

Towards an appropriate ethics framework for Health and Demographic Surveillance Systems (HDSS): learning from issues faced in diverse HDSS in sub-Saharan Africa

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ABSTRACT

Introduction Health and Demographic Surveillance Systems (HDSS) collect data on births, deaths and migration from relatively small, geographically defined populations primarily in Africa and Asia. HDSS occupy a grey area between research, healthcare and public health practice and it is unclear how ethics guidance that rely on a research-practice distinction apply to HDSS. This topic has received little attention in the literature. In this paper, based on empirical research across sub-Saharan Africa, we map out key ethical issues for HDSS and assess the relevance of current ethics guidance in relation to these findings.

Methods We conducted a qualitative study across seven HDSS sites in sub-Saharan Africa, including individual in-depth interviews and informal discussions with 68 research staff, document reviews and non-participant observations of surveillance activities. Qualitative data analysis drew on a framework approach led by a priori and emergent themes, drawing on the wider ethics and social science literature.

Results There were diverse views on core ethical issues in HDSS, including regarding the strengths and challenges of community engagement, informed consent and data sharing processes. A key emerging issue was unfairness in the overall balance of benefits and burdens for residents and front-line staff when compared with other stakeholders, particularly given the socioeconomic contexts in which HDSS are generally conducted.

Conclusion We argue that HDSS operate as non-traditional epidemiologic research projects but are often governed using ethics guidance developed for traditional forms of health research. There is a need for specific ethics guidance for HDSS which prioritises considerations around fairness, cost-effectiveness, ancillary care responsibilities, longitudinality and obligations of the global community to HDSS residents.

INTRODUCTION

A well-functioning health information system is a valuable resource. It draws from civil

Key questions

What is already known?

- Health and Demographic Surveillance Systems (HDSS) generate data on deaths, births and other health-related events in low-income and middle-income countries where most civil registration and vital statistics systems are incomplete.
- HDSS occupy a grey area between research and practice, which makes it difficult to determine the relevance of traditional ethics guidance that often rely on a research-practice distinction.
- There is limited empirical evidence on ethical issues in HDSS, but the potential social value of longitudinal data from HDSS is thought to outweigh potential burdens.

What are the new findings?

- HDSS across sub-Saharan Africa seem to operate as non-traditional epidemiological research projects drawing on widely divergent ethics policies and practices, including for ethics oversight, consenting, community engagement and data sharing.
- HDSS ethics practices and application of traditional ethics guidance, which tend to focus on informed consent and data sharing for research, seem to restrict benefits for HDSS residents.
- From the perspective of HDSS residents, HDSS present important uncompensated burdens.

What do the new findings imply?

- In addition to advancing knowledge through research and contributing to global health estimates, HDSS research stakeholders have an ethical responsibility for promoting the greater use of HDSS data to directly benefit HDSS residents and local health information systems.
- There is a need for further empirical research to explore the lived experiences of HDSS stakeholders and to support the development of HDSS-specific ethics guidelines that address ethical issues arising over time at individual, institutional and HDSS population level.

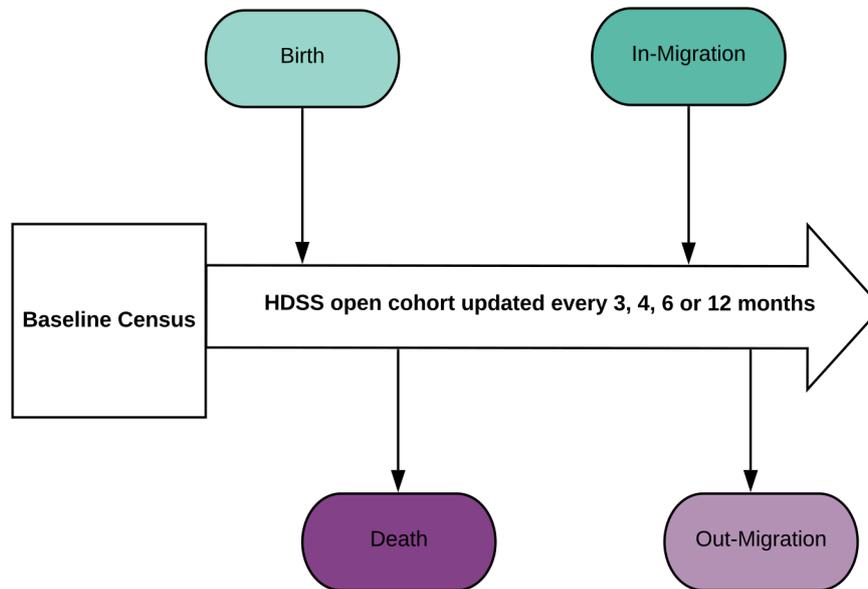


Figure 1 Basic structure and core functioning of a Health and Demographic Surveillance System (HDSS).

registration and vital statistics systems (CRVS), individual medical records, population censuses and other routine sources of individual, institutional and population-level data in a country.¹ These data are crucial for improving health, protecting human rights, informing social policy and supporting programme evaluation.²⁻⁴ However, the routine sources of data for health information systems in most low-income and middle-income countries (LMICs) are underdeveloped.^{5 6} Illustratively, a recent analysis of national surveys showed that over half the births (53.3%) of children aged under 5 years in Eastern and Southern Africa were unregistered and less than a third (26.9%) of these children had a birth certificate.⁷

Health and Demographic Surveillance Systems (HDSS) are interim sources of health-related data in Africa, Asia and Oceania, where many countries lack well-functioning health information systems.^{8 9} At a minimum, HDSS involve the active and long-term surveillance of births, deaths, cause of death, pregnancies and migration in relatively small geographically defined populations^{9 10} (figure 1). HDSS seek to recruit all residents in the target geographic area and collect data at the individual and household level, mainly during visits to households by field workers, and without a specified end date or official certification of vital events.⁸⁻¹² The frequency of data collection varies across sites, ranging from quarterly¹³⁻¹⁵ to annually.^{16 17} Besides this core functioning, HDSS are often used to collect a wide range of additional public health, clinical and socioeconomic data, including household income, marital status and blood samples, depending on the objectives and interests of each site.^{9 10}

Methodologically, HDSS seem to occupy a grey area between research and practice (healthcare and public health).¹⁸ Scholars have distinguished health research from healthcare or medical practice mainly based on intent; an explicit intention to develop or contribute to generalisable knowledge, including through

experimentation, is viewed as a key feature of research while healthcare refers to activities aimed at enhancing the well-being of individual patients using evidence-based or routine methods that are reasonably expected to succeed.^{19 20} Public health practice focuses on the well-being of populations rather than individual patients and includes activities such as surveillance, evaluation and monitoring.^{21 22} An alternative approach to distinguishing research from practice is to consider who runs an activity.^{21 23} For example, some have argued that public health surveillance conducted by public health authorities is not research, even if it involves systematic methods and produces generalisable knowledge.²⁴

Historically, health research institutions established HDSS to address specific research questions and to generate longitudinal data for multiple uses, including evaluation^{9 25}; online supplemental file 1 details original rationale for establishment of 37 HDSS sites across sub-Saharan Africa. Over time, HDSS have become complex programmes, involving multiple stakeholders and supporting diverse health-related activities.²⁶ Some HDSS support healthcare by linking household surveillance data with individual medical records.^{15 27 28} Most HDSS serve as sampling frames and platforms for interventions and nested studies, including community-based health projects,²⁹ observational studies and clinical trials.³⁰ Overall, the core HDSS functioning and diversity in associated activities contributes to uncertainty on what HDSS are, in methodological terms.

Traditional research ethics guidance for health-related activities rely on a distinction between research and practice.^{19 31} Widely used examples of health research ethics guidance include the International Ethical Guidelines for Health-related Research Involving Humans³² and the Emanuel *et al*³³ framework for research in developing countries. Widely referenced guidance, focused on public health practice, include the Kass *et al* framework³⁴

and reports from the Nuffield Council on Bioethics.³⁵ Recently, ethics guidelines and frameworks have been developed for health-related activities that clearly cross the traditional boundary between research and practice, including learning healthcare systems,^{36 37} public health surveillance³⁸ and health systems research.³⁹ However, it is unclear where HDSS lie on the spectrum of health-related activities and how existing ethics guidance apply.

HDSS have attracted little empirical ethics research despite involving millions of people in LMICs for decades.^{18 40} Most studies have focused on single sites, specific issues or stakeholders, such as perspectives of researchers on research using HDSS data⁴¹ and specific components of HDSS, including verbal autopsy.^{42 43} Previous empirical ethics studies suggest that community members develop a nuanced understanding of HDSS (eg, greater familiarity and acceptability of core HDSS functions than nested studies) and increased expectations of local and direct benefits after long-term engagement.^{44 45} Some have highlighted that reporting HDSS findings to residents through ‘one-off’ or recurring face-to-face meetings is feasible but requires significant investment of resources.^{46 47} This literature highlights a need for a holistic investigation of ethical issues in HDSS.

In this paper, we describe research that aimed to develop a grounded overview of core ethical issues for HDSS sites in sub-Saharan Africa and to assess the suitability of using different ethics frameworks and guidelines to identify and respond to these issues. This study was informed by the wider ethics literature and perceptions and experiences of stakeholders across the International Network for the Demographic Evaluation of Populations and their Health (INDEPTH Network), formed in 1998 as an organisation of HDSS sites across Africa, Asia and Oceania.^{9 10 12}

METHODS

Study design

We conducted an empirical ethics study combining qualitative social science data collection and analysis drawing on ethics literature to develop normative conclusions^{48 49} on ethical issues for HDSS in sub-Saharan Africa.

Study setting

Seven diverse INDEPTH Network HDSS sites across five sub-Saharan African countries were included in this study (table 1). Most (41/56) INDEPTH Network HDSS sites are in sub-Saharan Africa where they collectively follow-up over 3.5 million people in 14 countries.⁵⁰ For this reason, and pragmatic considerations such as social access and geographic proximity, we focused on sites in sub-Saharan Africa. We conducted more in-depth work in two Kenyan sites as part of a focused study on verbal autopsy in HDSS, including focus group discussions with HDSS residents, which will be published elsewhere.

Data collection

Data were collected through interviews and informal discussions with INDEPTH Network secretariat members, health workers in facilities affiliated with HDSS sites, and with HDSS researchers, managers and field workers, with the latter referring to HDSS field supervisors, routine census and verbal autopsy interviewers (table 2). We complemented these interviews and discussions with document reviews and non-participant observations involving HDSS field workers, residents and community representatives.

Individual interviews with HDSS research staff

Individual in-depth interviews (IDIs) were conducted through face-to-face meetings in Kenya and telephone or online video calls for participants in other settings. The interview guides included open questions about the participants’ responsibilities in the HDSS, views and experiences around HDSS methodological design, ethics review, consenting, community engagement, data and benefit sharing, and other ethically relevant issues. All the interviews were digitally recorded. The average duration of each interview was 58 min.

Informal discussions and overt non-participant observations of surveillance activities

Informal discussions⁵¹ were held with individual HDSS research staff and administrators purposively selected based on their ability to share views and experiences

Table 1 Features of HDSS study sites

Host country	Site urbanicity	Size of site (km ²)	Population size (approx.)	HDSS inception year
Ghana ⁹⁸	Rural	7162	140 000	2003
Ghana ⁹⁹	Rural	1675	156 735	1992
Kenya ¹⁵	Rural	891	280 000	2000
Kenya ^{29 100}	Urban	5 - 6.5	88 974	2002
Malawi ⁶⁷	Rural	135	39 000	2002
South Africa ²⁸	Rural	438	139 250	2000
Uganda ²⁷	Rural	28	23 000	1989

HDSS, Health and Demographic Surveillance Systems.

Table 2 Characteristics of interview and informal discussion participants

	N		
	Individual interviews	Informal discussions	Total
Gender			
Male	17	21	38
Female	12	18	30
Roles in HDSS			
Researcher	12	13	25
Manager	10	18	28
Field worker	7	5	12
Health worker	0	3	3
Affiliations			
Kilifi	15	1	16
Nairobi	9	6	15
Karonga	1	6	7
Kintampo	1	5	6
Kyamulibwa	2	10	12
Navrongo	0	7	7
AHRI	1	1	2
INDEPTH Network	0	3	3
Overall total			68

HDSS, Health and Demographic Surveillance Systems.

of working in HDSS. These discussions were held in natural settings, including participants' homes and offices.

Non-participant observations⁵² were undertaken during HDSS census and verbal autopsy interviews in 59 households, a field worker training workshop on electronic data collection and four meetings between HDSS research staff and community representatives. The observer (ANH) played no role in HDSS data collection or workshop facilitation and participants were made aware of the observations and the HDSS ethics study. Given the informality of these discussions and observations, there were no audio recordings, but notes were taken throughout.

Document reviews

Information about the characteristics of HDSS sites in sub-Saharan Africa was obtained from the INDEPTH Network website. Unpublished documents from the selected HDSS sites, including information and consent forms, HDSS questionnaires, workshop reports, and data and benefit sharing guidelines, were reviewed. Documents and quantitative data accessed in the Kenya sites for an in-depth verbal autopsy study, described elsewhere, provided additional insights into HDSS community engagement and data sharing processes.

Box 1 Scientific and ethics committees involved in this study

1. KEMRI Wellcome Trust Research Programme Centre Scientific Committee
2. KEMRI Scientific and Ethics Review Unit (SERU)
3. Uganda Virus Research Unit Research Ethics Committee
4. Uganda National Commission for Science and Technology
5. London School of Hygiene and Tropical Medicine Ethics Committee
6. Malawi National Health Sciences Research Committee
7. Kintampo Health Research Centre Scientific Review Committee
8. Kintampo Health Research Centre Institutional Ethics Committee
9. Navrongo Health Research Centre Institutional Review Board

Data management and analysis

Qualitative data were managed using the NVivo V.10 and analysed using the framework approach.⁵³ This process involved transcription of audio recordings, an in-depth familiarisation with content and a team approach to independently developing coding frameworks before identifying an agreed schema around HDSS characteristics, ethical policies, practices and perspectives across different sites and participant groups. All authors interpreted these data, drawing from the wider ethics and social science literature, to identify the key characteristics and core ethical issues for HDSS in sub-Saharan Africa.

Ethical considerations

Verbal consent was obtained for informal discussions, non-participant observations and interviews held through telephone and video calls. Written consent was obtained for face-to-face interviews. The study was reviewed and approved by the relevant ethics committees (box 1). In the Findings section, individual codes are not linked to sites where roles would risk identification.

RESULTS

We describe empirical findings related to HDSS methodological design, processes of ethics review, community engagement, informed consent, data sharing, and benefits and burdens in turn. While data on these themes were gathered from all sites, there is more in-depth data from sites 1 and 2. Where differences in views on ethical issues or, more commonly, practices were observed across sites, these are highlighted.

Views on HDSS methodological design

To contextualise views on ethical issues and given the indistinct positioning of HDSS, we sought to find out how participants defined HDSS beyond describing associated activities. Research staff, including those working in the same sites, often had diverse views on the appropriate methodological definition of HDSS, with some defining HDSS as 'research' or 'platforms for research' and others defining them as 'not research'.

I have the view that since it (HDSS) was set up for research purposes, it should be treated like any other research activity or project. Researcher_Site 4

I would bill it as surveillance rather than research. It doesn't have a research question itself. Research questions are bolted onto it, it is a sort of platform onto which research projects happen. HDSS-Manager_Site 1

A third and the largest group of participants felt that the definition of HDSS was unclear or highly context specific.

I think the main classification is dependent on who constitutes the DSS. DSSes that are constituted by governments, in my view, are involved in public health. I think a majority are constituted by research institutions, those I think are more or less research. Researcher_Site 1

Based on field observations, including conversations between HDSS residents and field workers, most residents seemed to see HDSS activities as conducted by a research institution and therefore largely as a research activity. However, some residents, especially in sites affiliated with healthcare facilities, also described these institutions as health service providers.

When defining HDSS, as illustrated above, most research staff discussed (even before further prompting) the implications of this definition for ethics review and consenting processes, discussed next.

HDSS ethics review processes

Ethics oversight processes in the HDSS sites studied ranged from one time approvals from government (without formal ethics review), through just one initial formal review by a research ethics committee (REC), to annual REC reviews.

From the outset, we have always applied for ethics approval from the (National ethics review committee). Every time we have a new tract of funding, when we introduce new procedures, we apply for approval. We also send annual updates to the ethics committee for renewal. HDSS-Manager_Site 3

...for other protocols even if they get ethics approval it is only valid for a year and then there are continued protocol review and ethics renewal. With the DSS, that is not what happens, after we renewed in 2011, that was that. Researcher_Site 4

However, changes in international ethics policies and guidelines around health-related research were reportedly influencing HDSS to submit protocols to research ethics review committees for annual ethics review and approval.

Many who supported research ethics review for HDSS cited a regulatory rationale, pointing out, for example, that ethics approval would facilitate publication of HDSS findings in scientific journals. Others cited more fundamental ethical protections, such as the role of ethics review in protecting residents from potentially harmful procedures.

HDSS community engagement

Across the seven sites, decisions to establish HDSS were preceded by information sharing, consultations and partnership building with a wide range of stakeholders, including government and community members.

...there was a lot of communication with the stakeholders... the community, chiefs, the sub-chiefs, the civil registration departments, the national bureau of statistics, they were all positive about this kind of work. There was a lot of internal consultations and discussions to okay the DSS to start. HDSS-Manager_Site 1

As an ongoing activity, HDSS community engagement is largely concerned with providing information to residents through mass media platforms, community meetings and distribution of pamphlets in the HDSS areas. Other forms of HDSS community engagement have been included, such as community consultation and—in three sites in this study—key informant systems, in which community members collect some HDSS data.

Notably, most of these community engagement activities, such as radio programmes or community meetings, are not HDSS-specific; instead, they are embedded in large one-off community engagement initiatives supporting a range of HDSS-linked research activities led by the host institutions. Relatedly, some field workers felt that community engagement and other HDSS-specific issues had not received adequate attention.

...sincerely speaking, since (studies nested within HDSS platforms) came on board, I think the centre has a lot of priorities. So, we don't really get attention. It's been more than ten years since we did dissemination for our DSS. VA-Interviewer_Site 2

Seeking consent from HDSS residents

In HDSS, consent for routine data collection is obtained at the household level.¹⁸ Experiences from site 1 highlighted the practical challenges of obtaining individual informed consent for routine HDSS census. In this site, a stakeholder described a pilot study that was conducted to assess feasibility of obtaining individual verbal consent from all adults (≥ 18 years) and mature minors, and verbal assent from children aged 13 to 17 years.

...that approach never worked. It turned out to be expensive because you need to have almost five times the fieldworkers here. HDSS-Manager_Site 1

Field workers in four out of the seven sites obtained verbal consent from HDSS residents, while written consent was the approved form of documenting consent in three sites. Support for verbal consent was common across many field workers and managers. This position was argued on the basis that participating in a routine HDSS census interview is a low-risk activity, and that written consent could lead to unnecessary refusals, raise tensions, present logistical challenges and undermine trust, especially in contexts where residents are likely to associate signing forms with legal and financial

transactions. Those who supported written consent argued this on a procedural basis, that is, that it could provide documentary evidence that field workers had collected data with consent from residents. While many participants felt verbal consent would be most appropriate, they also felt this would not generally be acceptable to some ethics review committees.

(verbal consenting) is not acceptable to the regulatory authorities. You have to make a very, very strong case for verbal consenting, it is very rare, I can get it (approval for verbal consenting) for some of the social science observations but not with a questionnaire. HDSS-Manager_Site 5

Ethics review committees and national laws may also prescribe written consent for HDSS because HDSS collect a wide range of data under the same protocol.

We have a number of components in the HDSS... The (law) requires we obtain consent for collecting certain data such as telephone contacts, for us to prove legally that we obtained consent we need it to be written. So, to make our work smooth we decided that we needed written consent for every aspect of our data collection. HDSS-Manager_Site 7

Field observations highlighted additional barriers to informed consenting in HDSS, including uncertainty on which information is necessary, feasible and culturally appropriate to share with HDSS residents at the time of data collection, given that HDSS involve multiple procedures and stakeholders. Acknowledging these challenges, some participants recommended that the consenting process would be better seen as part of a wider effort to build mutual understanding and show respect between HDSS stakeholders, than as a stand-alone activity.

The consent itself should begin with the homestead head if possible then go to each of the households within the homestead...explain to individuals within households... and back all of that up with a really good communication and community engagement strategy. Researcher_Site 1

HDSS data sharing and use

The INDEPTH Network has platforms for HDSS data sharing at the international level,⁵⁴ but data sharing policies and practices vary across sites. While some sites provide email addresses as a contact to request data, others have online data repositories and detailed institutional data sharing policies that outline the ethical reasons for sharing and procedures for requesting data.

Our data is put in a public repository. There are rules regulating the repository, but basically freely available to whoever wants to rationally use the data. Whether [it's] individuals, institutions or agencies they will be able to access the data. HDSS-Manager_Site 7

Discussions with participants and field observations highlighted practical barriers to HDSS data sharing, including limited human resources for effective and timely data entry and cleaning. Also, some felt that data sharing could have unintended consequences, such as

reducing data quality by disincentivising data collection, and promoting unfairness among stakeholders. Unfairness was seen both in terms of the interests of primary researchers and those who later use data, and between primary researchers and local and national HDSS stakeholders. In the latter case, researchers and HDSS managers reported using HDSS data for research, but all participants acknowledged that other stakeholders, including policy makers, field workers and community members might find it difficult to access and use HDSS data.

... I remember there was someone who wanted to develop a proposal to apply for government funds for youth... I am just imagining that if they wanted even simple statistics such as population size, how would they access it? Because I don't think they even have internet or anything, they write the proposals by hand. Researcher_Site 2

Benefits: generating data for research, policy and public health

The most prominent benefit of HDSS, from the perspective of HDSS stakeholders, was an aspiration that HDSS data would contribute to improvement of public health by supporting the responsiveness of future research and policy making. As an illustration, one HDSS information and consent form states that HDSS data "... will help the government plan public health services...". Participants also described some potential benefits for the local community, including direct and indirect employment.

Discussions with participants, and field observations, suggested that HDSS interviews could be positive experiences for some HDSS residents and field workers, in supporting friendly and interesting interactions. Further benefits reported were the renovation and establishment of local health facilities, healthcare and occasional provision of various forms of appreciation, such as soap or water purification tablets.

When a participant reports to the clinic with some ailments, and we find we cannot help them here... we refer and transport them to the referral hospital, and if necessary, we meet some of the costs for their treatment. HDSS-Manager_Site 5

Burdens of HDSS sites in sub-Saharan Africa

Potential burdens were identified at different levels and for different stakeholders. The most prominent burdens are related to HDSS residents and field workers. Time costs and 'fatigue' for HDSS residents emerged as the most reported burdens, where 'fatigue' was used to describe a sense of tiredness, boredom and some resentment towards repeated visits, against a background of few direct benefits for families involved. From observation, the duration of HDSS interviews varied, being particularly long in large households and where field workers used paper-based questionnaires or collected additional data, such as vaccination history. Also, most HDSS residents needed to abandon various activities (such as

farming, washing clothes and vending food) to take part in the interviews.

...some of them feel that we have collected these data so much that they are now tired. VA-interviewer_Site 2

In addition, some participants pointed to risks to HDSS residents' privacy and confidentiality through data collection and management, with risks seen as occurring at a very local level (within the institution) as well as the risks of data sharing more widely, as highlighted earlier.

...Although the DSS itself does not contain any particular revelations...there are obviously contentious issues of knowing paternity, people living in houses which perhaps they shouldn't be, perhaps they are not married... and then within the (research institution) we have people who are able to see data, names and places on databases and potentially that could be misused if it got in the wrong hands. HDSS-Manager_Site 1

Similarly, field observations suggested that questions around pregnancy and marital status, death, source and amount of household income, and ownership of economic assets, pose risks to privacy and could make some residents uncomfortable. However, the most severe burden described across all sites, as will be described in detail in a future publication, was emotional distress for HDSS residents and field workers directly involved in verbal autopsy. The verbal autopsy entails interviewing close relatives or final carers of the deceased to establish the circumstances and likely cause of death.^{55 56} The verbal autopsy is a much less frequent occurrence at the household level and methodologies may vary across sites, but inclusion of this activity is a current requirement for HDSS to be part of INDEPTH, given the potential public health value of cause of death data.^{2 26}

If I was to grade sensitivity of HDSS data, I would give socioeconomic data 6 out of 10 and Verbal Autopsy 10/10. HDSS-Manager_Site 2

Burdens associated with HDSS that were less commonly mentioned included insecurity and economic costs for HDSS field workers, who may feel compelled to make out-of-pocket financial contributions to assist residents facing significant health and socioeconomic challenges, for example. Other burdens included risks of supplanting local health systems, a potential for stigmatisation of HDSS communities (particularly in relation to the reporting of patterns of stigmatising illness or socioeconomic status across identifiable communities).

There was a time when the DSS was collecting data on toilet ownership, the community members came here (research institution) and we presented that data, there was a location that didn't have a toilet at all...everyone turned their heads (to look at people from that location) ... after that the chief came to complain...'you've made us feel like idiots'. Researcher_Site 1

In [table 3](#), we draw from prominent research and public health ethics frameworks^{33 34 57 58} to summarise the

core ethical issues emerging from our findings, alongside their ethical implications.

DISCUSSION

The empirical findings from this study identify important ethical issues associated with the conduct of HDSS ([table 3](#)) and highlight a core emerging ethical issue of fairness in the benefits and burdens experienced by HDSS stakeholders. These issues are not unique to HDSS and are partially addressed by different ethics frameworks and guidelines for research, public health and other health-related activities. However, the use of these frameworks and guidelines to address ethical issues in HDSS presents significant conceptual and practical challenges because in practice HDSS operate as what we describe as 'non-traditional research'. There is a recognised need for better ethics guidance in non-traditional areas of public health and epidemiology.⁵⁹ The development and application of specific ethics guidance for HDSS could highlight the main ethical issues and trade-offs and outline core ethical principles. We draw on our empirical findings, current ethics frameworks and guidelines, and the wider ethics literature to discuss ethical issues in HDSS and to contribute towards the development of an appropriate ethics framework for HDSS.

Community engagement in HDSS

Across our findings, and in common with others, we have highlighted conceptual and practical challenges for community engagement in HDSS.^{46 47 60 61} Reliable funding for HDSS can address some practical challenges, but addressing the conceptual challenges is more complex. The first conceptual challenge is that while a HDSS community is a geographically defined 'community', it does not include all residents as some can refuse to take part and others may not meet site-specific inclusion and exclusion criteria. There are also varying levels of participation in HDSS, for example, women are likely to be the main respondents for HDSS interviews. Therefore, a geographic-based definition of HDSS community seems inadequate. The concept of 'experimental publics' was developed to challenge the perception that a study community is a group of people with shared characteristics that pre-exist research,⁶² as might be argued for a HDSS. Instead, experimental publics are created through study procedures, such as the application of inclusion and exclusion criteria.^{44 62} A crucial issue in HDSS is that HDSS operate without a specified end date, with important implications for communities, relationships and costs, but current ethics guidance addresses this issue only superficially.

A second core conceptual challenge for HDSS community engagement concerns the meaning of 'engagement', with different goals of engagement reflecting different levels of power-sharing between HDSS practitioners and community members. While there was variation between sites, most of the engagement activities reported in this

Table 3 Key ethical issues in Health and Demographic Surveillance Systems

Theme	Ethical considerations	Ethical issues
Establishing a HDSS	Have the HDSS area and populations been selected fairly? The need for collaborative partnerships.	<ul style="list-style-type: none"> ▶ Risks of selecting the most vulnerable areas and populations. Most HDSS are in rural and poor urban areas of sub-Saharan Africa and have limited integration with CRVS and other health information systems.
HDSS methodological design	What are the objectives of the HDSS and how effective is the HDSS in meeting these objectives?	<ul style="list-style-type: none"> ▶ Unclear objectives, including that initial objectives of most HDSS have not been updated despite changes in HDSS functioning over time. ▶ Risks of collecting incomplete or inaccurate data for example, where insufficient funding and cultural sensitivities may hinder regular enumerations and collection of accurate data on income, pregnancy status and cause of death.
Ethics review processes	What ethical principles, theories and guidelines apply to the HDSS?	<ul style="list-style-type: none"> ▶ There is uncertainty over the appropriate ethics guidance for HDSS, leading to: <ul style="list-style-type: none"> – Ethics review processes being inconsistent across sites, including no annual ethics review and approval. – Default use of biomedical research ethics guidelines focusing on time limited individual-level issues only, when HDSS follow populations over time. – Practices of self-regulation, exempting harmful procedures from independent review. – Ethics review processes being unnecessarily burdensome.
Community engagement	Is community engagement necessary? What community engagement activities are feasible/appropriate?	<ul style="list-style-type: none"> ▶ Use of poorly defined concepts, such as ‘HDSS community’ and insufficient resources for HDSS-specific community engagement, leading to risks that community engagement is unduly limited for example, information sharing only.
Informed consent	Respect for individual autonomy and local community	<ul style="list-style-type: none"> ▶ Tensions between individual autonomy and enhancing social value, where individual written informed consent processes likely to compromise HDSS data quality and increase HDSS operating costs and burdens for residents and field workers (eg, interpretations of why a signature is needed may lead to refusals). ▶ Procedures and feasibility of withdrawing from HDSS are unclear, which may limit this choice.
Data sharing and reporting Results	What are the appropriate HDSS data governance systems? Who should access and use HDSS data?	<ul style="list-style-type: none"> ▶ HDSS collect, link, analyse and disseminate a wide range of sensitive data, generating potential risks to privacy and confidentiality including community stigmatisation from reporting sensitive community-level findings ▶ Risk of damaging trust among HDSS stakeholders ▶ Limited use of HDSS data
Benefits and burdens	What are the benefits of HDSS and who are the beneficiaries? What are the burdens of HDSS? Can they be minimised? Are burdens justified?	<ul style="list-style-type: none"> ▶ Risks of defining benefits narrowly, so that non-health benefits and beneficiaries of HDSS are unspecified ▶ Inability to measure and enhance benefits or identify, weigh and respond to HDSS burdens. ▶ Female residents, verbal autopsy respondents and interviewers often bear most burdens (time, insecurity, emotional distress) and little to no benefits. ▶ Since HDSS data are mainly used for research purposes, researchers and global health modellers who gain direct benefits from using HDSS data (influence, career development, funding) bear the least burdens. ▶ Overall risks of a disproportionate distribution of burdens.

CRVS, civil registration and vital statistics systems; HDSS, Health and Demographic Surveillance Systems .

study involved information sharing as opposed to seeking community input into HDSS design or policy. In addition to the existing ethics guidance on establishing collaborative partnerships with communities and their leaders,^{33 61} an ethics framework that views HDSS communities as experimental publics could support the development of more tailored engagement strategies.

Informed consent processes in HDSS

Our findings add to an extensive literature that highlights ways in which informed consent processes in research in sub-Saharan Africa are significantly impacted by wider health and social factors, including interpersonal relationships, cultural norms, expectations of health benefits and low literacy.^{45 63–65} In the sites involved in this study, field workers generally sought informed consent at the household level because obtaining consent from each resident for routine HDSS activities was impractical. Many study participants supported verbal consenting. A challenge is that some research ethics committees, drawing from traditional ethics frameworks, may not waive requirements for written consent unless they view HDSS as research with high social value and minimal risks,³² or as public health practice⁶⁶; conditions that many HDSS might not meet.

The high consent rates reported in HDSS^{67–70} seem to indicate general community acceptability, but they are likely to be a crude measure of community understanding, voluntariness or burdens experienced by HDSS residents, given general concerns with informed consenting in these contexts. In HDSS within sub-Saharan Africa, a requirement for written consent may not achieve intended ethical goals, and potentially increases practical and emotional burdens for HDSS respondents, field workers and institutions. HDSS-specific community engagement could strengthen consenting practices, while effective data governance could achieve the ethical goals of consenting without requiring HDSS residents to sign forms. A non-traditional ethics framework that acknowledges the unique features of HDSS methodology and ethical tensions between individual autonomy and population-level benefits might allow adaptation of consenting to specific HDSS contexts, in contrast to traditional research ethics guidance that is likely to prescribe written consent.

Data sharing and use

The principal goal in sharing health research data—and for HDSS—is promoting public health interests, including through supporting future research. The ethical and practical barriers to research data sharing in LMICs are well-acknowledged, such as challenges around prior informed consent for uncertain future use, privacy risks for participants, risks of primary researchers being ‘scooped’ by secondary research teams (often reflecting structural inequities in research resources) and concerns about fairness in balancing benefits for those who contribute and those who use data.^{71–73} While most of

these challenges apply, HDSS data are freely available online, including through INDEPTH Network, which should promote their social value. At the same time, researchers in sub-Saharan Africa may not have had the capacity building opportunities and resources of other researchers to support analysis of freely available data; a focus on data sharing over data use could exacerbate inequalities.⁷⁴

As other scholars have noted, HDSS data are primarily shared and used for research,^{10 75} with less attention to sharing data with HDSS residents, local policy makers or healthcare providers. This may contribute to a disproportionate distribution of benefits among HDSS stakeholders and inefficient use of resources. For example, most countries have classified CRVS as essential services to continue collecting vital data during the COVID-19 pandemic.⁷⁶ Additionally, international ethics guidelines emphasise that ethical public health surveillance³⁸ and research,⁷⁷ including timely data collection and sharing, are crucial for responding to public health emergencies, and yet, some HDSS sites are likely to have stopped collecting data during the COVID-19 pandemic, despite the urgent need for timely data on deaths, migrations and causes of death. There is a strong ethical argument for using HDSS data and platforms to address a wider range of local and international priorities, such as rapid response to public health emergencies. An ethics framework that prioritises fairness could allow greater use of HDSS data, especially for direct benefits to communities that contribute these data.

Highlighting issues of fairness for benefits and burdens of HDSS among stakeholders

As noted earlier, the justification of HDSS relates to a putative social value that outweighs potential burdens. To some extent, the social value of HDSS is evident, including contributions to global health estimates, provision of longitudinal data⁵⁴ and supporting important public health research in LMICs.^{30 78–83} However, many LMICs lack the infrastructure to convert these research and global health estimates into policy and health gains at the local and national levels.^{84 85} In addition, despite recommendations that HDSS should integrate with other health and population information systems, such as CRVS, to enhance direct and local benefits,²⁶ HDSS largely operate independently and for research. Although we identified some potential direct benefits for HDSS individuals and local communities, these were highly context specific. Thus, HDSS provide potentially valuable research evidence and data, but their social value at the local and national levels in sub-Saharan Africa is unclear.

Regarding burdens of HDSS, our study highlights that many HDSS residents and field staff are likely to experience a wide range of often minor burdens over a long time. The verbal autopsy, a core component of HDSS for collecting cause of death data, generates the most severe social and emotional burdens for specific groups of HDSS field staff and bereaved families, and will be the

focus of a future publication. At the same time, ethics processes such as ethics review and consenting could unintentionally increase burdens for HDSS stakeholders without protecting HDSS residents.

Overall, the study strongly suggests a high risk that the distribution of benefits and burdens among HDSS stakeholders in sub-Saharan Africa is disproportionate. While stakeholders who can use HDSS data, such as researchers and global health modellers, are likely to gain the most benefits, those who contribute and collect data, such as HDSS residents and field staff, bear the most burdens. We join others in recommending that research ethics review should be adaptive to consider a wider range of ethical issues, principles, stakeholders and study designs.^{36 39 86 87}

In relation to HDSS in sub-Saharan Africa, ethics review should prioritise ethical considerations around fairness (taking account of structural inequities evident in HDSS settings), cost-effectiveness, ancillary care responsibilities, obligations of the global community to HDSS residents and HDSS longitudinality.

Why HDSS are best considered as non-traditional health research

The research-practice distinction has a significant influence on ethics oversight for health-related activities. Activities defined as practice are generally exempt from ethics review while those defined as research are typically subjected to an ethics review process.^{19 31} Although some have observed that HDSS do not fit within the traditional definitions of health research or practice,¹⁸ little attention has been paid to what HDSS are in methodological terms. This ambiguity risks ethics guidance meant for other activities, particularly biomedical research, being applied to HDSS, which may unduly prioritise individual autonomy and individual-level issues^{58 63 88} over other important ethical considerations in HDSS.

We argue that INDEPTH Network HDSS sites are best considered as 'non-traditional epidemiologic research'. Epidemiology is the study (including surveillance) of the distribution and determinants of health-related states or events (such as causes of death) to improve health of populations.⁸⁹ An epidemiologic study design can involve the repeated observation of an entire geographically defined population.⁹⁰ While epidemiology overlaps considerably with human subjects research and public health,⁵⁹ it involves practices and values that distinguish it as an academic discipline, including use of specific terminologies, and institutional manifestation.⁹¹ Terms and methodologies such as 'cohorts' and 'population pyramid', which are common in epidemiology⁸⁹ are often used in HDSS. Also, most HDSS managers have academic training and expertise in epidemiology. In addition, HDSS cohort profiles are primarily published in journals specialising in epidemiology. Unlike typical epidemiologic research, however, HDSS do not have a specified end date, involve a real-life population rather than subgroups and support a wide range of additional health-related activities.^{9 12} These definitions and

standards, coupled with empirical evidence of core functioning, objectives and perspectives in diverse sites in sub-Saharan Africa, strengthen the argument for considering HDSS as non-traditional epidemiologic research.

Some have argued that the research-practice distinction has no independent moral value because defining an activity does not justify why it should be subjected to or exempted from ethics oversight.^{19 92} Instead, some suggest the risks and burdens of a health-related activity should inform ethics oversight processes.⁹³ Nevertheless, that the research-practice distinction remains prominent and has value in ethics debate and contemporary ethics practice is exemplified by a recent controversy over whether a WHO Malaria vaccine programme in Ghana, Kenya and Malawi is a cluster randomised trial in breach of international research ethics standards or a public health activity adhering to relevant regulations and widely accepted practice.⁹⁴⁻⁹⁶ We suggest that clarifying definitions for HDSS therefore seems to be an ethically important project in its own right.

Strengths and limitations

We conducted empirical work in seven INDEPTH Network sites, with in-depth data collection in two Kenyan sites. We acknowledge that generalisation of findings from qualitative research can be contested.⁹⁷ However, strength of our data and supporting the transferability of the learning is the diversity of sites, the bringing together of empirical evidence with wider social science and ethics literature, and the shared core methodological approach and standardised procedures across INDEPTH Network sites (figure 1).

CONCLUSION

Across this paper, we have identified a range of potential ethical issues for HDSS in sub-Saharan Africa and argued that, based on core HDSS design, practices and perspectives across diverse sites, as well as the research methods literature, we should consider HDSS as non-traditional epidemiological research. Adopting this approach and developing an ethics framework specifically for HDSS should address important ethical issues in HDSS, including challenges linked to use of traditional research ethics oversight processes. The most prominent of these ethical issues is the disproportionate distribution of benefits and burdens among HDSS stakeholders. Other key issues include balancing the optimal use of HDSS data, which are collected at significant cost to individuals and institutions, with protecting the interests of stakeholders. Besides mapping out key ethical issues in HDSS (table 3), we have provided empirical evidence of risks and burdens in diverse sites. This contribution is likely to strengthen ethics oversight processes for HDSS.

In addition to developing an ethics framework for HDSS, we need further research in diverse sites and consultation with stakeholders to promote ethical practices and policies. In-depth research around verbal autopsy and HDSS

longitudinality, and consultations involving research staff and community members, could further inform HDSS-specific international ethics guidelines.

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Rationale for establishment of health and demographic surveillance systems across sub-Saharan Africa

Country	HDSS Site	Site-specific Rationale for establishment
Kenya	Kilifi	To create a longitudinal community-based study linked to hospital morbidity surveillance in order to define the incidence and prevalence of local diseases of childhood, evaluate the impact of community-based interventions against infectious diseases and to provide an epidemiological sampling frame for studies KEMRI Wellcome Trust[1].
	Nairobi	To provide a platform to investigate the long-term social, economic and health consequences of urban residence, and to serve as a primary research tool for intervention and impact evaluation studies focusing on the needs of the urban poor in sub-Saharan Africa[2,3].
	Kisumu	To support a large insecticide-treated bed net trial. HDSS sustained post-trial to provide multi-disciplinary research data[4].
	Kombewa	To support regulated clinical trials, nested studies and local disease surveillance, by integrating household and health-facility-based data[5].
	Mbita	To establish baseline data on health, demographic, socio-economic and environmental characteristics of communities in Mbita District. To evaluate impact of health and socioeconomic interventions, support research on communicable and non-communicable diseases, and provide platform for education and training[6].
Ghana	Dodowa	Established to enable registration of households into a pilot community health insurance scheme (2003). Could not be sustained after initial census due to lack of funding. With research funding in 2005, re-established to provide platform for large scale trials and surveillance[7].
	Kintampo	To research diseases of public health importance nationally and internationally and contribute to reducing these diseases by developing interventions and sharing data with ministry of health and other health organisations.
	Navrongo	Established to support evaluation of a permethrin impregnated bed net trial. Preceded by surveillance activities that focussed on children <5years as part of the Ghana Vitamin A Supplementation Trial[8].
Uganda	Iganga/Mayuge	Established as a research setting to provide data for informing local and global policy. To serve as platform for developing operational research capacity for graduate students and academic staff at Makerere University, and to generate continuous population data for evidence-based policymaking at district and national level[9].
	Kyamulibwa	To examine trends in prevalence and incidence of HIV infection and their determinants[10].
	Rakai	To support population studies on HIV/AIDS[11].
Malawi	Karonga	To provide a platform for epidemiological studies of HIV and HIV-associated infectious disease and to monitor the impact of interventions[12].
Burkina Faso	Kaya	To regularly generate quality data for assessing population health, evaluating health interventions and supporting research[13].
	Nanoro	To provide a highly standardized means of monitoring the population living within the catchment area of a district hospital in Nanoro and to

		support a large pharmacovigilance study on artemisinin-based combination treatments (ACT) and a phase 3 vaccine trial[14].
	Nouna	To provide reliable demographic and health indicators for a rural population in Burkina Faso, and to generate an infrastructure and a sampling frame for epidemiological and clinical studies nested into this dynamic cohort[15].
	Oagadougou	To address the problems of the urban poor, by collecting data on the lives of people in one informal and one formal neighbourhood in Oagadougou[16].
Cote d'Ivoire	Taabo	To serve as a platform for evaluating interventions and health system strengthening with the aim of reducing morbidity and mortality especially from malaria and NTDs in Taabo, Cote d'Ivoire and sub-Saharan Africa. To conduct interdisciplinary research and build capacity in health research[17].
Ethiopia	Arba Minch	To track demographic changes, including births, deaths, migrations and marriages[18].
	Butajira	To develop and evaluate a system for continuous registration of births and deaths, to generate valid data on fertility and mortality and to provide a population and study base for essential health research and intervention in the area.
	Dabat	To generate longitudinal data on health and population at district level and provide a study base and sampling frame for community-based research.
	Kersa	To create a framework for research at the community level, given the lack of reliable information about health problems of public health importance[19].
	Kilite Awlaelo	To generate longitudinal health and demographic data for a rural low-income population[20].
Gambia	Farafenni	To generate health and demographic data for the evaluation of a primary health care programme by The Gambian government[21].
	West Kiang	To support research and provision of healthcare services[22].
Guinea Bissau	Bandim	To assess the prevalence of neonatal tetanus and to collect data on child mortality to monitor the impact of a Danish International Development Agency (DANIDA)-sponsored project to strengthen primary healthcare[23].
	Manhica	To provide data on fertility, migration and mortality and support epidemiological studies of infectious diseases for children < 5yrs and pregnant women[24].
Nigeria	Nahuche	To support research for informing policy health service delivery[25].
	Cross River	To generate timely and reliable data to inform policy makers on differences in population characteristics and access to health services[26].
Senegal	Bandafassi	To study the health and demographic situation of a rural West African population and assess changes over time, including causes of these changes. Preceded by a genetic study that involved collection of blood samples and demographic information to investigate survival rates in various genotype sub-groups in the population[27].
	Mlomp	To provide health and demographic data for a rural population that differed from that in Niakhar and Bandafassi in terms of historic, economic and ethnic characteristics, and therefore enhance the

		coverage of the diverse demographic and epidemiological characteristics in Senegal[28].
	Niakhar	To demonstrate the capacity to record reliable demographic and epidemiological data in rural areas of Africa. Because previous population-based data collection and civil registration had excluded African populations in rural areas[29].
South Africa	Agincourt	To provide reliable population-based information for programme planning and resource allocation towards strengthening the district health system[30].
	AHRI	To provide high quality longitudinal data for monitoring population health and demographic changes as a result of the HIV epidemic and to evaluate interventions against HIV[31].
	DIMAMO (formerly Dikgale)	To serve as a sampling framework for monitoring non-communicable diseases and their risk factors, given concerns in the 1990's that exposures to risk factors for NCDs in South Africa were increasing with changing lifestyles[32].
Tanzania	Ifakara	To support a field trial on effectiveness of social marketing of bed nets on morbidity and mortality of children aged under 5 years[33].
	Rufiji	To evaluate the impact, on morbidity and mortality, of a policy that introduced evidence-based health planning. Evaluate impact of changes in health polices and services[34].
	Magu	To monitor mortality, fertility and mobility in the general population as part of an open cohort HIV study[35].

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