promotion as well as environmental determinant encouragement like the clear and concise "PAT" message: “Play outside, Avoid junk food, and Time to sleep.” Such communication has proven both broadly applicable and effective against multiple chronic-related pathologies (E. Sears & J. Genuis, 2012).

6.3. Clinical Management and Referral Pathways

The management of health conditions associated with environmental exposures extends beyond appropriate screening and risk communication. Medical professionals involved in primary care should document health complaints related to environmental exposures and provide symptom management as needed. Referral to clinicians with specialization or additional training in environmental health should occur whenever a more extensive

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assessment is appropriate. Clinicians without such specialization may refer patients for comprehensive evaluations where environmental determinants have multiple, severe, or suspected roles. The determination of "when to refer" incorporates both competence and necessity; referral may become essential because of specific competence limitations or capacity constraints—such as time availability—experienced by practitioners with integrated environmental health training. Health conditions subject to significant and multisector environmental risk exposure warrant consideration for referral to clinicians with specific expertise in environmental health. Suggested action items (adapted from (MacDonald Gibson, 2017)) have been compiled to facilitate clinical referral with a broader scope than was itemized during the environmental exposure history discussion. These are predicated on professional role delineation; appropriately nuanced action items not exceeding practitioner competence and time availability remain likewise applicable, even when referral is subsequently deemed unnecessary.

Seven conditions meriting potential referral include:

1. Environmental determinants contribute to the presentation of a chronic health condition where temporal correlations with exposure events have been established. 2. Environmental determinants constitute a significant contributor to multiple chronic health conditions rather than a singular relation (e.g., either asthma or allergic rhinitis). 3. Additional exposure sources, pathways, or direct risks remain unidentified across environmental exposures documented during the exposure inventory. 4. Multiple chronic health conditions exist across different clinical specialties, for which identified environmental determinants and associated risk-reduction support may be concurrently relevant. 5. Attempts to engage in systematic, routine collection of environmental health histories across patient populations within clinical practice have been undertaken but failed to achieve the desired outcome. 6. Clinician knowledge, training, or competence regarding the subject of environmental hazards remains perceived as limited on the basis of the environmental health inventory completed since entry into clinical practice, or coachable colleagues possessing closer proficiency within clinical context remain known. 7. Request for supplementary material directing attention towards environmental health dimensions within specified health conditions is received.

7. Community Engagement and Public Health Integration

Two main aims characterize a community engagement strategy for environmental health (EH) practitioners: improving population health and increasing the influence of EH on public policy decisions (Reis et al., 2015). However, planning effective public policy on EH consistently remains a challenge. Environmental and public health communities recognize that they need objective information about potential health effects, gained through better

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community engagement. Across the country, stronger collaborative relationships are evolving between public health agencies and stakeholders not traditionally seen as colleagues. Such partnerships are recognized as critical to building healthier communities.

The Healthy Community movement simplifies social intervention, maintains citizen involvement through ongoing communications among community, stakeholders, and governmental agencies, and involves all urban segments. It recognizes the need for environmental justice and seeks not only to provide equal opportunities for all and universal access to health services, but also to develop the concept of the importance of a health community and educate communities about optimal health and health disarrangements.

8. Policy and Advocacy inside Clinical Settings

Human health is influenced not only by individual choices but also by systemic conditions, including economic inequities, political decisions, land use, community design, and industry regulation (S Meister & Guernsey de Zapien, 2004). Clinicians working in primary care frequently interact with complex health systems and can therefore engage in policy and advocacy initiatives at local, state, and federal levels to promote community wellness and advance chronic disease prevention. Community health instructions at the local level can build coalitions to collaborate on chronic disease prevention, address the causes and contexts of community or neighborhood health disparities, and amplify the voices of the underserved and those with non-traditional health concerns.

Public health considerably overlaps with environmental health; community health coalitions address both (Robbins & Freeman, 2002). Collectively, policies and interventions in neighborhoods—land use, greenspace, pollution, infrastructure, transportation, building codes, and housing availability—profoundly determine the health of residents. Better population-based information on threats and exposures is essential for responding effectively to environmental hazards.

Approximately one-third of deaths globally stem from preventable environmental risks, predominantly in low- and middle-income countries. The Health in All Policies initiative and the European Environment and Health Process promote extensive policy coordination for health improvement. Improving environmental and climate health requires engagement, partnerships, and strengthening in insurance, all sectors and actors, in communities (Reis et al., 2015). Many countries await rediscovery of a health perspective on policy discussion.

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9. Evaluation and Quality Improvement

A comprehensive evaluation framework that incorporates practice-based and population-based data will support quality improvement efforts to assess engagement in integrated practice and characterize associated responses. A common framework developed jointly by the National Association of Chronic Disease Directors, the CDC, and the PHN Partnership provides a pragmatic and flexible approach (Bailie et al., 2008). The discussion of performance evaluation centres on a selection of criteria for chronic disease prevention that can benefit from an integrated approach (M Beitsch et al., 2015). At the practice level, early evaluations of the integrated approach have demonstrated measurable impact in observing a reduction in the number of patients referred for surgical intervention and in wait times for booked procedures.

Equally, local population-based data have shown association between exposure to integrated environmental and health community engagement activities and the incidence of chronic diseases. Accordingly, indicators and specific measures have been identified that will provide a profile of integrated practice as a foundation for a broader evaluation of the resulting impact on chronic disease conditions.

10. Ethical, Legal, and Equity Considerations

The United Nations (UN) suggests that access to health is a human right incorporated within the Universal Declaration of Human Rights (1948). Given that chronic diseases account for 70% of deaths and represent critical policy priorities for many governments, the Clinical Practice Guide (2020) questions whether the integrated approach offers health efficiency, efficacy, and equity benefits. The stringent definition of health equity introduced by the World Health Organization (WHO, 2008) proposes that “health equity exists when everyone can attain the highest possible level of health” and denotes equity as a process and a goal. The question of who is likely to benefit from an integrated chronic disease approach naturally arises, especially in neglected populations living in deprived or hazardous environments. The Framework and Guide prioritize deprived populations who are likely to benefit the most from an integrated approach.

Following the WHO, the Guide proposes a restricted definition of environmental health that aligns with Gwatkin’s access-to-health approach (A. Eyler et al., 2019). Addressing the “upstream” determinants of chronic diseases—namely land use, housing, poverty, infrastructure, social, and health systems—contributes to a more effective and inclusive policy. Clinicians in deprived settings face a multitude of direct upstream drivers of chronic disease that necessitate systemic shifts addressed by other international agendas on health equity (Reis et al., 2015). For adequate responses, the Middle-Income Urban Health Equity

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Working Group aims to foster an upstream involvement among practitioners. The integration of environmental health information is expected to inform early detection of chronic diseases aggravated by contextual exposure to different environmental risk factors, hence enabling residents to mitigate worsening levels of chronic diseases in resource-poor settings (Marsili, 2017).

11. Challenges, Barriers, and Facilitators

Environmental health has now become an established part of the routine clinical visit in several clinical settings. Nevertheless, the integration of environmental health into broader clinical settings focusing on chronic diseases remains limited (A. Lemay et al., 2010). Environmental health in its various forms has yet to emerge as a core component of any of the national preventive care initiatives, and documented efforts to integrate environmental health into existing programs focused on specific health problems or age groups remain minimal. Modest progress has been made in some state and local systems, but many challenges continue to impede change.

Particular barriers to integration have remained consistent across a range of chronic diseases, at both the system and practice levels. Widespread incorporation of environmental-health protocols and checklists into electronic health records and clinical-support tools would facilitate integration and is recommended. Challenges unique to integrated environmental health practice have also been identified (Grandes et al., 2008). These include reluctance to address environmental factors in clinical practice, limited professional confidence in assessing environmental hazards or conducting risk communication, and uncertainty about counseling patients on disposal of materials or chemicals still present in residences vacated by tenants or family members (Daddy Massaquoi & Christine Edwards, 2015). Addressing these barriers is essential to realize the full potential of an integrated approach to chronic disease prevention.

12. Case Studies Demonstrating Collaborative Impact

Chronic diseases account for the greatest burden of mortality and morbidity in the United States (CDC, 2022). Collaborating with a broad range of stakeholders encourages the integration of environmental health into practice and policy. Federal mechanisms and state partnerships can create effective platforms for addressing health issues through coordinated action across sectors.

The National Center for Environmental Health and the National Center for Chronic Disease Prevention and Health Promotion collaborates to reduce the burden of chronic disease by

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targeting environmental risk factors (Momin et al., 2015). An initial effort led to partnerships with public health and environmental health professionals in six jurisdictions to address shared concerns about risks from blood lead level elevations, housing-related asthma triggers, exposure to secondhand smoke, obesity, and uncontrolled diabetes. Partners used the capabilities of chronic disease programs and the surveillance and investigation features of environmental health programs to incorporate environmental health into chronic disease programming.

Integrating chronic disease and environmental health programming better addresses the environment's role in health, facilitates access to interventions, and reduces service duplication (Linabarger et al., 2021). Collaborative impact occurs when public engagement emphasizes shared community concerns.

13. Future Directions and Research Gaps

The framework proposed addresses chronic diseases as a critical interdisciplinary concern, inviting focused investigation on dimensions not yet extensively explored.

Community action and regional engagement initiatives require dedicated attention. Coordinated inter- and transdisciplinary strategies can be shaped to articulate how to derive evidence on the links between environmental hazards and chronic diseases in connection with contextual pressures that influence the severity of risk factors (D. Kaufman & L. Curl, 2019). Creativity and collaboration provide power to articulate and define not fully addressed topics.

Many contemporary and widely developing areas are directly influencing human health and indirectly chronic diseases. Examples include eco-anxiety (the impact of a changing world) or the "digital divide" that may confer another dimension in cities with high populations of teenagers. Additional underexplored topics consider how various pollutants affect chronic diseases, and how multiple contaminants act synergistically or additively on several risk factors simultaneously.

14. Conclusion

The changes necessary to confront chronic diseases must be considered at three levels: society, the community, and individuals. Continual assessments must track the interconnected data of these levels. The recommendations offered are responses to gaps identified during these assessments. The degree of success depends on, among other things, the extent to which each recommendation is pursued. The actions outlined are interrelated and are therefore best taken as a set. Given the complex interactions of the agents involved, piecemeal

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accomplishment is likely to yield only limited results (Walpole et al., 2017) ; (F Wendimagegn & Bezuidenhout, 2019)

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