Research Directions: One Health

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From intention to action – cultivating future-ready One Health agents of change

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Abstract

We used a narrative literature review to identify attributes of One Health practitioners who can close the gap between intention and action to protect and promote health in this era of polycrises. The intention in this essay was to instigate discourse that challenges the current state of One Health teaching and practice, thus helping us reflect on how to future-ready One Health. One Health researchers and practitioners must become agents of change who accelerate and amplify innovations that promote One Health as a settings-based approach to advance interspecies and intergenerational health equity. This essay outlines how future readiness and disruption are intertwined and proposes that One Health training needs to cultivate curiosity, agility and convergence thinking to create future-ready researchers and practitioners. Institutional systems that can support future-ready One Health agents of change will need to be attentive to mechanisms that close the knowing-to-doing gap and promote crossing barriers. Game changing One Health requires greater investment in cross-cutting capacities and ideas that will make it easier to see what is working and for whom. At the heart of this issue is the need to mainstream concepts of fairness and redistribution of the health resources between people, animals, and settings.

The Need

The impetus for this essay was the need to critically reflect on education outcomes that can empower future-ready One Health practitioners to be active agents of change who can – and do – accelerate and amplify innovations that promote and protect good health for all species and generations. In this paper, we define practitioners as people who apply One Health principles, practices, knowledge, and skills within their scope of professional practice, including but not limited to researchers, policy maker, and health managers.

Several reports have made it clear that there is a rapidly narrowing window of opportunity to preserve the health of animals, people, and the environments they share (ex. IBES 2019, Dasgupta 2021). Unprecedent changes in biotic, abiotic, and social states and relationships are altering virtually all determinants of health for all species (Stephen and Walzer 2023). As the world becomes increasingly dynamic, complex, and nonlinear there is a growing need to be able to actively engage with, continuously explore, and adapt to changing circumstances (Hardy et al 2017). "Business as usual" based on past concepts of success and progress may no longer be future-ready. Education and training needs to quickly evolve to help practitioners deal with an uncertain, volatile, complex, and ambiguous future. It is no longer enough to try to document and explain things; one also must try to change them and be involved in the process of change.

The past years have seen many of declarations by international organizations (e.g., Lucas 2019; FAO, UNEP, WHO and WOAH 2022) and educators (e.g., Rabinowitz et al 2017; Villanueva-Cabezas et al 2022) on the importance of One Health to concurrently address human, animal, and environmental health. This has been heightened in response to several zoonotic events such as Zika virus, West Nile Virus, and most recently and dramatically SARS-CoV-2. However, there is a glaring gap between good intentions and meaningful action under the banner of One Health. As attention to enhanced collaborations at high-level political fora has increased, there has remained a scarcity of investment in collaborative endeavors and growing power struggles between dominant stakeholders (Spencer et al 2019). This has resulted in increased discussion about One Health, but in many cases, limited actions at the working levels that implement One Health.

Governments are seeking evidence-informed solutions to systems-level areas of societal challenges (e.g., climate change, biodiversity loss, and food security). Unfortunately, governments have often inadequately attended to the conditions and activities needed to effectively act on those challenges (Boon and Elder 2018), such as (i) fostering skills, processes and institutions that enable co-management and co-delivery across agencies, (ii) cultivating cross-sectoral leadership or power-sharing, and (iii) having governance suited to complex challenges and multi-actor responses (Stephen and Stemshorn 2016). Many areas of study and

policy struggle with the reality that current approaches inadequately translate evidence at the rates and scales needed to inspire and sustain actions against multifaceted global existential threats.

The first two decades of the twenty-first century have made the challenges ahead more apparent and urgent. The tasks ahead are made up of multiple, simultaneous assets, deficits, and problems that interact to pull us closer to or further from critical tipping points. Transformative changes are needed to concurrently protect health for all species and generations and make policies more impactful, achievable, sustainable, and actionable. One Health is being actively promoted at national and international fora as a transformative approach in health, conservation, and environmental sustainability. But can it keep up with the scale, pace, and intensity of human activity on the planet without disrupting the *status quo* ways of training and supporting One Health practitioners?

One Health as envisioned in this essay

As with the word health, there is no universally accepted and consistently applied operational definition of One Health. This paper does not argue in favor of one or another definition, but instead provides our view of One Health to contextualize the arguments laid out below.

Although the term One Health originated from a meeting of a conservation agency in 2004 (Atlas 2013), the predominantly human-centric focus of One Health has failed to realize the core desire for all species, places, and generations to reach their full health potential. The preoccupation of One Health on zoonotic diseases for public health purposes has led to an emphasis on epidemiological approaches rather than socio-ecological systems approaches (Gallagher et al 2021). Separating One Health into three different categories (i.e., human, animal and environment) rather than one interconnected health allows for one type of health (i.e., usually human) to overwhelm other types (Stephen et al 2023). Actualizing the ideal of One Health necessitates a focus on interspecies and intergenerational health equity by ensuring that all species and generations can reach their full health potential and are not disadvantaged from attaining it because of efforts to protect the health of one group in the current generation.

Understanding and managing health from an interspecies point of view calls for awareness of similarities between the needs of different living things in a shared setting. It also requires acceptance of the reality that the answer to many One Health problems is "it depends," because of the complex and dynamic socio-ecological interconnections and conflicting goals that drive these problems. The best overall solution to a One Health question may result from a plan that balances the needs of all the health systems, rather then "solves" a problem in one sector for the benefit of another sector. The usual presentation of overlapping but separate spheres of human, animal and environmental health suggests an unproblematic alignment of three sets of interests that are typically treated and managed separately. But, in reality, life is messier.

The Ottawa Charter for Health Promotion provides a conceptual starting place to rethink the "one" in One Health. The Charter states that health is created and lived within the settings of everyday life (WHO 1986), suggesting that the settings should be the "one" in One Health. A settings-based approach to One Health responds to the current paradigm of "Think Globally, Act Locally" that has been shown useful in implementing actions around current global challenges. Settings-based approaches requires concurrent attention to the natural and social capitals that influence access to resources and capacities for health of all living in a shared place, and how they are modulated by the circumstances of living and modified by interventions. Stephen et al (2023) provided a rationale for why a setting-based approach allows attention on the "bundled" relationships unique to a setting, rather than addressing independent and intersecting spheres of human, animal, and environmental health.

Settings-based approaches target the specific circumstances of a place and engage with local issues and opportunities that are driven by complex, intersecting factors, requiring a cross-sectoral response (Government of Victoria 2020).

A settings-based approach can help in formulating multilevel approaches that foster healthier circumstances for all in a setting by revealing the mutual benefits that emerge from pooling expertise, funding, and political will to solve multiple problems with a coordinated investment of resources and effort (Stephen and Walzer 2023). Unlocking the full potential of different people and organizations to address existential threats through One Health requires a new narrative to help people implement collective action for collective problems.

Becoming future-ready

There are four necessary circumstances to being future-ready (Stephen et al 2015; Bali and Taaffe 2017; Berkes 2017; Stephen and Walzer 2023). First, is to recognize interdependence of human and non-human systems in health protection, sustainable development, and conservation. Second, is the need for multifaceted approaches that address problems concurrently from several perspectives for faster, more effective acceptable and sustainable impacts. Third, is cross-sectoral learning that shares ideas, innovations, information, resources, and expertise to more efficiently combat threats that concurrently impact multiple sectors and species. Fourth, is to shift away from problem- or disease-specific solutions to comprehensive or system-level solutions.

We believe that to promote these four circumstances, future-ready One Health practitioners should be able to; (i) anticipate the future consequences of actions; (ii) incorporate future implications into present-day decision-making; (iii) help people and ideas come together to understand what choices need to be made and what information is needed to make those decision and (iv) expand beyond the tyranny of the urgent and the fixation on explaining the cause of past harms toward building capacity that generates options for an uncertain future.

Disruption underpins future readiness

Future readiness and disruption are linked in two ways. First, we can anticipate more frequent and more impactful disruptions to social and ecological systems given the rates of social and ecological change being experienced. Future-ready organizations and systems must build resistance and resilience to these disruptions (Word Economic Forum 2022). Second, there is a growing call for better understanding of how these unprecedented times are resulting in the cascading effects leading to system failure. This is propelling demands for new ways of research and learning that break traditional barriers and are integrative and action oriented (ex. Bradbury et al 2019; Barry 2021).

Disruption in research and practice is recognized by its success in introducing new ideas and approaches, asking fundamental

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questions that break the *status quo*, and pushing inquiry in new directions (Callier 2019). The ability to bring together traditionally distinct information and disciplines for disruptive purposes is an ever-growing expectation in universities, businesses, and governments (Halloun 2020).

A disruptive One Health agenda involves more than just integrating human and animal healthcare systems for better disease control. It should foster systems of inter-dependent and mutually supportive actions to promote health and resilience of people, animals, plants, and ecosystems today and in the future. Without transformation to collectively address root causes of health and resilience, we will continue to battle new crises as they emerge.

Despite accumulating evidence of the need for disruptive intersectoral approaches, there remain questions of how to operationalize this in policy and practice. Opportunities to transfer this idea into the radical changes and practical solutions have often been missed, neglected, or discouraged. As seen in medical education (Dyche and Epstein 2011), when education, hiring and evaluation emphasize the mastery of facts and skills, researchers tend to be drawn toward producing known answers and away from developing innovative or game changing solutions. Competitive pressure can further encourage attention on predictable and readily publishable results rather than findings that are innovative and useful (Knorr and Augustin 2021). Transformation to deep integration is unlikely to occur if we drive innovation through old ways of knowing and doing.

There has been a boon in publications calling for a better understand of which One Health projects work, how they work, where, and for whom (e.g., Häsler et al 2014, Lee and Brummer 2013, Baum et al 2017, Khan et al 2018). While such publications provide insights and general conditions for more effective work, they have not bridged the need to tailor recommendations to specific working context. Due to the trend towards and skepticism about transdisciplinary and interdisciplinary research, scholars have begun to look at the relationships between team structures and innovation or disruption. Based on their analysis of 65 million papers, patents, and software products that span 1954–2014, Wu et al (2019) concluded that "smaller teams have tended to disrupt science and technology with new ideas and opportunities, whereas larger teams have tended to develop existing ones." Small teams disrupted science and technology by exploring and amplifying promising ideas. Wu et al (2019) proposed that some types of research require the resources of large teams that demand an ongoing stream of funding which makes them more sensitive to the loss of support that comes from failure which, in turn, reduces risk taking. Xu et al (2022) determined that teams with few levels of middle management between leadership and employees, or in certain situations none at all, were more innovative and disruptive than more layered hierarchies. Zeng et al (2021) concluded that papers produced by teams with new team members were associated with greater originality and a greater multidisciplinary impact. The career freshness of team members was positively correlated with the originality and multidisciplinary of produced papers. Sugimoto et al (2017) concluded that mobile scholars show the highest impact and that limiting the circulation of scholars between programs or nations damages the scientific system. As a final example, Bercovitz and Feldman (2011) concluded that teams composed of members from multiple institutions were more successful and the presence of prior social ties supporting links with external team members positively influenced outcomes. Much of what has been written about building disruptive teams in business management are consistent with what is being described for innovative scientific teams (Table 1). These findings suggest the need to educate people who value diverse ways of knowing, are prepared to be disruptors, and have good collaborative skills and attitudes.

Table 1. Selected advice for building disruptive teams; lessons from business management

Source - Stricklin, 2018	Source - Condren, 2015
Strive for not only for diversity of expertise but also diversity of thought and experience	Have a leader who creates an environment for innovation and disruption
Maximize team members' potential and use other members to mitigate their weak areas.	Assemble the right team members who can bring ideas to fruition and can work in teams
Empower your team.	Have the organization ready for disruption
Trust your team	
Let each person knowhow vital they are to success and help them understand their contributions to something bigger than themselves	

Empowering disruptive One Health practitioners

Radical change to the *status quo* requires innovations in how we train people to produce, share and apply knowledge. To do so not only requires changes in social norms, beliefs and values but also in the attributes and competencies we want to instill in those charged with inspiring and leading change. Here we outline several critical thinking skills as they relate to One Health preparedness.

Agility

Future-ready One Health practitioners must be able to create novel solutions to the ever-changing problems precipitated by accelerating social and environmental change. Agility is the synergistic combination of robustness, resilience, responsiveness, flexibility, innovation, and adaptation (Alberts 2007). Learning agility refers to an individual's willingness and ability to learn new competencies to perform under first time, tough, or difficult circumstances (Lombardo and Eichinger 2000). A changing and uncertain future requires people who can respond flexibly to changing situations, who can make informed decisions in the face of change and uncertainty, and who can adapt to rapid change (Ab Jalil et al 2022). Agility helps learners succeed in situations where they have never been before (Ab Jalil et al 2022). Agile learners can look beyond what they already know and integrate unrelated pieces of information to gain a better perspective.

Like other transdisciplinary practitioners (Klein 2022), One Health practitioners need agile thinking to know where and when to switch on the spectrum of cross disciplinary methodologies appropriate to a given problem. This approach requires a willingness to learn from experience, an openness to being wrong, an acceptance of new ideas and desire to navigate differences in opinions, reflecting on what was learned. Educators must support learners use of past and present experiences to make sense of uncertain situations and apply their skills confidently to novel scenarios.

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Convergence

In a world of exponentially expanding rates of new knowledge generation, no person can keep up to date on all information relevant to a problem they are trying to solve. Collective insights of groups have the potential to generate more accurate information or decisions than individuals can make alone, as has been seen in clinical decision-making (Radcliffe et al 2019). Convergence is an approach to the integration of knowledge and ways of thinking to tackle complex challenges and achieve new and innovative and transformative solutions (NAS 2014). Convergence of ideas and knowledge requires relationships and interactions between and among knowledge holders.

Many health problems have traditionally been seen as complicated challenges that should be solved by breaking them down into smaller pieces. Solutions to the complicated problems are assumed to emerge from the solutions to many smaller problems. Teaching and training have tended to build "smaller pieces competences." Increasingly we are facing complex rather than complicated problems. Complex problems are problems that are difficult to define because different people have differing opinions about the nature and influence of different causal factors. The nature and extent of the problem are messier and more ambiguous; they are more connected to other and often very different problems; more likely to react in unpredictable ways; and more likely to produce unintended consequences. "Hierarchical and silo structures are perfectly designed to break problems down into more manageable fragments. They are not, however, so effective in handling high levels of complexity" (Hansen et al 2009).

As a result of the complexity of working across multiple ways of knowing and doing, convergence is both challenging to teach and challenging to do. Transdisciplinary teaching should involve situations where concepts and skills are developed through real-world context that includes the pluralist perspectives of several disciplines and the coordination of activities at all levels when addressing a problem (Bore and Wright 2009). To break silos of learning and doing, education must create conditions to foster transdisciplinary literacy. Learners will need opportunities to roam across disciplines or between different professions. Having the chance to reflect on how their disciplinary framing of a problem affect their openness to innovative or disruptive opportunities will come from examining how their beliefs, judgments, and practices influence their approach to a problem. Such a feat is often a challenge to achieve when educational programs are delivered in purpose-built facilities divorced or distant from other disciplines.

Curiosity

"Curiosity is [in] high demand in today's disruptive and fragmented world" (Buheji 2020). It is an emerging critical trait as it drives the impulse to seek new information, explore new experiences and discover novel possibilities (Brower 2021) When you are curious, your mind expects and anticipates new ideas, you are better able to see new possibilities that are normally not visible, you challenge assumptions, and seek out new perspectives. You don't spend too much time in just one way of knowing, and you look elsewhere for insight and ideas. Curiosity drives the depth and sophistication of questions one asks (Ng et al 2020).

Curiosity improves future readiness (Holtschneider and Park 2022). It opens thinking to better forecast possible changes on the horizon that may pose threats or opportunities by expanding points of view, to help see future possibilities by looking at present-day signals differently. By thinking beyond one's remit, one develops a broader conception of the intended and unintended consequences of decisions. Curious individuals may be better responders to emerging issues by uncovering a wider array of implications of future change. Curiosity can help one envision a wider suite of opportunities to shift and create a better understanding of motivators for change. Curiosity decreases the likelihood that we will only seek information that confirms what we believe we know, helps us adapt to uncertain circumstances, helps us think more broadly, deeply, and rationally about decisions and come up with more-creative solutions (Gino 2018).

Curiosity can be cultivated when learners are responsible for their own learning, are exposed to the value of considering multiple perspectives, see curiosity modeled and use inquiry-based learning. It can be suppressed when speed and efficiency of doing supplants depth of thinking and when mastery of facts creates overconfidence in finding workable solutions (Dyche and Epstein 2011).

Attention to team building

Anholt et al (2012) determined that interdisciplinary One Health collaborations are affected by; (i) the characteristics of the people, (ii) the degree to which the task is a shared goal, (iii) the policies, practices and resources of the workplace, (iv) how information technology is used and (v) the evaluation of the results. Personal relationships built on trust and respect were, above all, needed to best assemble the disciplinary strength of the collaborators.

Competent disciplinarians are better able to navigate the complex process of interdisciplinary collaborations when they combine their strong standards of scholarship and large bodies of knowledge with broad interests and imagination. A third-party interdisciplinary knowledge broker who knows where the knowledge could be found can facilitate introductions and help to build effective teams (Anholt et al 2012). Knowledge brokers are needed to leverage lessons learned from past experiences and improve diffusion of innovation by sharing and validating best practices.

Closing the knowing-to-doing gap

All forms of population management are increasingly expected to base their decisions on evidence. The lack of systematic program evaluations or implementation studies leaves decision makers with insufficient evidence to select interventions likely to be acceptable, effective, and sustainable within and across the disparate One Health context.

Effective implementation of health interventions requires people who can account for the variable context of interventions (MacDonald et al 2017). For example, the social, economic and ecological context of the wild animal hunting compared to farming that same species will affect the avenues to prevent disease emergence, to manage risks to other wild populations or political support for interventions even when the same pathogen and host species exist but in different situations. Evidence-based decisions need three types of evidence; (i) evidence specific to the decision-making social and ecological context; (ii) evidence extracted from other settings or situations and (iii) evidence pertaining to the values and expectations of the decision makers and those affected by the decision (Bowen et al 2009). Few decisions are made on scientific evidence alone. One Heath decision makers need to be able to distill evidence from research, context, and experience, and use that evidence to inform and improve decisions. Despite widespread support for using evidence in decision-making, there is little consensus on what evidence is, what kind of evidence is most

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appropriate and how "using evidence" can best be demonstrated (Bowen et al 2009).

Understanding the processes through which One Health interventions are effective, and how to spread and sustain effective interventions between locations and over time, will speed the diffusion of innovation and amplify the impact of investments. To do so, we must close the knowing-to-doing gap by systematically training people who can assess which One Health actions and interventions are feasible, acceptable, impactful, equitable, and sustainable within which social and environmental contexts.

Bridging the knowing-to-doing gap using collaborative approaches between knowledge producers and knowledge users can help identify the right questions to ask that will produce credible and trustworthy evidence that can be translated into practical, feasible, acceptable, and sustainable solutions. Further innovation is needed to clarify, reinforce, and magnify locally developed approaches and facilitate their diffusion and adaption to other settings in a timely fashion to create global solutions.

Removing disciplinary barriers

Removing disciplinary barriers is a prerequisite to promote innovative scientific approaches (Aragrande et al 2015). Unfortunately, remaining barriers to integration across public, environment, and animal health domains still limit the contribution of One Health (ex. Johnson et al 2018; Asaaga et al 2021; Humboldt-Dachroeden 2023).

If One Health strives to use different types of knowledge production to promote change by not only integrating knowledge from different disciplines, but also by integrating values, knowledge, know-how and expertise from non-academic sources, it needs to be attentive to experience in other transdisciplinary settings. "Transdisciplinary work involves situations where concepts and skills are developed through real-world context that includes the co-existence of perspectives of several disciplines and the coordination of activities at all levels when addressing a problem "(Bore and Wright 2009). To break silos of learning and doing, workplaces must create conditions to foster transdisciplinary literacy.

Expanding the questions

A transformative One Health agenda needs to move beyond discovering what works and why to understanding what works for whom and under what circumstances, but recent work suggests it is not common practice (Gallagher et al 2021). Innovation is the process of taking knowledge and making it valuable to stakeholders (Stikeleather and Masys 2020). Knowledge about new threats and risk factors alone will not lead to risk reduction without understanding the factors that can change the trajectory of a socio-ecological system to a safer state. Animal, human, and ecosystem health and resilience need to be built by design and in partnership with those who can influence locally adaptable policies and practices.

Adaptive management of the necessary infrastructure and processes to maximize the impacts of One Health require collaboratively built criteria for success, new capacity to evaluate success and dedicated efforts to systematically understand the enablers and obstacles to turning discovery into health benefits for people, animals, and their shared environments.

Institutional support

Bridging where we are now with where we need to be requires cross-cutting institutional support and investment in transformative ideas, people, processes, governance, and partnerships to adapt and mobilize innovations for resilience and health. Training for game changing One Health requires not only greater investment in conventional disciplinary education, but also in cross-cutting capacities and ideas that will make it easier to see what is working and for whom and to push those lessons throughout the research and policy communities more routinely and effectively. At the heart of this issue is the need to shift to integrated rather than sector-based approaches to achieve multiple objectives and to mainstream concepts of fairness and redistribution of the health resources between people, animals, and settings (Stephen and Parmely 2022).

Conclusion

The 21st century has been characterized by its unprecedented rates and scales of change. Climate change is a change amplifier. It interacts with other global pressures such as urbanization, species loss, habitat degradation and pollution. There are many areas of study and policy that struggle with the reality that current approaches to pressing health issues are insufficiently translating scientific discovery at the rate and scale needed to inspire or sustain actions against climate change and similar mega-threats. The *status quo* is not up to the tasks that lie ahead.

Disruption of the *status quo* approach to how we train people who can promote interspecies and intergenerational health equity will require the dominant constructs to be challenged. Given the persuasive nature of some dominant voices in the One Health community, it is reasonable to be concerned that power dynamics and bias in resource allocation may be constraining the ability of innovative educators to find new ways forward for a healthier more sustainable future. As Gustaffson (2017) pointed out with respect to species-at-risk management, new information is often incorporated into previously constructed and accepted narratives to create certainty and counteract the development of a new narrative. While this approach cements the legitimacy of the narrative, the lack of an opposing narrative limits attention on other uncertainties, often leaving those problems unexamined (Gustaffson 2017). Consequently, when the narrative is constructed and controlled by select sets of organizations, experts or fields, issues not at the forefront of academic discussions or funding may be constrained, thus limiting the potential to provoke the necessary transformational changes.

The arguments and attributes presented above are opinion based. We have raised, but not resolved, the issue of how we can expand One Heath education to bridge the intention-to-doing gap in a manner that keeps ahead of the pace and scale of threats shared by people, animals, and our environments. The arguments above need grounding in more in-depth theory, as well as application and evaluation. Our intention in this essay was to promote discourse that challenges the current state of One Health teaching and practice, thus helping us reflect on how to future-ready One Health. New educational programs will benefit from ongoing horizon scanning along with program evaluation to ensure we continue to produce people who can not only respond to today's problems but who are also are ready for tomorrow's One Health challenges.

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