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ORIGINAL RESEARCH/SCHOLARSHIP

Institutional Approaches to Research Integrity in Ghana

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Abstract

Research misconduct (RM) remains an important problem in health research despite decades of local, national, regional, and international efforts to eliminate it. The ultimate goal of every health research project, irrespective of setting, is to produce trustworthy findings to address local as well as global health issues. To be able to lead or participate meaningfully in international research collaborations, individual and institutional capacities for research integrity (RI) are paramount. Accordingly, this paper concerns itself not only with individuals' research skills but also with institutional and national policies and governance. Such policies and governance provide an ethical scaffold for the production of knowledge and structure incentives. This paper's operational definition of research therefore draws from Institute of Medicine's articulation of health research as an inquiry that aims to produce knowledge about the structure, processes, or effects of personal health services; and from an existing health systems framework. The paper reviews the research regulatory environment and the ethics apparatus in Ghana, and describes a project jointly undertaken by Ghanaian researchers in collaboration with New York University to assess the perceived adequacy of current institutional practices, opportunities, and incentives for promoting RI.

Keywords Research integrity · Health research · Research climate · Ethics apparatus · Ghana

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Background

In recent past, efforts to promote research integrity (RI), which broadly means ensuring the performance of research to the highest standards of professionalism, rigor, and in an ethically robust manner, abound (Adebamowo 2007; Caplan et al. 2018; Gutierrez et al. 2017; Hyder et al. 2007). Such efforts include RI capacity development. Collectively, RI capacity development aims to provide an evidence base for improved practices and policies to maintain or improve research quality. In this paper, we focus broadly on policies, structures, and capabilities in Ghana, a lower middle-income country (LMIC) in West Africa, to learn how research in the Ghanaian setting is produced with integrity. RI, as defined above, encompasses both subject protection and maintaining high scientific quality, including prevention and detection of research misconduct and the maintenance of valid scientific records. Because health research is likely to translate rapidly into clinical practice and directly impact lives, ensuring a high degree of integrity in health research is of particular importance.

While significant effort has been invested in building capacity for human subjects protection—through the establishment of Institutional Review Boards (IRBs) in LMICs (Glickman et al. 2009; Hyder and Rattani 2014; Nchinda 2002; Petryna 2009; Strosberg et al. 2013; WHO 1996), very little focus has been placed on ensuring RI (Ana et al. 2013). IRBs, also referred to herein as Research Ethics Committees (RECs) and Ethics Review Committees (ERCs), among others, serve to protect the rights of, or interests of human subjects/study participants. Whether or not IRBs effectively carry out this level of oversight is not routinely evaluated in Ghana. A recent assessment of local IRBs revealed that although their standard operating procedures closely align with international standards/recommendations, unique challenges (such as absence of a formal system to evaluate the activities of the IRBs, high protocol-to-committee member ratio and therefore inability to provide timely feedback on research protocols) remain (Boateng 2019). Other crucial steps central to RI occur largely outside of oversight: how the protocol is implemented, data acquisition, privacy protection, avoidance of misconduct, and the adequacy of data analysis. Other quality control mechanisms such as institutional oversight and peer review, which largely involves examining the finished product, sometimes are unreliable.

Over the years, efforts at defining, detecting and developing interventions for preventing research misconduct (RM) and promoting integrity in research have been made (Marusic et al. 2016; Resnik and Master 2013; Anderson and Kleinert 2013; Lee 2012; Resnik and Shamoo 2011; Farthing 2001). RM that violates data integrity is defined in part by the US Federal Policy on the subject as "fabrication, falsification, or plagiarism in proposing, performing or reviewing research, or in reporting research results" (Code of Federal Regulations 2011). In addition to deception in proposing, carrying out, or reporting results of research, others have broadened to definition to include "deliberate, dangerous or negligent deviations from accepted practices in carrying out research. For instance, failure to follow established protocols or adhere to established ethical principles if this

failure results in unreasonable risk or harm to humans, other living organisms or the environment and facilitating of misconduct in research by collusion in, or concealment of, such actions by others. It also includes any plan or conspiracy or attempt to do any of the above" (University of Sheffield Human Resources 2020). Fanelli and colleagues' study of retractions/corrections "supports the notion that scientific misconduct is more likely in countries that lack research integrity policies" (Fanelli et al. 2015). Also important is the absence of a science culture in which mutual criticism is hampered and where publications are rewarded with cash (Fanelli et al. 2015). In a related study of problematic image duplication, academic culture and peer control were found relevant to achieving integrity (Fanelli et al. 2018).

National policies appear to be a baseline protection. Policies depending entirely on whistleblower complaints have been found in the US to be associated with significant underreporting of suspected fabrication, falsification, and plagiarism (FFP) (Titus et al. 2008). A combined meta-analysis, largely of US and European studies, found a reported incidence of RM behaviors of about 2% (Fanelli et al. 2018). In a convenience sample of investigators from several Middle Eastern universities, 28.6% of respondents self-reported fabrication and falsification, which was significantly lower among individuals who held a degree from a Western university (Felaefel et al. 2018). A small (N = 158) survey in medical schools and hospitals in India found 57% of respondents knowing of another who had altered or fabricated data in order to get it published (Dhingra and Mishra 2014). Digging deeper into the subject, Kingori and Gerrets (2016) explore the "morals, morale and motivations for data fabrication" in the sub-Saharan setting. They note that fabrication and falsification of data among nonscientists collecting data in the field has been underexamined.

Rohwer and colleagues surveyed corresponding authors of Cochrane reviews working in LMICs, finding many describing a lack of clear policies regarding RM and a lack of RI offices in their institutions (Rohwer et al. 2017). Nearly 80% of the survey respondents noted that guest authorship occurred at their institutions, while 40% indicated that colleagues had not in the past declared conflicts of interest (COI) and that researchers were uncertain what COI is and how it may influence their research.

Much focus is currently being placed on reproducibility and questionable research practices (QRPs). QRPs generate research findings that may be neither valid nor replicable. Concerned about the low reproducibility of many scientific findings (Ioannidis 2005), many scientists, journals, and funders are looking to RI codes or innovations to improve the reliability and robustness of research. Marcus Munafò describes the practice of "p-hacking (where researchers exploit analytical flexibility to obtain a statistically significant finding), and then present these results as if they were anticipated a priori (also known as HARKing—Hypothesizing After the Results are Known)" (Munafò 2016). Open science, a movement to encourage openness in science through open access publication and open data archiving (Attwood and Munafo 2016), is being promoted as a means to improve the reproducibility of published work. A study of NIH-funded scientists found 70% reporting QRP behaviors (Fanelli et al. 2015). QRPs identified by Sacco and colleagues from surveying individuals with at least one active NIH grant during 2016 include: concealing data,

results, methodology, or sources of financial assistance; failing to disclose all relevant COIs; withholding publication to please a sponsor; providing a biased peer review to delay publication and drawing strong inferences from statistically significant but under-powered studies (Sacco et al. 2018). Such QRPs are largely unregulated and leave enforcement to peer review, mentors, and scientific self-correction over time. No comparable statistics exist for Ghana. In Nigeria, Okonta and Rossouw (2013) determined the prevalence of RM in a group of researchers and factors associated with the practice. They view their data as cause for serious concern and call for prompt intervention. Interventions to reduce RM, they authors note, should proceed from measures that contain both elements of prevention and enforcement. Training on research ethics and RI must be integrated into the curriculum of undergraduate and postgraduate students, while provision should be made for in-service training of researchers (Okonta and Rossouw 2013, 2014). Yet another global effort at promoting research honesty is the TRUST Project (European Commission Infocentre 2018). The project is leading far-reaching efforts to improve adherence to high ethical standards in scientific research around the world. The TRUST project's Global Code of Conduct for Research in Resource-Poor Settings aims to ensure communities, research participants and local resources in scientific studies are treated with fairness, respect, care and honesty. We concur. Whilst codes, tools, and innovations are necessary, the capacity needed to deploy them is essential. Existing efforts of building enduring RI in the sub-region are few (Adebamowo 2007; Hyder et al. 2007). Capacity building requires assessment of current levels of these elements of RI and of professional and/or state regulatory systems to support them. We first describe selected examples of international partnerships; second, the research regulatory environment and the ethics apparatus in Ghana; and, then, a project jointly undertaken by Ghanaian research leaders and scientists in collaboration with New York University School of Medicine's Division of Medical Ethics to assess the perceived adequacy of current institutional practices, opportunities and incentives in supporting RI.

Selected Research Capacity Development Successes and Challenges in Ghana

There are some powerful examples of partnerships to create, sustain, and lead research capacity and infrastructure development in pursuit of better health for Africans and Ghanaians. The Global Emergent Pathogens Treatment Consortium (GET) was established by academics, scientists, clinicians, and civil society to facilitate development of infrastructure to support a harmonized African approach to health crises on the continent. GET's focus is in biobanking and biosecurity in laboratory settings. GET, as a registered entity, has operational offices in several countries, including the West African states of Ghana and Nigeria (Abayomi et al. 2016).

The H3Africa consortium, begun in 2010, while funded by NIH and the Wellcome Trust, is African-led. H3Africa aims to develop capacity for genomic studies. By 2017, the consortium had funded 26 research projects in 27 African countries, including Ghana. H3ABioNet will assist with data quality control and analysis (Ramsay et al. 2016). In particular, this consortium has placed a strong emphasis on

capacity development in research ethics, particularly community engagement and informed consent (Munung et al. 2017).

The West African Network of Excellence for TB, AIDS and Malaria (WANETAM), funded by the European and Developing Countries Clinical Trial Partnership, is engaged in local capacity building to address these diseases. Previously underreported, standardized international drug susceptibility testing is necessary for an adequate surveillance system and treatment. During this project, Ghana's Korle-Bu Teaching Hospital became accredited as the country's national TB reference laboratory. This credential moved West Africa toward independent, local research and competitiveness for international TB trials (Gehre et al. 2016).

The National Institute of Mental Health (NIMH) has funded Collaborative Hubs for International Research in Mental Health, including in Ghana, to increase the evidence base for mental health interventions in LMICs. Emerging researchers receive seed grants and research mentoring for capacity building (Pilowsky et al. 2016). NIH has funded the Sickle Pan-Africa Research Consortium (SPARCo) on sickle cell disease, using genomics to catalyze discoveries in Africa. Ghana has leadership of a data coordinating center; development of capacity and infrastructure is currently underway. The science is to be led from Africa not only to develop locally effective, evidence-based solutions but also to produce work of global importance (Makani et al. 2017).

Other partnership examples include the Ghana-Dutch Research Collaboration (GDRC), and Ghana's participation in the European Developing Countries Clinical Trials Partnership (Atelu et al. 2016), World Health Organization task forces, and Special Programs for Research and Training in Tropical Diseases (Warsame et al. 2016). In addition, Ghana has participated, in partnership with Novartis, in capacity building for clinical pharmacology research. Locally conducted research in this field is essential to safeguarding drug efficacy, safety, and quality, and aims to understand the influence of genetic diversity on drug response and disease susceptibility (Gutierrez et al. 2017).

In their "Mapping of health research institutions in Ghana: Landscaping and comparative analysis," Seddoh and colleagues offer some lessons from the GDRC (Seddoh et al. 2015). Initiated in 2000, the GDRC was a product of the Health Research Project (HRP), which involved the Netherlands Development Assistance Research Council (RAWOO) and the Ghana Health Service (GHS) Health Research Unit.

The HRP aimed to conduct research that would assist the health sector to improve health care in Ghana, with the potential end users of research as the target of any research conducted. The program was financed by the Netherlands Directorate General of Development Cooperation. A Joint Ghanaian-Dutch Program Committee (JPC)—consisting of three Ghanaians representing academia, policymakers, care providers, and NGOs, and three Dutch scientists with backgrounds in health, biomedical, and social sciences—was constituted to perform such duties as policy decision making and awarding grants. A review of this program by Enyimayew et al. (2006) concluded that the research agenda was consistent with Ghana's health sector priorities. The review also concluded that collaboration enhanced local research capacity, although the number of trained researchers was considered inadequate for conducting research to inform policy and to improve health service delivery.

Beginning in 2009, the Doris Duke Charitable Foundation's Africa Initiative funded research capacity training in five countries, including Ghana. Funding was used to support infrastructure, research training, and mentoring. Sustainability at the end of such project funding is often problematic, and there are no internationally shared metrics for measuring such a project's impact (Hedt-Gauthier et al. 2017). Although systematic evaluation of the impact of these initiatives on development of research ethics capacity is rare, one assumes that these consortia and activities require high-quality ethical review and oversight as well as specific efforts to translate valid and reproducible research findings into improved health. They also pool resources to produce the science and ensure its integrity, which may be unaffordable to individual institutions.

Innovative practice in research ethics is also evident in Ghana. For example, Tindana and colleagues developed a culturally appropriate framework for concerns about broad consent in H3Africa (Tindana et al. 2019). Facilitation of indigenous ethics for genomic studies is important. Entrustment, Tindana et al. argue, requires establishing responsibilities to use study samples widely and reciprocating by providing tangible health benefits. Research institutions with oversight from RECs should remain the stewards of these samples, attending to both their scientific and their cultural value. Entrustment requires a culture of RI, clear and transparent institutional policies, and RECs actively monitoring research to protect participants from the possible consequences of misplaced trust (Tindana et al. 2019). In a setting where these ingredients are absent, or where cultural values are at variance with entrustment, such a model may not promote RI. Exploring the problematic translation of bioethics between the Global North and South and between resource-rich and resource-poor countries, Miles and Laar (2018) argue that for such standards to be applicable globally, they must more directly engage the dialectical tension arising between cultural diversity and communitarianism. It is often said that western bioethics is excessively individualistic and that Africa, for example, is more communitarian (Beauchamp and Childress 2001; Coleman 2017; Gbadegesin 1993). These observations should serve as a reminder that standards of research quality may not be universal.

Research Regulatory Structure and the Ethics Apparatus in Ghana

Ghana has had a long history of health research–related engagements internationally and of implementation at the national and sub-national levels. Ghana has drawn and continues to draw on existing international guidelines and local knowledge to shape the development of its health research architecture, health research, and health service delivery protocols. This section describes Ghana's health and public sector institutions as capacitated, tooled, and resourced to oversee, manage, and conduct health service research.

Landmark projects and research efforts that emblematize Ghana's post-independence development of health research systems include the Danfa Project in 1970, the Brong Ahafo Rural Integrated Development Project (Adjei and Gyapong 1999), and the establishment of the Noguchi Memorial Institute for Medical Research

(NMIMR) in 1979 at the University of Ghana. The NMIMR was envisioned to be a world-class institute capable of conducting high-quality, cutting-edge research and training in the biomedical sciences. It is. Indeed, the NMIMR would become home to Ghana's first IRB in 2000. However, Seddoh et al. (2015) note that the 1982 Report of the Council for Health Research and Development (COHRED) is most inspirational in charting the future course of health research in Ghana. Following the COHRED report, in 1992 Ghana developed a framework of Essential National Health Research that led to the development of five-year policy framework on health research development (Ministry of Health 1992). Seddoh et al. (2015) note that document set out the mechanisms for establishing a research agenda for the Ghana Health Sector, including the mechanisms for capacity development and for coordination of research. This eventually led to the establishment of the national Health Research Unit (HRU) in the Ministry of Health in 1994. In addition, three field research centers—Navrongo, Dodowa, and Kintampo Health Research Centers—were planned and established.

Seddoh et al.'s work shows researchers' high awareness of international ethics policies supporting health research. Of note, there is currently no law on health research in Ghana, although the Ministry of Health is generally acknowledged as having de facto responsibility for coordinating and providing leadership for setting national research priorities standards and regulating conduct of research countrywide (Seddoh et al. 2015). The Ghana Food and Drugs Authority (FDA), an agency of the Ministry, was established in August 1997 with the national regulatory authority to regulate food, drugs, and other products, as well as to provide guidelines for the authorization of clinical trials in Ghana involving medicines, food supplements, vaccines, and medical devices. The FDA also provides Ghanaian investigators with Guidelines for Good Clinical Practice for conducting clinical trials. However, the FDA does not provide ethical or legal standards for research not involving clinical trials: e.g., epidemiological research, genomics, public health interventions, health informatics, and other health sciences. Nor does the FDA offer a nation-wide definition of what constitutes RM.

As described earlier, yet another important RI infrastructure in Ghana is Ghana Health Service (GHS), which administers government health services nationwide. GHS has an Ethics and Research Management Department to ensure the development of quality and consistency in all types of research conducted within the GHS. The Department hosts the Ghana Health Service Ethical Review Committee (GHS ERC), which reviews and approves all proposals for research to be conducted in GHS facilities or by GHS personnel. Aside from the GHS ERC, three other Health Research Centers of the GHS each have independent Research Ethics Committees (RECs). Each has a Federal-Wide Assurance (FWA) agreement with the United States Office of Human Research Protections (OHRP), but not with the US Office of Research Integrity (ORI). Of note, the governance of clinical trials is placed under the FDA in line with the dictates of the Public Health Act, 2012 - Act. No. 851 (Republic of Ghana 2012), Part 7 of which defines the requirements for undertaking clinical trials and how this might be regulated.

In the absence of a national coordinating body, primary responsibility for RI and preventing RM lies within institutions. Ghana's Council for Scientific and Industrial

Research (CSIR) has the mandate to coordinate research activities in the country. The CSIR has an in-house ethics committee that support institutions requiring their review and ethical comment in support of grant applications.

The University of Ghana (UG) offers an excellent example of an institution that has sought to develop its own research integrity infrastructure. In the last decade, UG has taken several steps to develop their institutional capacities related to RI. There are currently five IRBs at UG: (1) The Noguchi Memorial Institute for Medical Research—Institutional Review Board, including (2) an active Institutional Animal Care and Use Committee, (3) The Ethical and Protocol Review Committee of the College of Health Sciences, Korle-Bu Campus, (4) The Ethics Committee for the Humanities, and (5) The Ethics Committee for Basic and Applied Sciences. Additionally, UG's Office of Research, Innovation, and Development (ORID) was established in 2010, creating a central office to promote, coordinate, and facilitate research activities in the university. ORID also leads the development of UG's strategic plans, including its business plan and fundraising strategies. Over the last half decade, ORID has facilitated the development of various research policies, including (1) research policy, (2) research ethics policy, (3) intellectual property policy, and (4) research misconduct policy. ORID has recently created a Research Integrity Unit (RIU), which serves as UG's independent hub for handling issues regarding and relating to RM.

Other universities, teaching hospitals, and the Christian Health Agency, Ghana, contribute to the 17 research ethics committees currently in Ghana. An Association, the Ghana Administrators of Research Ethics Committees (GHAAREC) now exists, providing a platform for networking and sensitizing the public and research stakeholders about the need for proper research ethics as well as promoting the rights, welfare, and safety of research participants through efficient and effective research ethics administration.

The guidance provided by the CSIR, FDA, GHS, UG, and the many RECs in Ghana make up a strong foundation to promote ethical conduct within biomedical research. However, gaps remain. Staffing RECs, establishing a national ethical framework for non-clinical research endeavors, assisting universities and other institutions in their oversight roles, developing RI training capacities, and attaining FWAs from OHRP and ORI within Ghana are important issues. To provide the needed facilitation in addressing some of the issues delineated above, the ethics apparatus in Ghana needs a National Research Ethics Council (NREC). The Council would, amongst others, set national norms and standards for conducting research, registering, and auditing RECs, adjudicate complaints about the functioning of RECs/IRBs, determine guidelines for the functioning of RECs, and promulgate regulations on RI. None of these currently exists. Some of the outlined issues will be addressed by two projects: first, the Ghanaian Research Integrity Development (GRID) Project; second, the NYU-UG Research Integrity Training Program (NYU-UG RITP). These efforts are currently jointly being implemented by NYU School of Medicine and the UG School of Public Health. The latter effort aims to build sustainable research ethics and integrity capacity in Ghana. It will also establish a Bioethics Program, which will provide master's degrees in Bioethics at the University of Ghana, the first program of its kind in the country (Caplan et al. 2018).

The Project—Ghanaian Research Integrity Development (GRID)

To date the major focus of the extensive effort to build research capacity in LMICs has been the establishment of ERCs/RECs/IRBs. Very little work has addressed the broader construct of RI, which incorporates the scientific quality of research, including prevention of RM and preservation of a valid scientific record in addition to ethical engagement with research participants and the public. A review of health research capacity development concludes that the most effective approach is locally built and led. Local groups and individuals often have a strong understanding of evidence gaps and of the political and cultural context (Franzen et al. 2017). Also important are the social and political structures in each country that support production of research with integrity (Mormina 2018).

Motivated by this, researchers at NYU and in Ghana, with funding from ORI, implemented a project titled "Ghanaian Research Integrity Development (GRID)". The project aimed to describe the relevant policies supporting RI in Ghana, determine current challenges to RI through self-assessment, and to formulate a plan to address them through RI capacity building. GRID engaged a group of sixty Ghanaian researchers, institutional and governmental officials, and was facilitated by local and NYU-based participants. GRID's planning committee generated a list of relevant RI topics, which were prioritized for inclusion at a national conference. The logic model for this project is based on the notion of a complex adaptive system—a network of local and international institutions, scientists, regulators, national strategy, and health care system users of research, each with expectations and incentives that affect the production and use of science.

The model is: (1) Assess participant perceptions of the level of RI, RM, and contributing conditions, informed in part by policy and position documents. This approach is congruent with current methods cited earlier since data about whistleblower allegations and disposition of RM cases are considered to be confidential and thus not accessible for study. (2) Since RI and prevention and detection of RM require some level of self-governance by the scientific community, this body should analyze perceptions, policies, and whatever empirical evidence exists, and determine its own judgment about adequacy of current practice and policy, and identify areas in need of improvement. (3) Develop a plan for desired individual, institutional, and national-level changes, including additional direct measures of areas of concern. Working through this process should create learning and accountability, which must be made explicit and based as much as possible on consensus.

A survey serving as a needs-assessment tool was initially developed by Sergio Litewka and Elizabeth Heitman (Litewka and Heitman 2017) and modified for use in Ghana (Step 1 in the logic model), asking about institutional mechanisms, significant issues, and availability of formal RI educational activities. The survey aimed to capture, from the vantage point of researchers and administrators in Ghana, the current landscape of institutional approaches to research integrity and how those approaches might be improved. We invited the sixty researchers and administrators who registered for the GRID conference to participate in the survey. Our aim was to capture their perceptions of RI-related issues, the mechanisms their institutions have for promoting RI, the importance their institutions assign to these matters, and the challenges they

presently face in those efforts. We specifically probed participants about the following issues: fabrication and falsification of data; plagiarism; data management, ownership, and sharing; financial COIs; misattributed or disputed authorship; and retaliation or fear of retaliation against reporters of RM. The questionnaire was anonymous and administered online using REDCap prior to the conference. Thirty responded. Our survey protocol obtained a priori ethics approval from the GHS ERC (Approval # GHS-ERC011/06/18).

Data from the survey revealed that most participants perceived RI issues as significant problems in their institutions. For some of the issues, such as authorship, most participants reported there were no institutional mechanisms or formal educational opportunities to address them. For other issues, such as plagiarism, these perceptions occurred despite the fact that participants' institutions had defined mechanisms or formal educational or training opportunities for addressing those issues. These results, which are the findings of self-assessment, suggest that there is work to be done to promote RI in Ghanaian institutions. A more fine-grained understanding of what that work must involve will emerge from our future research projects.

The NYU-UG Research Integrity Training Program (NYU-UG RITP)

The NYU-UG Research Integrity Training Program (R25-TW-010886) (Caplan et al. 2018) aims to address the gaps revealed by GRID. The program is a collaborative endeavor between NYU and UG, and is funded by the Fogarty International Center, U.S. National Institutes of Health. It has developed a fellowship program in research integrity to create a critical mass of faculty and other leaders with expertise in research ethics, RI, and research governance in Ghana. Its thirty fellows, divided in cohorts of ten over three years, take courses with faculty from both institutions in the history and philosophy of research ethics, research integrity, and developing collaborative research outputs. The fellows represent institutions across Ghana and are diverse in their professional backgrounds: they have professional or graduate degrees in medicine, nursing, social sciences, philosophy, law, and health sciences. Upon their completion of the fellowship, six fellows will matriculate in the master's degree program in bioethics at the NYU Center for Bioethics. Beyond this stage of training, the ultimate goal of the project is to establish by its fifth year a Bioethics Program at the UG School of Public Health leading to master's degrees in Bioethics.

NYU-UG RITP is informed and animated by the belief that building capacity the local production of knowledge requires capacity building in research ethics and RI. It aims to meet the RI- and RM-related challenges and opportunities described above by training current practitioners and future leaders who will reshape the science culture and impact institutions in ways that promote RI and prevent RM. Through this program, Ghanaian researchers are merging world-class science with world-class ethics.

Discussion

In this paper, we discuss the state of the health research climate and research integrity in Ghana. We focus broadly on policies, structures and capabilities in Ghana, and conclude with recent efforts by NYU, UG, and other partners to develop research integrity in Ghana. As in other LMICs, private multinational organizations and foreign governments fund most of the health research in Ghana, raising unique issues related to RI. While there are some mechanisms in place to promote RI and prevent RM, Ghana is one of many countries in which primary responsibility for RI and prevention of RM lies within institutions, given the absence of a national coordinating body.

Over the years, emphasis has been put on establishing IRBs/RECs. Currently, Ghanaian universities, research centers, teaching hospitals, governmental agencies, and quasi-governmental agencies contribute to a total of 18 IRBs/RECs. Little to no effort is geared toward RI. This is not unique to Ghana. The significant efforts that have been invested in building capacity for human subjects protection in LMIC settings (Glickman et al. 2009; Hyder and Rattani 2014; Nchinda 2002; Petryna 2009; Strosberg et al. 2013; WHO 1996) have not addressed the broader construct of RI (Ana et al. 2013). There is absence of evidence to show that the many and growing Ghanaian IRBs effectively carry out their oversight or RI-promoting responsibilities. A recent empirical review of IRBs in Sub-Saharan Africa concluded that current challenges to IRBs include a "lack of membership diversity, scarcity of resources, insufficient training of members, inadequate capacity to review and monitor studies, and lack of national ethics guidelines and accreditation" (Silaigwana and Wassenaar 2015). Others have noted that IRB members who lack adequate training are more likely to approve ethically risky research, especially given the motivation to impress funders and maintain international collaborative relationships (Ndebele et al. 2014). While comparable assessment has been done of the Ghana IRBs, our collective appreciation of their circumstances makes us believe that they do not fare differently.

Indeed, the effort made by Seddoh et al. (2015) to map health research institutions in Ghana identified other weaknesses of the Ghanaian health research apparatus. They made several recommendations, including improving the quality of research, RI, and the general health research landscape in Ghana. On the basis of these, we argue that the structures for detecting and preventing of RM and improving RI are less well developed in Ghana. Other actions recommended by Seddoh et al. (2015) were the development of a national health research priorities and strategic plan, and continued capacity building for research staff. In these recommendations, we identify opportunities for improving RI in Ghana, but also challenges. A deliberate inclusion of RI in the national research priorities and strategic plan is an opportunity. Also equipping researchers with required RI competencies through higher education capacity-building initiatives and health research management training is another opportunity. However, it is worth noting that capacity building, though an opportunity, is also fraught with challenges. Laar and colleagues share their experiences and challenges faced in their efforts to strengthen nutrition capacity in Africa (Laar et al. 2017). They note that, for such capacity-building initiatives

to have sustainable impact, a cocktail comprising higher education initiatives, short-term training, experiential learning, and continual/lateral mentoring is required. In the current context, such capacity-building initiatives would include structured RI or responsible conduct of research (RCR) trainings at the individual or at institutional levels. RCR as a concept covers core norms, principles, regulations, and rules governing the practice of research. The history, purpose, and future of instruction in RCR as well as what mentoring and training in RCR have been addressed elsewhere (Anderson et al. 2007; Steneck and Bulger 2007). Satalkar and Shaw (2019) discuss the significance of structured RI or RCR trainings at institutional levels, noting that such training will strengthen faith in RI among those who value honesty, transparency, and trustworthiness in their work. For those who are at risk of compromising RI if the external pressure to succeed gets too high, RCR training for such individuals, they note, could "strengthen the angel sitting on one's shoulder whereas institutional structures, rigorous supervision and internal peer review will keep 'the devil' sitting on the other shoulder in check" (Satalkar and Shaw 2019, p. 10).

Many calls exist for the establishment of an independent National Health Research and Ethics Council backed by legislature (Seddoh et al. 2015). Its proposed mandate includes: setting national norms and standards for conducting research; developing guidelines for the functioning of research ethics committees/IRBs; registering and auditing RECs; publishing a national registry of credible research institutions and organizations doing research in Ghana. As an authoritative national regulatory body that governs the conduct of research, the Council's RI-promoting duties should also include adjudicating on RI- and RM-related disagreements and complaints.

While there is growing base of research ethics infrastructure, as described earlier, both individual capacities and institutional RI structures are weak. There is an urgent need to address these. Our RI training initiatives—the GRID and NYU-UG RITP, pay heed. These projects have facilitated the formation of the Ghana Research Ethics Consortium (GREC), which among others, would oversee the organization of the Annual GRID Conference. With representation from all public universities in Ghana, the GHS, CSIR, FDA, Ghana Standards Authority, four Teaching Hospitals, GHAAREC, private Universities and other research institutions, the is well placed to provide strategic guidance on RI in Ghana—in line with Mitcham's notion of co-responsibility for RI (Mitcham 2003).

Limitations

The results of the online survey cannot be generalized although they provide valuable insight into the subject of RI. Also, the respondents of our online survey self-selected themselves and hence the results need to be interpreted keeping self-selection bias in mind. Those who were particularly interested in the topic of research integrity are more likely to have responded to our call for research participation. In spite of our attempts to include researchers across the three major ecological zones of Ghana, the participation by researchers from the Savanah and Coastal was minimal.

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References

Abayomi, A., Gevao, S., Conton, B., Deblasio, P., & Katz, R. (2016). African civil society initiatives to drive a biobanking, biosecurity and infrastructure development agenda in the wake of the West African Ebola outbreak. *The Pan African Medical Journal, 24*.

Adebamowo, C. A. (2007). West african bioethics training program: Raison D'etre. *African Journal of Medicine and Medical Sciences, 36*(Suppl), 35–38.

Adjei, S., & Gyapong, J. (1999). Evolution of health research essential for development in Ghana. *Council on Health Research for Development, Geneva, Switzerland. Document* (99.3).

Ana, J., Koehlmoos, T., Smith, R., & Yan, L. (2013). Research misconduct in low-and middle-income countries. *PLoS Medicine, 10*(3), e1001315.

Anderson, M. S., Horn, A. S., Risbey, K. R., Ronning, E. A., De Vries, R., & Martinson, B. C. (2007). What do mentoring and training in the responsible conduct of research have to do with scientists' misbehavior? Findings from a national survey of NIH-funded scientists. *Academic Medicine, 82*(9), 853–860.

Anderson, M., & Kleinert, S. (2013). Montreal statement on research integrity in cross-boundary research collaborations. In *Third world conference on research integrity*. Montreal, Canada (pp. 5–8).

Atelu, G. R., Duah, N. O., & Wilson, M. D. (2016). Carriage of sub-microscopic sexual and asexual *Plasmodium falciparum* stages in the dry season at Navrongo, Ghana. *Ghana Medical Journal, 50*(4), 220–227.

Attwood, A. S., & Munafo, M. R. (2016). Navigating an open road. *Journal of Clinical Epidemiology, 70,* 264–266. https://doi.org/10.1016/j.jclinepi.2015.04.016.

Beauchamp, T. L., & Childress, J. F. (2001). *Principles of biomedical ethics*. New York, NY: Oxford University Press.

Boateng, E. G. (2019). *Assessment of the standard operating procedures of selected research ethics committees in Ghana*. Doctoral dissertation, University of Ghana.

Caplan, A., Amos, L., & Olugbenga, O. (2018). New York University–University of Ghana Research Integrity Training Program. Fogarty International Center, National Institutes of Health.

Code of Federal Regulations. (2011). Title 42—Public Health, Section 93.103—Research Misconduct. October 1, 2011.

Coleman, A. M. E. (2017). What is "African Bioethics" as used by sub-Saharan African authors? An argumentative literature review of articles on African bioethics. *Open Journal of Philosophy, 7*(31).

Dhingra, D., & Mishra, D. (2014). Publication misconduct among medical professionals in India. *Indian Journal of Medical Ethics, 11*(2), 104–107. https://doi.org/10.20529/IJME.2014.026.

Enyimayew, N., Yeboah, Y., Vordzorgbe, E., & Kok, M. (2006). Midterm review of the 5-year Ghana-Dutch joint research programme in the context of the 2001 Medium Term Health Development Strategy, MoH.

European Commission Infocentre. (2018). A global code of conduct to counter ethics dumping. 27 June 2018. https://ec.europa.eu/research/infocentre/article_en.cfm?id=/research/headlines/news/article_18_06_27_en.html?infocentre&item=Infocentre&artid=49377. Accessed 1 June 2020.

Fanelli, D., Costas, R., Fang, F. C., Casadevall, A., & Bik, E. M. (2018). Testing hypotheses on risk factors for scientific misconduct via matched-control analysis of papers containing problematic image duplications. *Science and Engineering Ethics,* 1–19.

Fanelli, D., Costas, R., & Lariviere, V. (2015). Misconduct policies, academic culture and career stage, not gender or pressures to publish, affect scientific integrity. *PLoS One, 10*(6), e0127556. https://doi.org/10.1371/journal.pone.0127556.

Farthing, M. J. G. (2001). Research misconduct: Diagnosis, treatment and prevention. In M. Schein, J. R. Farndon, & A. Fingerhut (Eds.), *A surgeon's guide to writing and publishing* (Vol. 193). Castle Hill Barns: TFM Publishing.

Felaefel, M., Salem, M., Jaafar, R., Jassim, G., Edwards, H., Rashid-Doubell, F., et al. (2018). A cross-sectional survey study to assess prevalence and attitudes regarding research misconduct among investigators in the Middle East. *Journal of Academic Ethics, 16*(1), 71–87.

Franzen, S. R., Chandler, C., & Lang, T. (2017). Health research capacity development in low and middle income countries: Reality or rhetoric? A systematic meta-narrative review of the qualitative literature. *British Medical Journal Open, 7*(1), e012332. https://doi.org/10.1136/bmjopen-2016-012332.

Gbadegesin, S. (1993). Bioethics and culture: an African perspective. *Bioethics, 7,* 257–262.

Gehre, F., Otu, J., Kendall, L., Forson, A., Kwara, A., Kudzawu, S., et al. (2016). The emerging threat of pre-extensively drug-resistant tuberculosis in West Africa: Preparing for large-scale tuberculosis research and drug resistance surveillance. *BMC Medicine, 14*(1), 160.

Glickman, S. W., McHutchison, J. G., Peterson, E. D., Cairns, C. B., Harrington, R. A., Califf, R. M., & Schulman, K. A. (2009). Ethical and scientific implications of the globalization of clinical research: Mass Medical Soc.

Gutierrez, M. M., Pillai, G., Felix, S., Romero, F., Onyango, K. O., Owusu-Agyei, S., et al. (2017). Building capability for clinical pharmacology research in sub-Saharan Africa. *Clinical Pharmacology and Therapeutics, 102*(5), 786–795. https://doi.org/10.1002/cpt.695.

Hedt-Gauthier, B. L., Chilengi, R., Jackson, E., Michel, C., Napua, M., Odhiambo, J., et al. (2017). Research capacity building integrated into PHIT projects: Leveraging research and research funding to build national capacity. *BMC Health Services Research, 17*(Suppl 3), 825. https://doi.org/10.1186/s12913-017-2657-6.

Hyder, A. A., Harrison, R. A., Kass, N., & Maman, S. (2007). A case study of research ethics capacity development in Africa. *Academic Medicine, 82*(7), 675–683. https://doi.org/10.1097/ACM.0b013e3180674484.

Hyder, A. A., & Rattani, A. (2014). Changing the discourse on health systems research: Response to open peer commentaries on "ethical review of health systems research in low- and middle-income countries: a conceptual exploration". *American Journal of Bioethics, 14*(2), W1–W2. https://doi.org/10.1080/15265161.2014.881212.

Ioannidis, J. P. (2005). Why most published research findings are false. *PLoS Medicine, 2*(8), e124. https://doi.org/10.1371/journal.pmed.0020124.

Kingori, P., & Gerrets, R. (2016). Morals, morale and motivations in data fabrication: Medical research fieldworkers views and practices in two sub-Saharan African contexts. *Social Science and Medicine, 166,* 150–159. https://doi.org/10.1016/j.socscimed.2016.08.019.

Laar, A. K., Aryeetey, R. N. O., Annan, R., Aryee, P. A., Amagloh, F. K., Akparibo, R., et al. (2017). Contribution of scaling up nutrition Academic Platforms to nutrition capacity strengthening in Africa: Local efforts, continental prospects and challenges. *Proceedings of the Nutrition Society, 76*(4), 524–534.

Lee, J. (2012). The past, present, and future of scientific misconduct research: What has been done? What needs to be done? *Journal of the Professoriate, 6*(1).

Litewka, S. G., & Heitman, E. (2017). Inter-American encounter on scientific honesty. ORI conference grant # 1 ORIIR160022-01-00, PI Sergio Litewka, MD, MPH. 5th World conference on research integrity May 28–31, 2017 Amsterdam The Netherlands. Available at https://wcrif.org/images/2017/documents/1.%20Monday%20May%2029,%202017/5.%205A-00/S.%20Litewka%20-%20Conclusions%20inter-%20american%20encounter%20on%20scientific%20honesty.pdf.

Makani, J., Ofori-Acquah, S. F., Tluway, F., Mulder, N., & Wonkam, A. (2017). Sickle cell disease: Tipping the balance of genomic research to catalyse discoveries in Africa. *Lancet, 389*(10087), 2355–2358. https://doi.org/10.1016/S0140-6736(17)31615-X.

Marusic, A., Wager, E., Utrobicic, A., Rothstein, H. R., & Sambunjak, D. (2016). Interventions to prevent misconduct and promote integrity in research and publication. *Cochrane Database of Systematic Reviews,* Issue 4. Art. No.: MR000038. https://doi.org/10.1002/14651858.mr000038.pub2.

Miles, S. H., & Laar, A. K. (2018). Bioethics north and south: Creating a common ground. *Ethics, Medicine and Public Health, 4,* 59–64.

Ministry of Health. (1992). Health research development in Ghana. Framework for Action, 1992–1996. MOH, Accra.

Mitcham, C. (2003). Co-responsibility for research integrity. *Science and Engineering Ethics, 9,* 273–290. https://doi.org/10.1007/s11948-003-0014-0.

Mormina, M. (2018). Science, technology and innovation as social goods for development: Rethinking research capacity building from Sen's capabilities approach. *Science and Engineering Ethics*. https://doi.org/10.1007/s11948-018-0037-1.

Munafò, M. (2016). Open science and research reproducibility. *Ecancermedicalscience, 10*.

Munung, N. S., Mayosi, B. M., & de Vries, J. (2017). Equity in international health research collaborations in Africa: Perceptions and expectations of African researchers. *PLoS ONE, 12*(10), e0186237.

Nchinda, T. C. (2002). Research capacity strengthening in the South. *Social Science and Medicine, 54*(11), 1699–1711.

Ndebele, P., Mwaluko, G., Kruger, M., Ouwe, O., Oukem-Boyer, M., & Zimba, M. (2014). History of research ethics review in Africa. *Research ethics in Africa: a resource for research ethics committees.* Stellenbosch: Sun Media, pp. 3–10.

Okonta, P., & Rossouw, T. (2013). Prevalence of scientific misconduct among a group of researchers in Nigeria. *Developing World Bioethics, 13*(3), 149–157. https://doi.org/10.1111/j.1471-8847.2012.00339.x.

Okonta, P. I., & Rossouw, T. (2014). Misconduct in research: a descriptive survey of attitudes, perceptions and associated factors in a developing country. *BMC Medical Ethics*. https://doi.org/10.1186/1472-6939-15-25.

Petryna, A. (2009). *When experiments travel: Clinical trials and the global search for human subjects*. Princeton: Princeton University Press.

Pilowsky, D. J., Rojas, G., Price, L. N., Appiah-Poku, J., Razzaque, B., Sharma, M., et al. (2016). Building research capacity across and within low- and middle-income countries: the collaborative hubs for international research on mental health. *Academic Psychiatry, 40*(4), 686–691. https://doi.org/10.1007/s40596-016-0493-3.

Ramsay, M., Sankoh, O., & and members of the, AWI-Gen study and the H3Africa Consortium. (2016). African partnerships through the H3Africa Consortium bring a genomic dimension to longitudinal population studies on the continent. *International Journal of Epidemiology, 45*(2), 305–308. https://doi.org/10.1093/ije/dyv187.

Resnik, D. B., & Master, Z. (2013). Policies and initiatives aimed at addressing research misconduct in high-income countries. *PLoS Medicine, 10*(3).

Resnik, D. B., & Shamoo, A. E. (2011). The Singapore statement on research integrity. *Accountability in Research, 18*(2), 71–75.

Rohwer, A., Young, T., Wager, E., & Garner, P. (2017). Authorship, plagiarism and conflict of interest: Views and practices from low/middle-income country health researchers. *British Medical Journal Open, 7*(11), e018467.

Sacco, D. F., Bruton, S. V., & Brown, M. (2018). In defense of the questionable: Defining the basis of research scientists' engagement in questionable research practices. *Journal of Empirical Research on Human Research Ethics, 13*(1), 101–110. https://doi.org/10.1177/1556264617743834.

Satalkar, P., & Shaw, D. (2019). How do researchers acquire and develop notions of research integrity? A qualitative study among biomedical researchers in Switzerland. *BMC Medical Ethics, 20*(1), 72.

Seddoh, A., Nazzar, A., Batse, Z. K., Tetteh, E., & Adjei, S. (2015). Mapping of health research institutions in Ghana: Landscaping and comparative analysis. Centre for Health and Social Services (CHeSS), Accra, Ghana.

Silaigwana, B., & Wassenaar, D. (2015). Biomedical research ethics committees in sub-Saharan Africa: a collective review of their structure, functioning, and outcomes. *Journal of Empirical Research on Human Research Ethics, 10*(2), 169–184.

Steneck, N. H., & Bulger, R. E. (2007). The history, purpose, and future of instruction in the responsible conduct of research. *Academic Medicine, 82*(9), 829–834.

Strosberg, M. A., Gefenas, E., Loue, S., & Philpott, S. (2013). Building research ethics capacity in post-communist countries: Experience of two Fogarty training programs. *Journal of Empirical Research on Human Research Ethics, 8*(5), 28–39. https://doi.org/10.1525/jer.2013.8.5.28.

Republic of Ghana. (2012). Public Health Act, ACT 851, 2012. Available from: http://extwprlegs1.fao.org/docs/pdf/gha136559.pdf.

Tindana, P., Molyneux, S., Bull, S., & Parker, M. (2019). 'It is an entrustment': Broad consent for genomic research and biobanks in sub-Saharan Africa. *Developing World Bioethics, 19*(1), 9–17.

Titus, S. L., Wells, J. A., & Rhoades, L. J. (2008). Repairing research integrity. *Nature, 453*(7198), 980.

University of Sheffield Human Resources. (2020). What is research misconduct? https://www.sheffield.ac.uk/hr/guidance/academicstaff/researchmisconduct/overview. Accessed 1 June 2020.

Warsame, M., Gyapong, M., Mpeka, B., Rodrigues, A., Singlovic, J., Babiker, A., et al. (2016). Pre-referral rectal artesunate treatment by community-based treatment providers in Ghana, Guinea-Bissau, Tanzania, and Uganda (Study 18): a cluster-randomized trial. *Clinical Infectious Diseases, 63*(suppl 5), S312–S321. https://doi.org/10.1093/cid/ciw631.

WHO. (1996). Investing in health research and development: Report of the ad hoc committee on health research relating to future intervention options.