Assessing and Addressing Environmental Health Disparities with Indigenous Communities: An Environmental Health Disparities Literature Review

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Introduction

The concept of this literature review emerged from a need to holistically address the nature of environmental health disparities impacting indigenous communities; and as well to inform strategies of intervention through community based participatory methods; and further, to inform future research that will help close the gap in access to evidence based planning data for indigenous community based environmental health monitoring and evaluation activity.

Background

Indigenous peoples experience disparities in environmental health outcomes when compared to settler populations in a myriad of compounding ways. A larger picture emerges when considering the intersecting issues of climate change, environmental justice and pollution, and a gap in evidence based planning data for monitoring and evaluation methods appropriate for use with, and within, indigenous communities. This lack of access to evidence based planning perpetuates an ongoing lack of fiscal resources from being allotted to address matters. Localized disruptions in codified rights to natural resources, and a lack of fortification in laws concerning indigenous health and human rights, often create shortcomings in attempts to address issues of indigenous and environmental health at the local level.

Methodology

The questions driving this collection of literature were: What issues define the current state of environmental – and related – health disparities in indigenous communities? What are the emerging evidence-based strategies to assess and address these issues? Search criteria included: 1)'environmental health disparity' (all fields) (AND) 'indigenous people' (all fields); 'environmental health' (all fields) (AND) 'indigenous' (all fields); 'monitoring and evaluation' (all fields) (AND) 'indigenous' (all fields); 'indigenous' (in title) (AND) 'public health' (in all fields) AND 'environmental' (in all fields) AND 'law' (in all fields); and, due to mounting calls for policy approaches at the international level, also included was 'indigenous rights law' (all fields) in a strictly medical and public health database.

Results

Climate change quickly emerged as a broad theme of environmental health disparity and environmental injustice – encompassing present and unfolding impacts, as well as imminent future impacts on the indigenous environmental health disparity at a global level. Other abstracted themes from the overall literature were: affecting sustainability through community-based participatory research methods; culturally appropriate monitoring and evaluation methods; and, community-based risk assessments and reporting strategies.

Conclusions

Attempts to address the systemic issues that manifest as threats to biocultural resources in indigenous communities, and a heightened vulnerability of indigenous peoples to environmental toxins, will require unprecedented cooperative efforts between indigenous communities, trained researchers, and health practitioners. The situation calls for a social

ecological approach with a multifold focus on merging local community knowledge systems and values – it might surprise some public health researchers to learn that many indigenous communities have been monitoring their community's environmental health for quite some time – with scientific methods (particularly in determining causation) and support for policy shifts in environmental health law and indigenous rights law at the international level.

Indigenous People and Climate Change

Indigenous peoples are living at the forefront of global climate change. Whether related to residing in high impact coastal regions, or depending more on the natural environment for personal subsistence or cultural and spiritual continuity, the increased impact climate change will have on indigenous communities around the world should be garnering due attention. Webb, Bambrick, Tait, Green, and Alexander (2014) explored one way to predict future impact from climate-change driven temperature increases on hospital visits (acute health crises) in indigenous and non-indigenous populations in Australia's Northern territory. Their analyses of admisson rates confirmed that indigenous peoples of the region were more vulnerable to negative impacts on morbidity rates (experiencing an increase in illnesses) associated with climate change related temperature increases. Furthermore, the negative effect was even stronger for indigenous youth, which unfortunately mirrors the devastating suicide epidemic currently endemic to global indigenous populations.

Saxena, Fuentes, Herbas, and Humphries (2016) examined what implications climate change had on traditional indigenous crops in the Colomi, Cochabamba region of Bolivia. Indigenous Colomi agricultural farming exists as part of a broader network of 'indigenous food systems' which are largely ignored in most aggregations of climate change impact data regarding global agriculture. Yet, they are likely more vulnerable to immediate and direct threat from climate shifts. The overall health status of food production – as well as processing activities and environments – in this larger context requires more practical research to determine which of the harmful consequences might be mitigated or avoided. A coalition of research institutions, including the Yale School of Public Health, sponsored the efforts to collect this mixed methods data. Their joint analyses suggested that the impact of climate change on indigenous agriculture is vaster than just issues of yield; and, can be determinative of choices farmers have to make regarding planting times, management of soil, and the spacing of various crops. Even more micro-level household practices of preserving and detoxifying food may be reliant on environmental resources that are vulnerable to a shifting climate.

Unlike the indigenous suicide epidemic – which research has shown might be better addressed through an increase in protective factors – Knibbs and Sly (2014) described the importance of developing a greater focus on environmental risk. Crucial to this approach are scientific efforts to isolate and definine the causal mechanisms that are producing the environmental health impacts and manifesting in the indigenous environmental health disparity.

Responding to observations recorded by tribal elders concerned with decreasing measures of annual snowfall, as well as an observation of overall milder winter temperatures, Doyle, Redsteer, and Eggers (2013) spearheaded a local investigation of climate and hydrolic data from the Tribal College of the Crow Reservation in south-central Montana. Stemming from the inherent and unique vulnerabilities indigenous communities often embody in terms of climate change – due to ecosystem interconnectivity, nature-based cultural practices, larger

ongoing challenges to public health, and a lack of access to resources for beneficial, adaptive, infrastructure – the community on the Crow Reservation is concerned about future impacts from climate change and what it all will mean for local ecosystems and community health. The team's analysis confirmed the elder's observations regarding a decline in snowfall, and measured an increase in frost-free days as well as other shifts in precipitation and temperature. Stream flow is declining; and elders reported such changes as disruptive to fish distribution and food-providing plant species. There were also concerns among the community about dangerous heat exposure that could disrupt cultural activities like ceremonial fasting; concerns about alternate flooding and susceptibility to fires; and concerns about declining water quality. The researchers issued a call for even more localized research to document current – and predict future – impacts in order to better inform adaption-based strategic planning.

Lauer and Aswani (2010) have provided examples from an indigenous community-based management operative founded on traditional ecological knowledge and customary sea tenure governance. Included in their paper is a discussion on how local observers of ecological change shape the way marine resources are used and also provide a means for adaptation centered management to be conducted by sovereign indigenous or pluralistic governance systems. By comparing data from two villages, the authors documented how local indigenous resource centers can provide community members with the ability to monitor ongoing ecological changes in their community; while also impacting their understandings of what drives these changes; and as well, increasing understanding about the ecology of the region, in general. Local records were compared with historic aerial photography and IKONOS satellite images over the past fifty years. The results confirmed that tribal record keepers had effectively documented the long term ecological shifts in their ecological communities.

Risk Assessment and Reporting

Review of the risk assessment literature reveals a need to increase support for community-based risk assessments and protocol development related to indigenous environmental health in order to assess disparities in health outcomes related to environmental toxins. Pan, Erlien, and Bilsborrow (2010) adopted Poisson regression to compare data on morbidity between indigenous and settler populations in the Ecuadorian Amazon. Taking a probability sample of land plots to obtain a sample of colonists, the indigenous data was collected from a representative sample of the five largest indigenous nationalities in the region – Quichua, Shuar, Huaorani, Cofan and Secoya. Results demonstrated undeniable differences in health outcomes between the two population groups. Indigenous peoples in the region suffered a third higher probability of mortality (death), and a two-thirds higher incidence of all-cause morbidity (illness) compared with the settlers. Adding to these statistics, the research team noted that exposure to environmental toxins was increasingly identified as the source of various morbidities. Particularly, petroleum contaminants were linked to increasing cancer related mortality rates, spontaneous abortions, as well as various skin and respiratory ailments. The authors of the study noted that debate surrounding the health impacts of petroleum extraction continued against the backdrop of a multinational case the Ecuadorian govenrment filed against Chevron. The study is fairly sound, but their logic was questionable when they attempted to link findings that indigenous groups were 2.5 times more likely to associate adverse health effects to petroleum

toxins than colonists—possibly being attributed to indigenous political movements. Their tacit assumption is indicative of a false baseline. Why would colonist data automatically be the standardized norm or automatic reference group? Why wasn't it framed as colonists being 2.5 times less likely to associate adverse health effects to petroluem? Surely, the colonists have their own potential biases and political movements (not to mention potential ties to the peteroleum industry.) This inherent distrust and bias towards indigenous data sets unwittingly highlights the need for a more evolved and conscientious approach to collaborative efforts.

Castro, Savage, and Kaufman (2015) assessed these ultimately discriminating views that indigenous peoples can face in health and health research settings. Their team noted how discrimination can present as patient-blaming – such as in the study above, where indigenous objectivity is questioned over the variance of their monitoring and reporting data compared with settler populations – disregard for traditional values, and disregard for language barriers in communications. The latter point is a huge issue in the emerging narratives of forced and coerced sterilizations from indigenous woman around the world, as consent was often sought in languages not familiar to the men and women receiving the life-altering procedures. Such deeply ingrained attitudes and negligence on the part of researchers and health workers – which are sometimes masked by feelings of righteous paternalism – can end up perpetuating the very disparities they seek to address, resulting in ineffective treatment; and in severe cases, verbal and physical abuse. Being treated in such a manner can further discourage indigenous people from seeking appropriate and timely clinical care; and, concurrently create a sense of shame or distrust that could obstruct their participation in future collaborative health initiatives.

Discussion of the study in the Ecuadorian Amazon also brings in the emerging theme of multinational stakeholder involvement in intersecting issues of indigenous and environmental health. The team of researchers, King and Furgal (2014)conducted a literature review using the terms: "Indigenous, Aboriginal, Inuit, First Nation, Native peoples, land…and 2013 available in English" among a relevant selection of electronic databases. Acknowledging both an uneven regional emphasis, and a gap in wide-ranging analyses of interdisciplinary or 'cross-ecozone' evidence to assess the intersections of benefit and risk in individual and environmental health, their paper describes a new model developed to faciliate deeper acknowledgment of the complexity of issues playing out on a global scale.

Gaydos, Thixton, and Donatuto (2015) address challenges related to multi-national ecosystem risk management, while simultaneously recognizing the merit of local ecosystem approaches. Their study looks at energy development intiatives that would increase levels of marine vessel traffic, and evaluates the individual threats each project posed to the area's natural resources. Their preliminary evaluation confirmed and demonstrated the importance of an international perspective and approach to ecosystem management; and, highlighted a vital need for collaboration and management at this macro level to evaluate large scale ecosystem threats. Beyond this, they also recognized a need for imminent risk assessments to be conducted at a similar scale. Included in their text is a usedful table outlining wildlife risk assessment strategies which could be appropriate for use in efforts to legally address large scale threats to indigenous environmental health – like in Guatemala where, recently, an indigenous-led movement produced a charge of ecocide against a multinational palm oil company.

Holistic risk based assessments must be approached through a new paradigm, more completely conceptualizing these intersecting themes of indigenous and environmental health according to research collaborators, Arquette, Cole, and Cook (2002).Cultural and subsistence practices of indigenous peoples tend to increase their overall exposure to environmental contaminants; and any disruption to these activities can produce further negative impact on individual and community health.

A holistic approach must incorporate risk assessment within a socio-cultural framework, and this will require interdisciplinary (ecological-biological and social sciences) and metadisciplinary (united practical and theoretical) approaches. An appropriate mixed methods design might include embracing scientific disciplines such as epidemiology, toxicology, and ecology, and combining them with collaboratively conducted qualitative research. Arquette, Cole and Cook concluded that there were serious limitations to purely quantitative risk assessments.

Flores-Ramírez, Pérez-Vázquez, and Cilia-López (2015) assessed the exposure of Mexican indigenous children to a mixture of pollutants in three communities, while operationalizing a community-based health model. The strength of their study lies in the way it assessed exposure to toxins using indigenous-specific indications of risk to inform interventions intent on managing risk at the community level. Their results confirmed the unfortunate theme that children in indigenous communities are exposed to elevated levels of environmental pollutants; and also reiterated the need for more evolved approaches and mixed-method assessments involving culturally specific protocols.

Sustainability and Community-Based Participatory Approaches

Sustainability can be a rather slippery term; it is often used almost arbitrarily in discussions about environmental health and program management. However, in terms of assessing the benefits of community-based participatory approaches to assessing and addressing the environmental health disparities common to indigenous communities, the term has due place. Again and again, researchers are finding that involving indigenous communities in the conception, application, and evaluation of environmental health research and interventions can provide a degree of stakeholder buy-in that helps insure any relevant findings will be absorbed, maintained, and even built upon in the community, once the initial research has run its course.

Researchers, McOliver, Camper, and Doyle (2015) revealed a number of initiatives sponsored by the United States Environmental Protection Agency's (USEPA) Science to Achieve Results (STAR) environmental research grants programs which allotted funds to tribal communities for self-addressing disparities in environmental health. The STAR program was spearheaded in accordance with the knowledge that tribal populations are likely at an increased risk for environmental health related morbidities. The team asserted that two of the most crucial steps for validating and advancing community-based participatory research in tribal communities are: outlining the sustainablity of strategies to produce long term impact; and, increasting the capacity for indigenous communities to form partnerships and knowledge-sharing cooperatives with other communities, therefore empowering tribes to meet long term goals themselves. Supplemental – or perhaps even foundational – to this process are efforts to support access to information initiatives that connect indig-

enous communities both with each other and with relevant streams of culturally appropriate information in order to increase potential for the sharing of research designs, implementations, and results.

Another researcher, Cook (2008),identified original articles that reported results on community-based participatory research applications in occupational and environmental health in the U.S., accommodating various inceptions, processes, methods, and outcomes. Cook revealed that in 14 out of 20 systematically reviewed reports, community-based participatory methods led to community-based action, which led to improvements in community level indicators of health and wellbeing. More likely to produce community action, were studies that investigated problems which had been identified by the communities themselves. Coalition-building between scientists, university researchers, community partners, and government entities, emerged as a new model of community-based participatory research capable of unifying the research process with community-based action. In order to capitalize on this value, Cook recommended a shift towards 'community-initiated and action-oriented studies'.

Friendship and Furgal (2012) conducted forty-one partially open-ended interviews with people they deemed as 'Traditional Food Knowledge Holders' and 'Health and Environment Decision-makers'. The duo also analyzed and reviewed organizational records regarding past risk management events relative to these issues. Theirs was a project exploratory in nature, qualitative in deisgn, with an intent to investigate what role indigenous knowledge plays in the management of environmental toxins through consumption of traditional foods in Yukon First Nations (YFNs.) Efforts to include indigenous communities in cost-benefit analyses were shown to have a significant impact on the community's perception of results. Researchers concluded that a responsive set of guiding frameworks, intent to unite people and knowledge systems, could achieve more progressive results in the contexts of multi-cultural research initiatives than would attempts to implement rigid, preconcieved strategies of researcher(outsider)–prescribed frameworks.

Another review, conducted by Ahmed, Shahid, and Episkenew (2015), assessed various theoretical approaches to treating disparities in indigenous health through medical and public health interventions that target areas such as the environment. The authors describe how current health disparities are rooted in centuries-old patterns of colonlialism and assimilation policies that have shaped social and health determinants through the social and physical environment, and are evident in intersecting markers such as unemployment, poverty, and pollution. Especially important to understanding indigenous health disparities, they point out, is the analysis of issues through the lenses of critical theory, postcolonial theory, and the social-ecological model. Perhaps the least well known of those, postcolonial theory, is actually a family of theories based on an ethically motivated sociopolitical focus on how the legacy and history of colonialist policy continues to mold indigenous peoples' experiences, opportunities, and general health outcomes. The team reinforced the mounting conclusions that community-based interventions are necessary to the achievement of sustainable and impactful shifts in health outcomes; further emphasizing how they are specifically imperative to reducing the rising burden of cancer, in particular.

Hankivsky, Grace, and Hunting (2014) presented a framework developed especially to embrace the overarching theme of intersectionality in order to produce more socially just and inclusive health outcomes. The framework they

propose is called Intersectionality-Based Policy Analysis (IBPA). To promote the merits of the framework, the analyses of each case study was approached through the idea of providing an innovative structural policy analysis while capturing varying and intersecting dimensions of policy contexts (i.e. politics, experiential realities, history, biocultural diversity, sociocultural places and networks). Also part of their intent, was towards generating paradigm shifts regarding the lenses through which knowledge and policy solutions are transformed into action (with the aim of transcending other policy frameworks currently aimed at measures of equality.) The authors define intersectionality through a set of central tenets: 1) human lives cannot be reduced to demographics or singular characteristics; human experience cannot be understood through the abstraction or prioritization of any single trait; many organizing traits are socially constructed to begin with (i.e. race, gender, sexuality, ability, etc.); and interactive social realities are generated by intersecting social processes and structures – which are then shaped further by influences such as power structures, time and place. All of these factors combine to constitute the need to approach health and social problems via a lens that promotes social justice and equity of outcomes and impact.

To close out this section, let's take a look at a specific community-based approach that aims straight at the heart of many collaborative and ethical issues: involving indigenous community elders in the research process. Flicker, O'Campo, and Monchalin (2015) examined what role indigenous elders can play in making sure research methods and concepts are aligned with community and individual ethics, values, and traditions. The team concluded that indigenous elders are important keepers of knowledge, and valuable consultants on ethics – protective, knowledgeable, and credible concerning community issues. Their abilities to offer counseling and support, while mediating any conflict – and providing place-based context while fulfilling traditional ceremonial roles – make them vital conduits of intent and relationship-building within the communities, and potentially, within the research process. Potential challenges the authors cited involved finding culturally appropriate ways to initiate contact with community elders while operating through sometimes seemingly incompatible bureaucratic systems.

Monitoring and Evaluation

Monitoring and evaluation initiatives that address the intersecting themes of indigenous and environmental health are in dire need of attention and development. Bainbridge, Tsey, and McCalman (2015) concluded that the development of a strategy for systematically assessing benefits – in a manner also deemed beneficial by the indigenous peoples involved – in terms of monitoring and evaluation systems, planning, and research prioritization, was imperative to the implementation of indigenous health research projects. The team also posited that this will likely involve efforts to embrace alternative research methodologies in a benefit-led (and therefore, benefit-defined) approach. Benefit analyses should be routinized from the conception of research projects and the processes must take into account the varying perceptions of value – regarding both outcomes and the nature and purpose of the research in general. Moving forward with these intents will involve collaborating with, and taking into account the experiences, values, and perceptions of indigenous communities; and as well, making an effort to better demonstrate – as well as measure – the benefits and positive outcomes along the way.

Continuing in the vein of study about increasing indigenous community stakeolder

buy-in, Gray, Saggers, Drandich, Wallam, and Plowright (1995) reinforce these burgeoning themes of reciprocity in approach. The researchers assert that evaluation strategies must adopt a broad and responsive system that employs both qualitative and quantiative methodologies, is malleable to sociocultural factors unique to each indigenous communitiy, and is operable in terms of limiting research infrastructures like administrative, technological, and information systems. The authors also echoed the notion that indigenous peoples must be consulted through every part of the evaluation.

Identifying a gap in research and empirical data regarding the monitoring and evaluation of community health coalitions (which are, as previously described, often central to crucial collaborative, multinational efforts) Francisco, Paine, and Fawcett (1993) identified eight key measures of coalition process and outcomes along which evaluations should occur: 1) number of members; 2) planning products; 3) financial resources generated; 4) dollars obtained; 5) volunteers recruited; 6) services provided; 7) community actions; and, 8) community changes. By evaluating community health coalition activity and output along these measures, the development process is well documented, and empirical information regarding key outcomes associated with the group's mission is well preserved. The authors added that other scientific strategies should be applied to assess any causal impacts related to an intervention; and, that assessments for overall impact at the community level will require baseline (pretest) data relevant to community wide factors.

Monitoring and Evaluation – Community-Based Participatory Research and Sustainability

One of the sub-themes generated by this review involves the intersection of appropriate monitoring and evaluation strategies with CBPR and sustainability. Jollands and Harmsworth (2007) tackled the broad subject of sustainable development and the growing body of evidence that identifies a need to evaluate the progress of sustainable development policies at the community level. Indigenous communities, they note, are often notably and disproportionately left out of these evaluation processes. They sought to understand how sustainability monitoring systems might be approached in a participatory, community-based fashion amongst other themes of ecological economics and transdisciplinary research. The authors further isolated the need for the development of sustainability indicators – and reinforced the call for focus on an appraisal of benefits – to offer as rationale in garnering participation from indigenous stakeolders. The researchers noted that present participation rates are low; and, efforts to increase them are under-funded, and subsequently not achieving full potential. Jollands and Harmsworth (2007) concluded that addressing factors significant to this lack of participation on the part of indigenous stakeholders is key to improving the impact of sustainability indicators, globally.

Research team, Danielsen, Mendoza, and Tagtag (2007) isolated a need for better understanding the status of environmental vulnerability, while at the same time safeguarding against alienating the local populaces and stakeolders from involvement in key environmental decision-making processes. One solution proposed, again, was embracing a strategy of participatory environmental monitoring. The authors included that scientifically guided community based participatory biodiversity monitoring techniques could be quite valuable in conceptualizing new approaches; and, also valuable as complimentary approaches to existing schemes of environmental monitoring and evaluation. The important distinction made

here is that previous methodologies and initiatives don't have to necessarily start over from scratch or reinvent the proverbial wheel; more collaborative methodologies can be introduced effectively, in a supplemental manner, at varying junctures and trajectories.

Another team responded to barriers of indigenous support for scientific research and the need to hone themes of monitoring and evaluation already in use. Jollands and Harmsworth (2004), offered their approach that science is expensive and nature is vast; and building upon these barriers is the fact that "customary users of wildlife" may not always be welcoming or trusting of researchers, research, or research intent. With this in mind, they recommended adopting pre-existing traditional monitoring methods – specifically, in this case, to peform spot analyses regarding prey population dynamics. Their paper analyzes methods of traditional indigenous stewardship and includes monitoring techniques of "catch per unit effort and body condition." Broader findings showed that the combination of modern scientific and traditional indigenous monitoring methods can not only serve to build ongoing partnerships between researchers and communities, but can also foster consensus and sustainability regarding resource management at the community level. Since most traditional methods of monitoring already operate on a scale of practicality and low fiscal burden, they can be, and often are, incorporated into other traditional activites, like hunting. In all of the cases they examined, the researchers discovered a surprising level of congruence and agreement between modern surveillance methods and traditional indigenous ecological knowledge frameworks. Problems do tend to emerge in disagreements over causality, and in determining problem solving strategies; there can also be conflict in overall approaches to population monitoring. The authors assure though, that embracing an alternative viewpoint could be key to overcoming any perceived differences and finding ways for unique approaches to compliment each other rather than contradict. To this end, Jollands and Harmsworth suggest that scientific methods can be applied to test causation in accordance with the observation methods and history central to the approaches of indigenous stakeholders. Involving indigenous stakeholders, they concluded, is more likely to lead to the actual application of research results.

Natcher and Hickey (2002)go against the general grain to take issue with the way advocates of community-based resource management often tend to depict indigenous communities as 'homogenous sites of social consensus'. While strides are made in garnering local support and participation in management and decision making processes, this good intent can also fail communities by failing to represent the full spectrum of values and interests amongst different segments of the community itself. If left unchecked, this can lead to a perpetuation of the dysfunctional 'top-down' model which is often a byproduct of the institutionalization of resource management. With this kept in mind though, such strategies can indeed nurture new and innovative community based resource management approaches. The team identified a model for such innovation in the Little Red River Cree Nation currently residing in what is now Alberta, Canada. Adopting specific, community-generated criteria and performance indicators, the Little Red River Cree Nation has honed a self-sustaining – and even self-improving – system of forest management that is demonstrating repsonsiveness to the shifting needs, expectations, and differing underlying values of community stakeholders. The Little Red River Cree Nation model shows how community-based resource management systems can adopt and

fuse cultural, ecological, economic, and social criteria into the assessment processes, while implementing a self-improving monitoring and evaluation strategy that manages conflict by simultaneously serving as a venue for the full spectrum of values within the community. The core theme of their paper is to demonstrate the necessity of more pluralistic representation methods when working with indigenous communities to explore sustainable and alternative approaches to environmental resource management.

A study conducted by Nanyunja (2006) in Uganda also aimed to isolate appropriate indiciators for participatory biodiversity assessment and monitoring through the knowledge of local people to determine trends in natural resources in the fifty years prior. Results of this study indiciated consistent measures of biodiversity loss – as is thematic at a global scale – that was due mainly to changes in peoples' livelihoods related to over-harvesting, as well as to broader political and institutional failures. Their takeaway point was that the use of indigenous knowledge proved to be a cheaper, and thus more pratical, method of biodiversity monitoring that also empowered local communities to better and more sustainably manage local natural resources. While Nanyunja concluded that these methods are important in biodiversity monitoring systems based on human perceptions; a concurrent caveat was issued that it would not be wise to rely on only one data source in general. To this end, there is found here a reiterated call to combine participatory biodiversity monitoring systems with other surveillance methods – both on the ground and by air.

Stem, Margoluis, Salafsky, and Brown (2005) cited an increasing consolidation of views among conservation scholars and practicioners that effective project management is infinitely tied to aptly designed systems of monitoring and evaluation. A problem many organizations face in trying to develop such systems lies in misguided efforts to reinvent the wheel in terms of approach instead of drawing benefit from the preexisting evidence and outcomes of other efforts. In addressing this, the team took to reviewing monitoring and evaluation approaches in conservation, as well as in related fields such as public health, international development, family planning, education, business and social services. Based on their findings, the team concluded that the conservation community must continue to support community-based collaborative endeavors towards improving monitoring and evaluation techniques by including qualitative and social factors; while, jointly making sure to establish replicable systems through careful clarification of key terms and components.

Another researcher put together a paper to address the present failings of monitoring and evaluation systems in adequately serving disadvantaged groups like some indigenous communties. Elias (2014) outlines the historical foundations of infant mortality assessments, locally and globally, and decries an underlying lack of uniformity in the way vital events are collected in indigenous communities. The conclusion, not surprisngly at this point, is that indigenous leadership is required to improve indigenous identifiers for better representation in vital statistics systems.

O'Neill, Harding, and Harper (2012) reviewed issues of research ethics, data sharing, and indigenous sovereignty in the processes of community-based participatory research in matters of indigenous health and natural resources with American Indian nations. In their article, they present a model and contract for data-sharing that is in accordance with both tribal and university requirements. The team reccomends developing agreements with indigenous community partners that reflect IRB

concerns in both areas of health and natural resources. To do this, they further recommend that researchers working with indigenous communities become aquainted with the concepts of indigenous sovereignty and informed consent. Since the community itself likely has the best foresight concerning potential negative impact and outcomes, they must be involved in any cost-benefit anlyses – which requires they be made familiar with the themes and methods of any proposed research designs. The authors here reiterated the broadening theme that indigenous communities must be truly equal partners in research conception, data collection, data interpretation, and even publication.

Orozco, Cole, Forbes, Kroschel, Wanigaratne, and Arica (2009) adopted the constructs of the WHO's Food and Agriculture Organization's Code of Conduct and re-framed them in terms of farmers' rights. Drawing on survey and focus group data, as well as participatory observation methods, indicators were constructed to reflect the status of such rights. Operationalizing a framework of farmer's rights as a guiding theory, their ultimate strategy included questioning powerful forces of industry and government regarding pesticide use – and overuse – and urging reformations in codified laws concerning pesticides. They were concerned as well with evolving more sensitive and sophisticated surveillance structures. Their overall strategy involves – and here we see this theme again – coalition building; as well as code-promoting and monitoring; and larger advocacy efforts towards mitigating the health and social risks of current and past hazardous levels of pesticide use.

Intersecting Issues

At this point the notion that indigenous communities face disparities in health and environmental health risks and outcomes, compared with settler populations, has been supported. Hoover, Cook, and Plain (2012) make the case that these health impacts constitute issues not just of environmental justice, but also of reproductive justice. Reviewing five indigenous communities conducting environmental health research at various stages, the authors discussed the points of intersection in environmental health and reproductive justice, including options and limitations to legal recourse. Noting that health disparities impacting reproductive function and life expectancy rates in indigenous communties are a manifestation of environmental, social, and economic factors, the researchers revealed that many indigenous communities have an interest in developing research partnerships towards conducting environmental risk and impact assessments that can help mitigate or prevent further damage. And once again, the research team reccomends continued research undertaken collaboratively with community members and health care providers in determining impacts of environmental contamination and ascertaining what to do about it.

Issues of environmental justice and indigenous health also collide with issues of biopiracy, when bioprospectors seek to copyright and profit from traditional indigenous knowledge or resources. According to Mackey and Liang (2012), there are global health consequences to biopiracy that include lack of access to traditional medicines and depletion of biocultural resources (without due compensation, if and where possible) and this all compounds to impact entire systems of health care and ethnomedicine. Many of the affected communities are already experiencing health disparities; therefore the compounded impact of biopiracy can be especially problematic. Once again, we see researchers calling for an international approach to issues of environmental protection and indigenous health. Because of the multinational nature of bioprospecting

and biodiversity; the authors conclude that management might best occur through global governance – though conceding that attempts to protect biodiversity through global governance have not been effective enough thus far. While recognizing bioprospecting as important to fields of medicine, the authors of this paper propose the need to share the benefits of a region's biodiversity equally among stakeholders in a manner that promotes environmental health and justice for all whom are impacted. In order to achieve this, they call for a health–economics policy capable of addressing issues of biopiracy and allowing the responsible development of medicines to promote local and global health.

Discussion and Conclusions

The main limitation of this review is that findings are possibly skewed due to publication bias, as well as the availability of free access to research data online. However, given the overwhelming support uncovered for community-based risk assessment and reporting strategies, as well as monitoring and evaluation methods, it seems likely that the results are sound – the overwhelming uniformity making up for a larger margin of error. To this end, future research might be needed to focus more on identifying and strategizing to overcome potential problems and divides in implementing these approaches. The consensus is there; so, perhaps it's time to dissect the approach on a deeper level, (and efforts to begin this – as described in this review – are already being initiated.)

Also overwhelmingly evident, is the need for a social ecological approach to data collection and assessment methods that incorporates both local and international perspectives and partnerships. Coalition building between local and global stakeholders, as well as researchers and indigenous communities, would need to come into focus more in order to operationalize a lot of the findings detailed in this report.

Climate change is demanding special attention; it will take the combined vigilance of local community traditional techniques and up to the minute scientific surveillance methods to stay on top of strategy development with focuses on both prevention (first) and adaptation (second.) International laws and the validation of international jurisprudence concerning indigenous land and resource rights should be viewed through a social ecological approach to change – change coordinated and enforced at local, national and international levels. A subtheme to this is the need for more defined trajectories to address conflicts between corporate and pharmaceutical stakeholders in issues of resource extraction and bioprospecting. As has been detailed time and again, industry activity that causes shifts in indigenous ecosystems can have immediate and long-lasting effects on indigenous communities whose traditions mandate a closer relationship with the natural environment than most other groups due to both cultural and subsistence activities. It should be reinforced again that international efforts will need to be developed collaboratively with local communities to ensure that their rights to health, and the environmental health of their territory, are increasingly and concretely codified into international jurisprudence. The continued push for creating an International Environmental Court would probably be met with support from advocates of the international approach.

Again, research gaps seem to exist in addressing barriers to community-based participatory research projects with indigenous communities. The benefits of such approaches have been confirmed time and again, yet not much research has explored existing barriers. Important themes have emerged, such as: accommodating native languages, adopting a clear

benefit-led approach during initial contact (i.e. 'these are the benefits that will come from this research' rather than 'this is the problem that will be addressed by this research'); and attempting to access indigenous community elders or indigenous community media as a conduit to the community; still, more specific themes could benefit from further attention and research. Ironically, this sort of research – to address potential barriers to the CBPR approach – would also best be carried out using a CBPR model. Initial focus groups might generate some ideas about what particular issues are important to indigenous communities, which researchers might then choose to address (flipping the script on the standard narrative of researchers approaching a community with an idea already intact). Initial ideas could be tested in the larger community through intra-tribal surveys and ethnographic data. At some point, an aggregation of results should be published concerning the research needs, and desires for collaborative projects, from participating indigenous communities. Considering how studies aimed at investigating problems identified by indigenous communities themselves have been demonstrably more likely to generate ongoing community action, recognizing a community's original call for research might indeed be the best 'approach strategy' of all.

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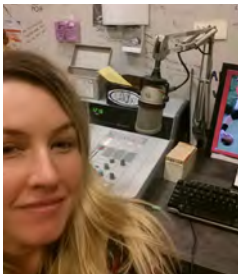
About the author



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