



COMMENT



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Achieving the sustainable development goals: investing in early career interdisciplinarity

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The sustainable development goals (SDGs) emphasize the inextricable connections between improved health and wider development indices. This vision is not matched by the ways that progress towards each constituent goal is achieved, and the SDGs are not on track to being met. This commentary considers theories and frameworks capturing the inter-relationships between health and its wider determinants, before discussing examples from mental health and HIV which demonstrate the power of interdisciplinary research. This commentary proposes solutions to integrate wider determinants of health into future research and practice, considering evidence from the PLoS International Interdisciplinary Researchers (PIIR) program between Arizona State University, King's College London and the University of New South Wales, and how other approaches to interdisciplinary training can enhance clinical-academic progress in the post-COVID-19 era. Despite several frameworks promoting interdisciplinary collaboration, specialists continue to be segregated by funding, training and departmental structures. Early career researchers are well-placed to lead innovative approaches to pressing research questions. International partnership models and interdisciplinary training for early career researchers can expose participants to new perspectives and integrate wider determinants of health into future research and practice. University communities must embrace the need for a radical reimagining of boundaries and connections, if academia, too, is to “build back better.”

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Introduction

The 17 sustainable development goals (SDGs (UN, 2015)) reach far beyond the eight millennium development goals (UN, 2009) in emphasizing the inextricable connections between improved health and wider development indices. From hunger and education to gender equity and climate change, the SDGs envisage prosperity, security, health, equity, human rights, dignity, and ecological sustainability for the world in 2030 (Bekker et al., 2018).

Despite being adopted by all UN member states, the SDGs are not on track to being met (Nature, 2020a) and their vision is not matched by the ways that progress towards each constituent goal is achieved. The complexity of researching more than one SDG simultaneously inhibits aspirations to do so. Funding streams, training schemes, clinical and academic departmental structures segregate specialists from other, related disciplines (Nature, 2020b). SDG domains must be researched collaboratively, but how can this occur when early career researchers continue to train in isolation from complementary disciplines?

The wider determinants of health

Branches of medicine and medical research vary in their consideration of social determinants, such as childhood adversity, adulthood abuse, housing, financial stability and food security (Chilton et al., 2017). For example, clinicians and academics specializing in geriatrics, pediatrics and psychiatry are more likely to explore these factors than peers in surgery, radiology and pathology. However, all practitioners working in high-income countries are less likely to consider the impacts of broader determinants of their patients' health, such as climate change, than their peers in low and middle-income countries, even when climatic events have contributed to their clinical presentation. Clinicians and researchers require simple frameworks to encourage them to consider local and global determinants of health and well-being.

A syndemic (synergistic epidemic) occurs when disease states interact detrimentally, leaving communities more vulnerable (Sharma, 2017). Exacerbated by inequality, syndemics demonstrate how interplay between social, economic, environmental and political conditions influences health. For example, the cumulative interaction between substance abuse, violence and human immunodeficiency virus (HIV) in 1990's America was exacerbated by poor housing, poverty, stigma and lack of social support (Singer, 2000). Syndemics have also been used to conceptualize comorbidities between diabetes and disorders such as HIV (Kenya), tuberculosis (India) and depression (South Africa (Mendenhall et al., 2017)). Recently, the concept of a *global syndemic* was applied to obesity, undernutrition and climate change (Swinburn et al., 2019).

Considering syndemics as potentially global phenomena encourages consideration of broader health determinants beyond the local, such as climate change. Focused on planetary sustainability, "doughnut economics" models the intrinsic relationships between multiple social and ecological dimensions (Raworth, 2017). A "safe and just space for humanity" exists in equilibrium between meeting human needs (for health, food, water, energy, housing, gender equality, education, peace and justice) and excessive pollution and depletion of water, land, biodiversity, air, ozone, climate and other resources. Although doughnut economics might sound theoretical, in 2020, Amsterdam became the world's first city to embrace this model (Boffey, 2020).

The Organization for Economic Co-operation and Development (OECD) framework for measuring well-being and progress (OECD, 2009) divides current well-being into quality of life aspects (such as health, education and environmental quality) and

material conditions (such as housing and income). It depicts a cycle in which resources for future well-being (such as social and economic capital) feed into overall sustainability. The OECD framework recognizes that economic progress defined by gross domestic product fails to capture human experience. Some sub-domains are more familiar concerns of health researchers and clinicians (such as health status and social connections) than others (such as civic engagement and governance). However, the OECD framework has been embraced by economic circles, with well-being increasingly integrated into national budgetary policies (Graham McLay, 2019).

Adopting a similar approach at a more public-facing level, Happy City's Thriving Places Index (Happy City, 2016) enables individuals to discover whether their region meets their needs for equality, local conditions and sustainability for well-being. UNICEF's "Report Card 14" evaluates high income countries' performance on adapted indicators, including poverty, hunger, health education and gender equality, recognizing that the SDGs are most applicable to low-income countries (UNICEF, 2017). Report card 14 also incorporates less directly health-related domains, such as sustainable production and consumption, safe, sustainable cities and growth and employment.

Each of these frameworks has relevance for practicing clinicians and researchers. Indeed, a variety of approaches has been proposed for sensitizing health professionals to the social determinants of health (National Academies of Sciences and Medicine, 2016). These include community action, public health and systems interventions, education and workforce development. However, widespread attention to wider determinants of health has not translated to front-line practice, in our clinical and academic experience.

Clinical guidance (Andermann, 2016) encourages health workers to make patient and practice-level changes to address social determinants of health. Public Health England (Dee, 2019) prioritized a multisectoral approach to health promotion and prevention, advocating "holistic, personalized, and community-based care." Tellingly, however, the environmental determinants addressed in the OECD, Thriving Places and Report Card 14 frameworks are less dominant in guidance focused on front-line services, which looks increasingly out of touch with public concern about the impact of climate change.

Example 1: The social determinants of mental health. The social determinants of mental health demonstrate the need for interdisciplinary approaches to apparently singular disorders. The predisposition, precipitation and perpetuation of mental health problems and their treatment are widely regarded as "biopsychosocial". Whilst medication and talking therapies can address biological and psychological elements of mental ill-health, the social determinants of mental health (WHO, 2014), although well-known, are often neglected or addressed in isolation. Moreover, exposure to one social determinant of mental ill-health often predisposes the individual to experience others. For example, there is a graded relationship between the number of adverse childhood experiences and an individual's risk of physical problems, from obesity, smoking and physical inactivity to substance use disorders, depression and suicide attempts. Many of these social determinants pertain to unequal basic needs provision (poor housing, food, education, relationships, lifestyle and opportunities) and human rights safeguards (victimization, violence and abuse) than the population average. Whilst psychiatric research requires greater attention, the traditional focus on specific diagnostic categories has two limitations. First, randomized

Box 1: | PluS International Interdisciplinary Researchers (PIIR) program

How can interdisciplinary experience be fostered among early career researchers? PIIR is a pilot program of the PluS Alliance partnership between Arizona State University, King's College London and the University of New South Wales. PIIR aimed to empower interdisciplinary teams, develop global networks and develop early career research careers through mentoring, with a focus on tackling global challenges.

PIIR competitively recruited 32 Ph.D students and post-doctoral researchers to participate in a hybrid online and in-person course from September 2018 to June 2019. Participants attended online seminars focused on creative problem solving, group meetings at each university, pan-program virtual meetings and in-person week-long workshops in London or Sydney. The two facilitated in-person workshops enabled participants to collaborate in interdisciplinary teams to address themes of sustainability, technology and innovation, social justice and global health. For example, the present co-author team came together from health economics, intimate partner violence and HIV research fields to explore wider inequities influencing global health challenges today. Each author obtained personal benefits from participation. One author appreciated training sessions on thinking styles in teams and how creative thinking and design research can inspire user-centric solutions. Another valued the opportunity to consider global challenges flexibly and from a range of disciplines. A third author was inspired by the scope of this largely remote network, to actively foster new collaborations.

Initial outcomes for PIIR participants included five successful grant funding applications for a total of over £120,000, submission of three articles to peer-reviewed journals, creation of two new international networks and active entrepreneurship including the filing of a patent. Faculty members also obtained competitive grant funding for PIIR-inspired programs with other universities in Europe and North America. A limitation was PIIR's focus on three high-income country universities; its impact and benefits would be enhanced by building links with early career researchers from low and middle-income countries. PIIR participants and organizers recommended that the program increase its global reach by creating places for participants from other universities and enabling tiered engagement (with more students participating online than can be accommodated in person). A key recommendation for such programs is to develop the roles played by faculty members in mentoring participant teams, linking their projects to the wider partnership's research priorities, and offering strategic guidance on how interdisciplinary collaborations can be taken forwards.

controlled trials tend to be conducted in ideal conditions with selected samples unrepresentative of the severity, inequality, comorbidity, and social adversity experienced by the population. Second, research studies usually focus on the disorder and outcomes of interest, rarely measuring moderators of treatment effectiveness which may be etiologically, mechanistically and therapeutically relevant (Roth and Fonagy, 2006).

Example 2: The wider determinants of HIV care and treatment.

The wider determinants of HIV care and treatment offer a second example of how interdisciplinary approaches are required for seemingly self-contained public health concerns. The spread and containment of infectious diseases can also be conceptualized as biopsychosocial. The public health approach to HIV standardized global management through antiretroviral therapy protocols, clinical algorithms and laboratory monitoring (Gilks et al., 2006; El-Sadr et al., 2017), despite wide resource variation. Although this approach scaled up HIV management substantially, treatment failure and drop-out rates (Cambiano et al., 2013; McCreesh et al., 2017) demonstrate the need for personalized service delivery addressing multimorbidity and health system limitations (Vorkoper et al., 2018). The World Health Organization's ambitious goal for universal health coverage aims to integrate formerly isolated initiatives like the public health approach to HIV, with wider communicable and non-communicable disease responses, mainstreaming health throughout public policy (Bekker et al., 2018).

The role of early career researchers

The complexity of intersecting communicable and non-communicable disease often limits the ability to integrate wider determinants of health into routine clinical practice (Horton, 2019). Might academia be a better starting point? Under time and resource pressures, one barrier to a broader perspective in health research is the traditional narrow focus of academic groups on their own methodology and sphere of interest. International partnership models which bring early career clinical and academic researchers together (Agarwal et al., 2019) expose participants to new perspectives outside their own fields, expertise and research paradigms (see Box 1) (Persson, 2018).

Considering a continuum from lone researcher to multi-disciplinary team (Blackwell, 1954), Stember (1991) offered

instructive definitions. *Intradisciplinary* occurs exclusively within disciplines, *cross-disciplinary* views one discipline from the perspective of another and *multidisciplinary* entails several disciplines contributing different perspectives. Crucially, *interdisciplinarity* integrates the contributions of several disciplines on an issue and *transdisciplinarity* unifies intellectual frameworks beyond disciplinary perspectives. *Multidisciplinary*, common in clinical practice, is relatively uncommon in health research. The benefits of *interdisciplinarity* for the future of energy, food, water, climate and health research were highlighted in a *Nature* special issue (Brown et al., 2015). Fostering cross-disciplinary or multidisciplinary research partnerships are important formative steps along the continuum towards integrating interdisciplinarity.

The benefits of collaborative learning (Bruffee, 1993) and incorporating social justice perspectives on scientific subjects (Chamany, 2006) are well-recognized in higher education, perhaps especially in the United States, where students do not commit to a single subject in their first undergraduate year. In the UK, scientific interdisciplinarity has been encouraged by flexible undergraduate degree courses in natural sciences and human sciences, exposing students to a range of life, earth, mathematical, behavioral, and other sciences. Life sciences degrees, introducing students to a range of biological subjects before specialization, are becoming more widespread. However, the standardized content of healthcare degrees such as medicine, nursing and pharmacy limits their flexibility. Medical humanities and intercalated undergraduate degrees offer healthcare students opportunities to gain interdisciplinary exposure but are often self-selected. The need for interdisciplinary degree students to select a specialism in later years also encourages a narrowing of focus. Postgraduate study is therefore an important opportunity to foster interdisciplinary collaboration. How can such learning be encouraged?

The openness to learn beyond the boundaries of one's own discipline is facilitated by "shared socio-emotional-cognitive" conditions (Mansilla et al., 2013). These are (a) cognitive-intellectual: defining initial success as shared learning, growth and benefitting from others' expertise, (b) emotional: feeling as intrinsically motivated about another field as one's own, and (c) socio-interactive: building meaningful relationships with colleagues outside one's field.

Five principles proposed to foster interdisciplinarity are: (i) forge a shared mission, (ii) develop researchers who can immerse in and look beyond their discipline, (iii) nurture constructive

dialog in safe learning environments, (iv) provide institutional support and (v) bridge research, policy and practice to grow collaborations (Brown et al., 2015). In our experience as early career researchers, universities in high income countries are more likely to focus on (i) and (iv) than (ii), (iii) and (v).

An important benefit of interdisciplinary collaboration is its potential to extend the relevance of research findings beyond a single disciplinary audience. Under the concept of a critical threshold of diffusion, a “tipping point” can be reached, at which “subcritical” networks (which gradually recede) become “super-critical,” continuing to grow (Simler, 2019). Were interdisciplinarity to become mainstream across early career researcher funding, recruitment, assessment and training, it could itself reach a critical threshold, becoming the norm across academic practice.

Taking interdisciplinarity a step further, co-production of research with stakeholders is increasingly advocated by funders. However, the concept has been criticized for a lack of clarity about what it means in practice, why it is undertaken, appropriate aims and best practice (Oliver et al., 2019). Unreflective advocacy for co-production neglects to incorporate its costs into research design. Planning, training, human resources and funding are required for meaningful interdisciplinary co-production.

Implementation research explores real-world applications of evidence-based interventions, to discover how high-quality care delivery can be optimized in practice. It is especially important in the resource-constrained contexts where syndemics often arise. Creative health workforce capacity building initiatives, including technological, task-sharing and supply chain innovations have a growing, intrinsically interdisciplinary, evidence base (Yapa and Bärnighausen, 2018).

The impact of the coronavirus disease pandemic (COVID-19)

Events from 2019 onwards underscored the importance of addressing the SDGs in tandem rather than in isolation. Extraordinary economic measures to protect jobs threatened by lockdowns, such as the UK’s furlough scheme, have strengthened arguments for universal basic income (Mason, 2020). A consortium of environmental organizations is advocating a “green new deal” that invests in communities’ health in the widest sense (Build Back Better, 2020). Black, Asian, and Minority Ethnic (BAME) groups in England and Wales were disproportionately affected by COVID-19 (Public Health England, 2020) and systemic racial inequality has been identified as playing a key role (The Health Foundation, 2020). Inequality also impacts on BAME groups’ readiness to accept vaccination (Razai et al., 2021). Interdisciplinary approaches, including clinical medicine, behavioral and social sciences, psychology, psychiatry and neuroscience, are required to respond to the pandemic (Pearce, 2020), to research its impact (Holmes et al., 2020) and spread (Kapitány-Fövény and Sulyok, 2020).

Although COVID-19 poses a significant threat to world health and stability, it presents opportunities to rethink the status quo. Early career researchers are well-placed to spearhead exciting new collaborations to tackle these vital research priorities. However, the loss of face-to-face teaching poses an existential threat to the university sector, where an “academic exodus” is anticipated (Woolston, 2020). The inability to build international networks through conference attendance and overseas field work (Courage, 2020) are additional threats to interdisciplinary innovation. While online alternatives have promise, remote networking has social and practical limitations. Early career researchers must be actively supported to engage in interdisciplinary collaboration, to maximize their potential in the post-COVID-19 era.

Conclusion

The SDGs emphasize the inextricable connections between improved health and wider development indices and require clinicians and academics to consider broader health determinants. The unprecedented impact of COVID-19 only makes this more apparent. Despite several frameworks promoting interdisciplinary collaboration, funding, training and departmental structures continue to segregate specialists. Early career researchers are well-placed to lead innovative approaches to pressing research questions but the university sector faces existential threats in the post-COVID-19 era. International partnership models and interdisciplinary training for early career researchers expose participants to new perspectives and integrate wider determinants of health into future research and practice. While in-person networking and conferences are inaccessible, creative approaches are needed to foster such partnerships. University communities must embrace the need for a radical reimagining of boundaries and connections, if academia, too, is to “build back better.”

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Competing interests

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