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Assessing health impacts in complex eco-epidemiological settings in the humid tropics: The centrality of scoping

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ABSTRACT

Natural resources development projects are – and have been for more than 150 years – located in remote rural areas in developing countries, where local level data on community health is notoriously scarce. Health impact assessment (HIA) aims at identifying potential negative health consequences of such projects and providing the initial evidence-base for prevention and mitigation of diseases, injuries and risk factors, as well as promotion of positive effects. An important, but under-systematised early phase of the HIA process is scoping. It aims at organising diverse, often fragmentary, evidence and identifying potential project-related health impacts and underlying data gaps. It is also a key element in defining the terms of reference for the entire assessment. We present novel methodological features for the scoping process, emphasising the evaluation of quality of evidence, and illustrate its use in a contemporary HIA of the Simandou iron ore project in the Republic of Guinea. Assessment of data quality is integrated with specific content information via an analytical framework for the systematic identification of health outcomes and determinants of major concern. A subsequent gap analysis is utilised to assess the need for further baseline data collection and to facilitate the specification of a set of potential key performance indicators and strategies to inform the required evidence-base. We argue that scoping also plays a central role in the design of surveillance systems for longitudinal monitoring of health, equity and wellbeing following project implementation.

1. Introduction

For more than 150 years, exploration and development of natural resources have frequently been carried out in remote rural areas in tropical countries (Watson, 1921, 1953; Chamberlain, 1929; Boxer, 1962; Manderson, 1996). In contrast to this long history, impact assessments for large-scale development projects are relatively new (IAIA, 2010). Within the impact assessment suite, health impact assessment (HIA) is the most recent addition dating back to the late 1980s/early 1990s, but is increasingly becoming a routine feature of the project permitting and approval process (Kemm, 2000; Birley, 2003; Mindell and Joffe, 2003). In the developing world, the International Finance Corporation (IFC) has played an important role in this regard through inclusion of community health as a specific performance standard (number 4) (IFC, 2006a,b). The IFC performance standards are considered the key international benchmarks for the environmental impact assessment (EIA), social impact assessment (SIA) and HIA processes (Krieger et al., 2010). In addition, the IFC has issued both guidance notes and a HIA toolkit to ensure that health is fully considered within the overall assessment process (IFC, 2007, 2009a, b). The World Health Organization (WHO) is in the process of issuing similar guidelines for private sector lenders emphasising the critical role of health in the overall project development process. In addition to IFC, other private sector organizations (e.g. International Petroleum Industry Environmental Conservation Association (IPIECA) and International Council on Mining & Metals (ICMM)) and individual companies (e.g. Chevron, Eni, Newmont Mining and Shell) have developed guidelines and benchmark practices to support HIA within natural resources and industrial development projects (IPIECA, 2005; ICMM, 2010). All of these efforts represent an important step forward towards linking sustainable public health policy with large resource development projects (Mercier, 2003; WHO, 2005; Bos, 2006; Singer and Castro, 2007). Moreover, these initiatives demonstrate an effort to leverage the potential of industrial projects to promote sustainable community health either through direct mitigation of impacts, or through social investment projects (Lerer and Scudder, 1999; WHO, 1999; Utzinger et al., 2004,

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2005; The Global Fund, 2008). Voluntary contribution efforts (also known as extended benefits) in the health sector are encouraged, and IFC has developed an overall strategic community investment handbook (IFC, 2010).

However, in many parts of the developing world, the presence of a large-scale development project can severely stress underlying health systems that are already fragile and overwhelmed. Most of the published methodologies for HIA have been developed, validated and applied in Western Europe (Erlanger et al., 2008a). Hence, there is a pressing need to develop 'fit for purpose' HIA methodologies for developing country settings where the inherent resources and available baseline health data are far less sophisticated or unavailable compared to industrialised countries. An important aspect of our ongoing HIA of projects implemented in the humid tropics is to develop and validate appropriate but rigorous tools and methods for the various steps of a HIA (from screening to evaluation). The development of these tools and techniques has largely been driven by empirical necessity, i.e. based on specific case studies. This paper further extends our earlier work pertaining to HIA in complex eco-epidemiological settings (Winkler et al., 2010). Here, we add to the methodology of project scoping for rapid and accurate assessment of available baseline health data, giving particular emphasis to assessments of quality of evidence and combining it with data-driven projections of likely health impacts of the project. We also show how this methodology helps to identify important data gaps, which might require additional baseline health surveys.

Detailed baseline environmental and socioeconomic surveys are a regular and well-established feature of the impact assessment process. However, health impacts have repeatedly been identified as inextricably linked to environmental and social impacts as part of EIA and SIA. Exposure to toxic chemicals in communities proximal to mining projects and influx of commercial sex workers, promoting correlative increases in HIV transmission near project construction sites and transportation hubs, are two examples of this phenomenon (Ogola et al., 2002; Clift et al., 2003; Wang, 2004; Laite, 2009). Hence, there is every reason to include human health in analogous baseline analysis and documentation. Private sector companies are largely comfortable with the EIA and the SIA process. However, our experience indicates that in the context of HIA, the private sector is extremely concerned about sliding down a slippery slope that incrementally usurps the appropriate role of the host country's Ministry of Health (MoH). Engaging with the MoH as part of the production of a HIA can dampen this concern. It is in the long-term interest of both resource developer and host country to understand the pre-project health conditions at an appropriate level.

With this background at hand, we proceed in Section 2 to explicitly describe the scoping process. Section 3 contains a case study in the mining sector of the Republic of Guinea. In Section 4, we spell out our scoping methodology, including gap analysis, emphasising transparency of the components. Utilising our methodology, Section 5 contains the key findings from the scoping phase of the aforementioned case study. We conclude in the final section with a discussion of research steps that could further enhance the scoping process.

2. Scoping as part of the HIA process

Scoping is an early and important phase of the overall HIA process (Harris et al., 2007; IFC, 2009a,b). The objective of scoping is to identify the range of potential project-related health impacts, and to ensure that the HIA remains focused on the primary expected outcomes of a project. Scoping provides the blueprint for the entire impact assessment (Mindell et al., 2001; Cole et al., 2005; Joffe and Mindell, 2005).

The increasing number of available HIA guidelines offers a host of techniques and general suggestions for scoping. However, there is no clear articulation about which tools are most suitable for a given context. The complexity of a developing country environment (e.g. broad range of potential health impacts, sensitive socio-cultural issues and human influx concerns), renders the choice of appropriate methods for scoping a formidable challenge. Against this background, we were motivated to develop a specific and rigorous set of strategies, including data quality assessments, for scoping in the context of large-scale development projects operating in complex eco-epidemiological settings.

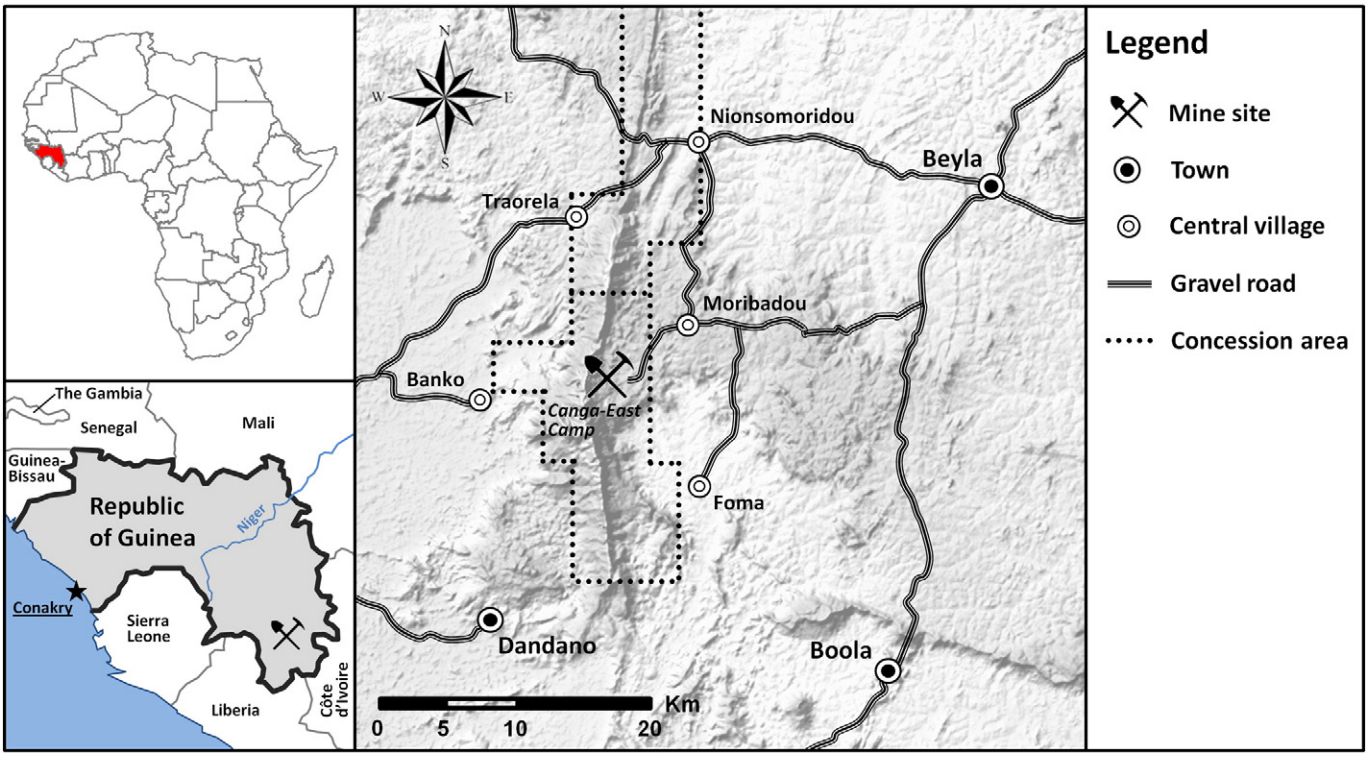

Fig. 1. Map showing the location of the Rio Tinto Simandou project in south-eastern Republic of Guinea and the surrounding communities (background: shaded relief map).

Our ongoing HIA studies include projects in the mining, water resources development, oil/gas and bioenergy sectors across the globe. Despite the diversity of geography and industrial sectors, there is considerable commonality and typicality in the scoping issues that are encountered. The generic scoping process will be presented in the context of a HIA for a large iron ore mining project in West Africa (Rio Tinto, 2010). We highlight the centrality of scoping for planning of the next steps of the HIA process (e.g. whether or not collection of additional baseline health data is necessary). Indeed, scoping is essential for determining the health status of project-affected communities and enabling long-term monitoring of project-related health impacts (PACs).

3. Case study

3.1. General considerations

In the Republic of Guinea, the mining sector contributes approximately 20% of the gross domestic product (GDP) and over 70% of export revenues (IFC, 2006a,b; CIA, 2009). Many of the poorest people in the Republic of Guinea are resident in the eastern part of the country. Thus, any large-scale economic activity in this part has the potential to both positively and negatively impact health, equity and wellbeing of potentially affected communities.

3.2. Rio Tinto Simandou project

The Rio Tinto Simandou project is an iron ore exploration and mining project located in the south-eastern part of the Republic of Guinea (Fig. 1). Rio Tinto's presence in the country dates back to 1997, accompanied by initial exploration work at Simandou, a 110-km long mountain range at an altitude up to 1650 m above sea level. In 2003, Rio Tinto signed a mining convention with the government of the Republic of Guinea to develop a mining concession at Simandou, including a 700-km long heavy haul iron ore railway and a deep-water port south of Conakry. The total workforce has been predicted to exceed 10,000 people for the construction of the mine, rail and water port, with some 4500 full-time jobs during the project's operational phase. At an estimated production rate of over 70 million tonnes per annum over a 50-year period, the Simandou mine is predicted to generate considerable taxes and royalties to the Government of the Republic of Guinea, and contribute to a regional development fund (Rio Tinto, 2010).

3.3. Corporate objectives and standards

Rio Tinto has a group community relations standard that serves as a framework for each operation to develop its own community relations policy. Additionally, the company has published a statement of business practice entitled "The way we work", with the stated goal to support regional- and community-based projects that contribute to sustainable development, without creating dependency (Rio Tinto, 2010). IFC is a partner in the Simandou project, holding a share of 5%. Thus, Rio Tinto must adhere to 'IFC social and environmental sustainability performance standards' (including community health) for the Simandou project (IFC, 2006a,b). Strategic community investment is also an important consideration, particularly since most health programmes are dual-use, i.e. a health mitigation programme often has extended benefits to a wider set of communities than those in close proximity to the project (Utzinger et al., 2004; IFC, 2010). Consistent with IFC and corporate standards, a HIA of the proposed project was commissioned with a formal, detailed community health management plan (CHMP) as an ultimate deliverable and management tool.

4. HIA scoping study: methodology and gap analysis

4.1. Guiding framework

In 2009 the IFC released a HIA toolkit (IFC, 2009a,b) that outlines a methodology to support the requirements of performance standard number 4 (IFC, 2006a,b) and guidance note number 4 (IFC, 2007), which pertain to community health, safety and security. The proposed HIA framework for the Simandou project was developed in accordance with these IFC standards and guidance note. Tools such as the environmental health areas (EHAs) framework, stratification of the relevant population into PACs and a risk analysis matrix to facilitate ranking of potential health impacts for subsequent prioritisation of mitigation strategies form an integral part of the assessment, and are described in more detail elsewhere (Winkler et al., 2010).

For the Simandou project, the need to consider community health was identified during the preliminary social assessments (La Granada Enterprise, 2008; SNC-Lavalin, 2009). The size of the potential area of influence of the proposed project, a high social sensitivity of the local communities, and a broad range of potential project-related health impacts triggered the need for a comprehensive HIA (IFC, 2009a,b). Against this background, the HIA screening concluded that a HIA is necessary, and hence a detailed scoping phase was deemed essential. The scoping analysis would set the boundaries of the HIA, and further clarify the following issues:

- timing and geographical boundaries;
- PACs, including the identification of inequalities and most vulnerable groups;
- baseline health status of the affected people, stratified by PACs;
- high-level health impacts and health needs, stratified by PACs;
- gaps that may exist in the baseline health data of the PACs;
- key performance indicators (KPIs) for subsequent monitoring and evaluation of the HIA and any CHMP and their outcomes;
- key stakeholders of the HIA, including their roles and responsibilities;
- non-governmental organization (NGO) partners that could support health initiatives in communities through assistance programmes; and
- overall scope, methodology and terms of reference (ToR) for the HIA.

In developing countries – where a broad range of health concerns and considerable local variation is the rule rather than the exception – it is crucial to have reliable evidence on the health status of affected communities in order to perform an effective impact assessment. This assessment prioritises potential impacts and leads to the development of a suite of relevant mitigation management measures. In order to effectively develop cost-effective mitigation strategies, it is essential to have robust KPIs for subsequent monitoring and surveillance for the selected mitigation activities. Hence, the identification of available information on the baseline health status of PACs becomes a challenging task that draws on (i) existing project documents (e.g. any available local, regional or national socioeconomic studies) as well as peer-reviewed and grey literature (e.g. any national demographic and health surveys (DHS), WHO data, Multiple Indicator Cluster Surveys (MICS) of the United Nations Children's Fund (UNICEF) and research-driven epidemiological investigations) and (ii) available health statistics from local health facilities. Socioeconomic data are critical as extensive published literature demonstrates that key health outcomes strongly covary with income/consumption expenditure, employment status, educational attainment of the household head, female educational attainment, household consumer durable assets and other physical capital indicators such as housing characteristics, size/occupancy rates and housing construction materials, water sources and distances, etc. (Wagstaff et al., 1991; Gwatkin et al., 2000; Filmer and Pritchett, 2001; O'Donnell et al., 2008). Baseline health analysis can be facilitated by

understanding the intimate connection between key physical, financial and education "capitals" and health. While education is typically included with health under "human capital" (Moser, 1998), our experience indicates that household educational attainment is much simpler to obtain than reliable community morbidity and mortality data. All of this analysis helps identify data gaps within the PACs. The capital analysis is a central feature of our scoping study approach as it cost-effectively develops a picture of the PACs and focuses attention on those data gaps that need to be filled by additional household-level field assessments.

4.2. Initial literature review

Project-related data included an initial review of the present preliminary project designs and proposed activities, the potential zones of influence and the location of people/communities in relation to these, past social and environmental baselines and assessments, community health interventions and any other related documentation. This included the socioeconomic baseline studies that were conducted in the project area in 2008, which provided valuable background information on the project area in general and detailed community profiles that could be analysed in terms of key health covariates (La Granada Enterprise, 2008; SNC-Lavalin, 2009). Company management standards and policies were also consulted.

To further inform the baseline status in the area of influence, a literature review was carried out to profile the health status of the communities residing in the footprint of the Simandou project, which was done prior to a first field visit. Due to the unstable political situation in the country, there has been a paucity of health-related research in the Republic of Guinea over the past decade. Information that was available often excluded remote regions of the country. Thus, minimal current health-related publications could be identified in the peer-reviewed literature, and none had a specific focus on the project area. Nevertheless, approximately 40 sources (mainly grey literature) were identified, from which data could be extracted to profile the baseline health status. Of note, identified sources from WHO, UNICEF, United States Agency for International Development (USAID), Food and Agriculture Organization (FAO) only provided disease prevalence rates on a national level and occasionally at a regional level, but not at a local level.

Of particular relevance was the 2005 Guinea DHS (GDHS) (Direction Nationale de la Statistique (DNS) and ORC Macro, 2006) which provided a host of demographic and health-specific indicators, stratified on a regional level. The 2005 GDHS was the third of its kind conducted in the Republic of Guinea and allowed comparison with the two previous GDHS done in 1992 and 1999 for analyses of trends. An additional key source was the provisional report on the National Survey on the Nutritional Status and Key Indicators of Child Survival (NSCS) (DNS, 2008), which was carried out as direct follow-up of the 2005 GDHS. The goal of this survey was to obtain reliable information to define appropriate interventions to reduce the upward trend in child malnutrition that was observed in the GDHS.

As part of the standard process of getting stakeholder involvement, the initial literature review formed the basis for production of a set of interview guides to support key informant interviews (KIIs) in a subsequent field visit. The interview guides were based on the structure of the EHAs and comprised a set of open-ended questions to deepen the understanding of community baseline health status in the project area. Similarly, discussion guides can be prepared to carry out a limited number of focus group discussions (FGDs) with community members to determine local knowledge, attitude and practices (KAP) regarding specific health-related issues. However, in the present scoping study no further FGDs were conducted, since health-related information at the community level, using various qualitative and quantitative methods, had already been obtained as part of the previously conducted socioeconomic baseline studies (La Granada Enterprise, 2008; SNC-Lavalin, 2009).

4.3. Field visit and stakeholder engagement

Stakeholder engagement is a foundation of the HIA process. In the scoping stage, it is essential to engage the national and prefecture health authorities and administrators, key local actors in the health and social development sectors, as well as village leadership structures. Our experiences thus far with engaging different stakeholders are that "top-down" engagement is essential prior to local interactions. In many projects the desire to have "bottom-up" dialogue often overlooks the essential need to involve senior MoH officials prior to extensive community-level engagement.

Key areas of support and potential collaborations were discussed with the MoH in Conakry, which led to the formal authorisation from the MoH in the form of an "Ordre de Mission" for the planned scoping activities. This document, in turn, facilitated engagement with the health authorities in Beyla to obtain permission for a meeting with the decentralised health centres and posts, and allowed us to have access to readily available health statistics at the Beyla prefecture.

Communities residing on the perimeter of the project were visited. This included a visit to the district hospital in Beyla, the health centres in Nionsomoridou and Boola, the health post in Moribadou, as well as the Simandou project medical centre (Fig. 1). KIIs were done with health professionals, adhering to the previously elaborated and pre-tested interview guide.

Taken together, a variety of (i) project documents, (ii) local and regional health statistics, (iii) national public health programme policies, (iv) information on local NGOs engaged in health, including other stakeholder agencies that were active in the project area, and (v) other potential partners for community health were interviewed during the field visit. The information and knowledge derived from these documents and interviews were then incorporated into the EHAs framework to form a detailed baseline demographic, health and socioeconomic profile of the PACs.

4.4. Health outcomes and determinants of major concern

The accumulated baseline health data obtained from the initial literature review and the in-country field visit were analysed in order to accurately frame the overall scope and determine any relevant data gaps. It is of pivotal importance during this early stage to focus the impact assessment on the most important health issues; a necessity in view of the multi-factorial settings that are commonly encountered in a developing country context.

As an entry point, the occurrence and importance of the different health outcomes and determinants were assessed for the project region, drawing on the available evidence, including: (i) peer-reviewed and grey literature, (ii) stakeholder input, including information obtained from KIIs and FGDs, and (iii) direct observations made during field visits (Fig. 2). Such a methodological triangulation, leading to multiple forms of evidence and perspectives, is an important means to enhance the validity of a decision and thus most relevant for the entire HIA (Razum and Gerhardus, 1999). Hence, the different sources were checked against the others to finally summarise and stratify the health outcomes and determinants. We employed the following system: (i) absent (e.g. dracunculiasis has been eliminated in the Republic of Guinea), (ii) rare/insignificant (e.g. very few cases of human African trypanosomiasis (HAT) were reported for the project region), (iii) occasional/minor importance (e.g. skin diseases and diabetes), and (iv) frequent/major importance (e.g. malaria and diarrhoeal diseases).

In a second step, with the detailed analysis of each EHA, it was determined, which of the health outcomes and determinants were of major concern from a public health perspective and in view of potential

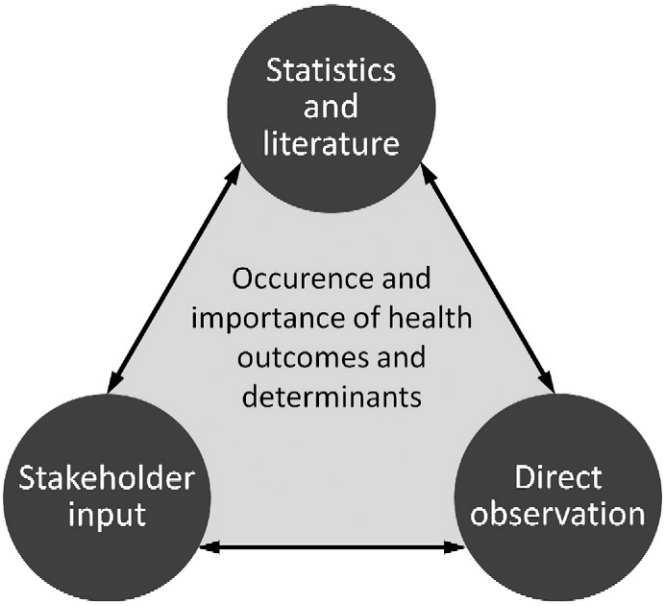

Fig. 2. Methodological triangulation to determine the occurrence and importance of health outcomes and determinants.

future project-related health impacts. In this process, it is important to consider community, project and institutional risk factors, which are often interlinked. For example, the high endemicity of malaria in the project area is a risk factor for the workforce be they recruited locally or from further away. This is also influenced by the presence or absence of institutional capacities (e.g. existence of a functional national malaria control programme).

As a result, the selection process was based on the analysis of available evidence, best professional judgement, and further consolidated by means of a modified Delphi approach (Rowe and Wright, 1999). Provision of a rationale for the 'best professional judgements' by the assessors themselves can provide a level of transparency for the results that can be challenged by critics and, in an iterative process, even revised.

4.5. Gap analysis

A gap analysis informs the assessors whether sufficient data are available to proceed directly with the risk/impact analysis and mitigation phase, or, in case of inadequate or insufficient data, whether the collection of additional baseline health data is recommended. Fig. 3 shows a decision tree, which is used to support the decision making process on whether or not additional baseline health data collection is necessary to support the overall HIA framework (IPIECA, 2005; IFC, 2009a,b).

In practice, a gap analysis has a focus on the health outcomes and determinants of major concern that were defined in the prior data collection and information gathering. This includes critical appraisal of data quality of identified sources. While information from national surveys such as the GDHS, the NSCS or peer-reviewed literature usually provide robust data, the accuracy of grey literature or routine health facility statistics needs to be scrutinised in greater depth. Importantly, data on major health outcomes and determinants of concern require a high level of accuracy on a regional and/or local level allowing for evidence-based risk and impact assessment and subsequent monitoring and surveillance. Based on these requirements, the available quantitative and qualitative information was ranked as follows: (i) low level of fidelity, (ii) moderate level of fidelity, and (iii) high level of fidelity.

In case important data gaps are identified, additional baseline data collection becomes part of the ToR for the overall HIA. This includes further specifications of KPIs to inform the required evidence-base. Two major strategies are available to support this collection of primary data. The first is to perform a baseline health survey in the project region. This can entail the collection of qualitative and quantitative data to produce representative KPIs that can be utilised to monitor mitigation and management strategies. The primary data collection methods can be based on a variety of methods such as examination of biological samples (e.g. blood, sputum, stool and urine), anthropometric measures (e.g. height, weight, blood pressure and arm circumference), questionnaires, observations (e.g. presence of latrines and sleeping under an insecticide-treated net (ITN)), FGDs, in-depth interviews and environmental monitoring, among others. The second is referred to as health system strengthening by reinforcing the diagnostic accuracy and reporting systems of the local health facilities. This is not only an important means to obtain

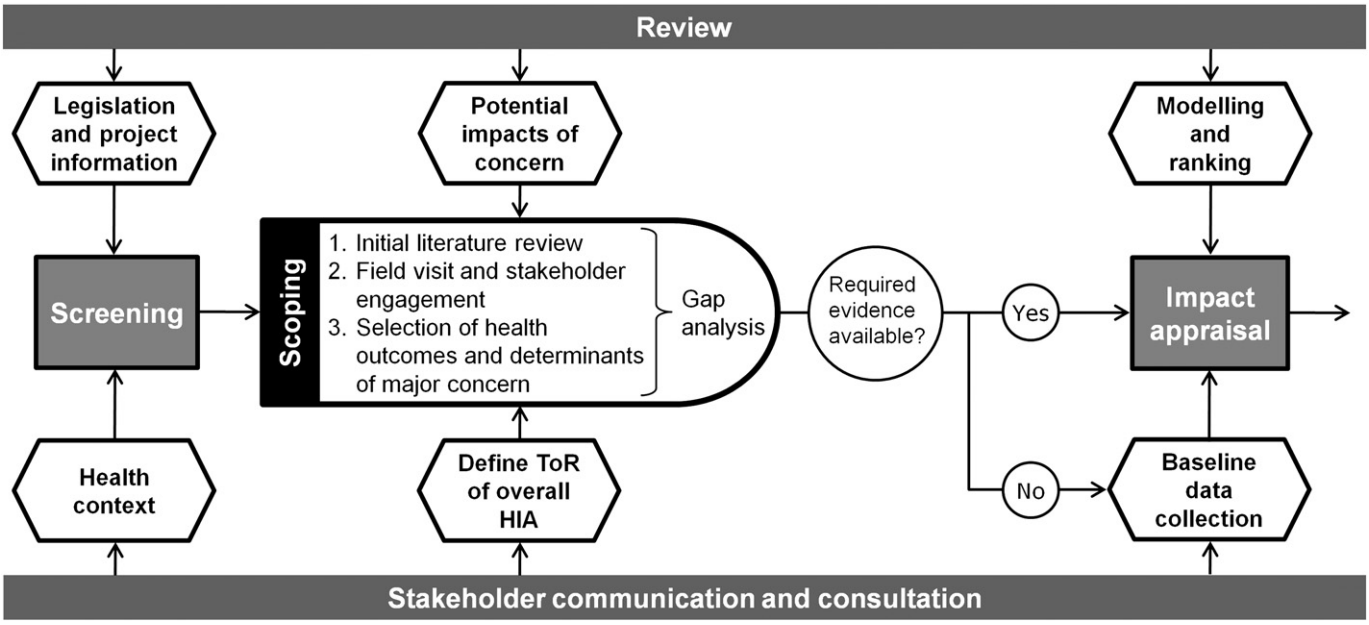

Fig. 3. The evidence gathering and decision making process of scoping to support the overall HIA (adapted from IPIECA (2005) and IFC (2009a,b)).

Table 1
Summary table of health outcomes and determinants of major concern, and their inclusion in additional baseline data collection.

Environmental health areas (EHAs)		Most important data sources at regional and local level	Occurrence/ importance	Health outcome/ determinant of major concern	Pooled quality ranking of available evidence	Additional baseline data needed	Source of additional baseline data
No.	Health outcomes and determinants						
1	Communicable diseases						
	Tuberculosis	HFS	♦♦♦	✓	♦	✓	HSS
	Respiratory tract infections	HFS	♦♦♦	✓	♦♦	✓	HSS
	Measles	HFS	♦				
	Meningitis	HFS	♦				
	Leprosy	HFS	♦				
2	Vector-related diseases						
	Malaria	HFS, GDHS, NSCS	♦♦♦	✓	♦	✓	BHS, HSS
	Arboviral disease	HFS	♦				
	Human African trypanosomiasis (HAT)	HFS	♦				
	Lymphatic filariasis	HFS	♦				
	Dracunculiasis	ND	–				
3	Soil-, water- and waste-related diseases						
	Diarrhoeal diseases	HFS, GDHS, NSCS	♦♦♦	✓	♦♦	✓	BHS, HSS
	Soil-transmitted helminthiasis	HFS	♦♦♦	✓	♦♦	✓	BHS
	Schistosomiasis	HFS	♦♦♦	✓	♦	✓	BHS
	Buruli ulcer	HFS	♦				
	Hepatitis A and E	n/a					
4	Sexually-transmitted infections (STIs), including HIV/AIDS						
	HIV/AIDS	GDHS, HFS, BS	♦♦♦	✓	♦♦	✓	BHS, HSS
	STIs	GDHS, HFS, BS	♦♦♦	✓	♦♦	✓	BHS, HSS
	Hepatitis B	n/a					
5	Food- and nutrition-related issues						
	Malnutrition	HFS, GDHS, NSCS	♦♦♦	✓	♦♦	✓	BHS, HSS
	Anaemia	HFS, GDHS, NSCS	♦♦♦	✓	♦♦	✓	BHS
6	Non-communicable diseases						
	Cardiovascular diseases	HFS	♦♦	✓	♦	✓	BHS, HSS
	Diabetes mellitus	n/a					HSS
	Cancer	HFS	♦♦				
	Chronic respiratory diseases	HFS	♦♦				
7	Accidents/injuries						
	Traffic accidents	HFS	♦♦	✓		✓	HSS
	Work-related injuries	HFS	♦				
8	Veterinary medicine and zoonotic diseases						
	Leptospirosis	n/a					
	Rabies	n/a					
	Lassa fever	ND	♦				
9	Exposure to potentially hazardous materials, noise and malodours						
	Water quality	EIA	♦♦♦	✓	♦♦	✓	BHS, EnvM
	Air quality	EIA	♦♦	✓	♦	✓	EnvM
	Noise	EIA	♦♦	✓	♦	✓	EnvM
	Waste management	EIA	♦♦	✓	♦♦		BHS, EnvM
10	Social determinants of health						
	Mental health	HFS	♦♦	✓	♦	✓	BHS, HSS
	Health seeking behaviours		♦♦♦	✓	♦	✓	BHS, HSS
	Life style	SIA	♦♦	✓	♦♦	✓	BHS
	Inequalities	SIA	♦♦♦	✓	♦♦	✓	BHS
	Health education	GDHS, SIA	♦♦♦	✓	♦	✓	BHS
11	Cultural health practices						
	Traditional medicine	GDHS, SIA	♦♦♦	✓	♦	✓	BHS
	Female circumcision	GDHS	♦♦♦				
12	Health systems issues						
	Infrastructure and capacity	ND	♦♦♦	✓	♦♦	✓	BHS
	Reproductive health	GDHS	♦♦				
	Maternal health	HFS, GDHS, NSCS	♦♦♦	✓	♦♦	✓	BHS, HSS
	Child health and immunization	HFS, GDHS, NSCS	♦♦♦	✓	♦♦	✓	BHS, HSS
	Programme management and delivery systems		♦♦♦	✓	♦♦♦		

Abbreviations: BHS, baseline health survey; BS, baseline study; EIA, environmental impact assessment; EnvM, environmental monitoring; GDHS, Guinea Demographic and Health Survey; HFS, health facility statistics; HSS, health system strengthening; n/a, not applicable; ND, national data; NSCS, National Survey on the Nutritional Status and Key Indicators of Child Survival; SIA, social impact assessment.
Occurrence/importance: –, absent; ♦, rare/insignificant; ♦♦, occasional/minor importance; ♦♦♦, frequent/major importance.
Health outcome/determinant of major concern; Additional baseline data needed: ✓, applies.
Pooled quality ranking of available evidence: ♦ low level of fidelity; ♦♦ moderate level of fidelity; ♦♦♦ high level of fidelity.

longitudinal data, but also the preferred strategy for indicators that are difficult to assess in a cross-sectional study (e.g. incidence of respiratory disease and number of traffic accidents). Additionally, the reinforcement of diagnostic accuracy also has great potential to have a positive impact on community health and can thus become a community health intervention per se (e.g. provision of rapid diagnostic tests (RDTs) for malaria diagnosis) (D'Acremont et al., 2009).

5. Key findings from HIA scoping study

To illustrate the analytical framework of our scoping methodology, the evaluation of two specific EHAs (i.e. EHA 2: vector-related diseases; EHA 3: soil-, water- and waste-related diseases) will serve as examples. Table 1 provides a comprehensive overview of the key findings and conclusions derived from the entire scoping process. This level of detail, including the assessment of data quality, is rarely – if ever – included as part of scoping in the HIA. However, this form of reporting greatly enhances the utility of the scoping analysis and provides stakeholders with a better understanding of how the overall conclusions were reached.

5.1. EHA 2: vector-related diseases

In the initial literature review, malaria (RBM, 2010), arboviral diseases (i.e. yellow fever and dengue) (CDC, 2009; WHO, 2009), HAT (Simarro et al., 2008) and lymphatic filariasis (GAELF, 2008) were identified as vector-related diseases that occur in the Republic of Guinea. Clearly, malaria was identified as the single most important vector-related disease in the project area, whereas none of the other potential vector-related diseases were mentioned by key informants or reported in health statistics obtained during the in-country field visits.

According to the GDHS 2005, which provides robust information on the use of preventive measures against malaria down to a regional level, the national malaria prevalence was 18% for the entire population and 21% among pregnant women in 2002 (DNS and ORC Macro, 2006). Local level statistics on malaria morbidity were obtained during the in-country field visit. In 2007, out of 56,762 registered consultations in Beyla prefecture, 13,537 (23.9%) were diagnosed for malaria (all age groups), with 5180 of the patients aged 5 years and below (Service National d'Information Sanitaire (SNIS), 2007). Also in the first term of 2008, one in four patients presented with malaria in Beyla prefecture (SNIS, 2008). The KIIs with local health authorities and professionals of the health facilities in proximity to the project underscored that malaria is a key public health problem. Interestingly though, questions pertaining to local practices regarding vector control measures, as well as direct observations, revealed a less homogeneous picture, indicating considerable variation in the perceived public health relevance of malaria among local communities.

We concluded that malaria is a disease of major importance in the project area and a key community risk factor. The Simandou project represents a possible additional risk factor for malaria as it will result in demographic and environmental transformations linked to in-migration and project-related environmental changes that may, or may not, expand the *Anopheles* larval habitats. Health systems performance, or the lack thereof, is considered as an institutional risk factor for the heavy burden of vector-related disease, which is further reflected by the fact that only one out of five households in the N'Zérékoré region were in possession of an ITN at the time of the NSCS carried out in 2007 (DNS, 2008). Malaria is thus clearly a major health outcome of concern for the HIA that will need special attention.

Although the GDHS and the NSCS provide regional data on the possession and use of two preventive measures against malaria (i.e. ITNs and intermittent preventive treatment during pregnancy (IPT_p)), little is known regarding local variation. Additionally, the true malaria prevalence in the project region is unknown due to the lack of community-based malaria surveys. This is also true for people's KAP of vector control measures in the local communities. Ultimately, the accuracy of available morbidity statistics is reduced as peripheral health facilities in the study area rely on presumptive diagnosis due to the lack of microscopes and RDTs. In conclusion, the available information on malaria and its determinants has a low level of fidelity and considerable data gaps exist. Clearly, further baseline data on a local level will be required, not only to deepen the understanding of the malaria burden in the project area at an early project stage, but also to further our understanding of local KAP in relation to vector-related disease and prevention. Potential KPIs and strategies to inform the required evidence-base are presented in Table 2.

Table 2
Potential key performance indicators (KPIs) and strategies to inform the required evidence-base on vector-related diseases (EHA 2).

Baseline health survey
➢ Malaria prevalence in children below the age of 5 years (The Global Fund, 2009)
➢ Percentage of children with a measured haemoglobin concentration of less than 8 g/dl (The Global Fund, 2009)
➢ Percentage of children below the age of 5 years that sleep under an insecticide-treated net (ITN) (MEASURE DHS, 2010)
➢ Percentage of women who received two or more doses of intermittent preventive treatment (IPT) for malaria during their last pregnancy (MEASURE DHS, 2010)
➢ Status of knowledge, attitude and practices (KAP) in relation to malaria and how to prevent the disease
Health system strengthening
➢ Longitudinal data on malaria incidence by improving diagnostic and reporting abilities of the local health facilities

5.2. EHA 3: soil-, water- and waste-related diseases

In 2006, it was estimated that 51–75% of the Guinean population is using an improved drinking water source, but less than 25% used improved sanitation facilities such as latrines (WHO/UNICEF, 2008). For the project region, the socioeconomic baseline study (La Granada Enterprise, 2008) reported that, on average, less than 60% of the population had access to improved drinking water sources in 2008 and most of the population relied on unprotected surface water from local rivers, streams and other freshwater bodies in close proximity to villages. According to the NSCS, over 50% of the households in the N'Zérékoré region practiced open defecating, which represents the highest portion of any region in Guinea (DNS, 2008). As a result, diarrhoeal diseases are a major public health concern in Guinea with 16% of children under the age of 5 years who had at least one episode of diarrhoea during the 2 weeks before health interviews were conducted by GDHS (DNS and ORC Macro, 2006). This rate was highest in N'Zérékoré region (21.6%).

According to health statistics of Beyla prefecture with 56,762 registered consultations in 2007, common diarrhoea was responsible for 7.5% of all the consultations (n = 4263; all age groups). There were 2451 cases with bloody diarrhoea, accounting for 4.3% of the total number of consultations (SNIS, 2007). In the immediate project area, diarrhoea is one of the most important causes of morbidity in the local communities. In 2008, at Nionsomoridou and Boola health centres, 21.7% and 33.8% of all diarrhoeal cases (n = 106 and n = 284; all age groups) were bloody diarrhoea, respectively. There is a host of bacterial, viral and parasitic agents as potential causes for common diarrhoea in the project region, most of which are spread by faeces-contaminated water. However, there is a lack of diagnostic tests at the community health facilities, and hence the aetiology of diarrhoea warrants further investigation.

In 2007, helminthiasis was the third leading cause of health seeking according to statistics at Beyla prefecture, accounting for 14% (n = 7962) of the total consultations (SNIS, 2007). The 2008 health statistics of Nionsomoridou and Boola health centres revealed that soil-transmitted helminth (STH) infections ranked fourth (n = 464) and third (n = 81) in terms of consultations, respectively. Few cases of intestinal schistosomiasis due to *Schistosoma mansoni* and urinary schistosomiasis due to *Schistosoma haematobium* were reported for Beyla prefecture in 2007; they accounted for 1.5% (n = 834) and 0.3% (n = 194) of the total number of health consultations, respectively (SNIS, 2007).

Table 3
Potential key performance indicators (KPIs) and strategies to inform the required evidence-base on soil-, water- and waste-related diseases (EHA 3).

Baseline health survey
➢ Percentage of households that have functioning improved toilet facilities within their compounds (Finn, 2007)
➢ Water quality of community water sources
➢ Water quality 'in the glass' at household level
➢ Prevalence and intensity of soil-transmitted helminth and schistosome infections in school-aged children (Hall and Horton, 2008)
➢ Status of knowledge, attitude and practices (KAP) in relation to water and sanitation practices as well as personal hygiene
Health system strengthening
➢ Longitudinal data on diarrhoeal disease, soil-transmitted helminthiasis and schistosomiasis by improving diagnostic and reporting abilities of the local health facilities

In view of the many community risk factors, such as unsafe drinking water, lack of sanitation facilities and poor hygiene, it is conceivable that soil-, water- and waste-related diseases are highly prevalent. Indeed, available health statistics and KIIs reveal high frequencies of diarrhoeal diseases and STH infections, whereas schistosomiasis was of lesser importance. However, visits to the local health facilities revealed that the diagnosis of STH and schistosome infections was based on a syndromic approach, and hence the data have to be interpreted with care. Awareness about the transmission of helminthiases and how to prevent these parasitic worm infections was limited. The Simandou project, which is likely to trigger substantial in-migration into the project area (La Granada Enterprise, 2008; IFC, 2009), represents an additional risk factor, as it may induce further pressure on the already limited clean water and sanitation infrastructure. Concluding, diarrhoeal diseases and STH infections are health outcomes of major concern for the HIA. Importantly, the Simandou project supports water and sanitation services and was indeed the only such capacity enhancement identified during our scoping survey. Hence, it is conceivable that diarrhoeal diseases and helminth infections are mitigated by the project.

The currently available data on soil-, water- and waste-related diseases, which are based on syndromic approaches, have a low to moderate fidelity due to the lack of standardised, quality-controlled copro-microscopic diagnoses. Consequently, this jeopardises proper prioritisation of mitigation strategies as well as any future monitoring and surveillance activities. KPIs identified to tackle the gap between available and required information on EHA 3 are presented in Table 3.

6. Discussion

Scoping is the second step in the overall HIA process and plays a crucial role in subsequent phases of risk appraisal, mitigation and long-term monitoring (Cole et al., 2005; Joffe and Mindell, 2005; Harris et al., 2007). The results of the scoping process often constitute the *de facto* evidence source for the HIA. This is particularly the case when there are financial constraints and severe time restrictions – several days to a few weeks – on carrying out the entire HIA process, as for example in the Nam Theun 2 hydroelectric project in Lao People's Democratic Republic (Lao PDR) (Krieger et al., 2008). Much more extensive baseline data than was used in the official HIA were in fact available via the MoH in Lao PDR. They were only organised and published after completion of the HIA due to the time constraints imposed on the HIA process for that project (Erlanger et al., 2008b; Sayasone et al., 2009).

In this regard, an important consideration is the availability and quality of different data sources that have been identified and carefully reviewed within the scoping exercise (Bhatia and Seto, 2011-this issue). While national surveys such as DHS and MICS provide relevant data at the regional level, they often lack precision at a smaller scale (district and village level). Indeed, health characteristics and potential project-related impacts often vary considerably from one community to another, and hence local level health data is crucial. Health statistics are often the only available data source at this fine-grained level, but data quality might be an issue. In a first instance, it is important to know which methods and diagnostic approaches were utilised to determine the presence of malaria, intestinal parasites, sexually-transmitted infections (STIs) and non-communicable disease. Moreover, data management and reporting needs to be scrutinised. Accessibility and affordability of health care are other important factors to be considered as they have important repercussions on the local validity and representativeness of health facility statistics (Rowe et al., 2009). Hence, critical appraisal of data quality of identified sources plays an important role and governs the subsequent gap analysis. The appraisals must, of necessity, be condition/disease-specific. For example, in a specific setting all the health facilities may be equipped with RDTs for malaria, while diagnosis of intestinal parasite infections relies on clinical algorithms that lack accuracy, and hence lead to different levels of data quality reported in the same health facility-based statistics. Malaria diagnostic data would receive a high quality rating, whereas data on diagnosis of intestinal parasites would be assigned a lower quality grade. The scoring of data quality is also closely related to the importance of the relevant health issue, which is of particular interest with regard to subsequent monitoring and surveillance of major potential health impacts.

In the developing world, the broad range of potential health impacts, sensitive socio cultural and equity issues, and human influx concerns are often the driving forces in the HIA process for large-scale development projects. In case important data gaps are identified during the scoping process, or the project operates in a setting with a high social sensitivity, has a broad range of potential health impacts, or a large footprint, then more comprehensive HIAs should be the preferred mode of assessment, which means that in-country data gathering is required (Harris et al., 2007; IFC, 2009). The key point here is that the overall financial envelope and the possible short time frame allotted for the full HIA are important limiting factors. As HIA become a more routinised part of the planning process for development projects in the tropics, we would anticipate longer allowed time periods for their conduct. As they parallel EIA and/or SIA, or are even integrated with them, major data gaps identified in the scoping process are more likely to be filled.

With this background at hand, it is important to embrace a forward looking perspective for a durable implementation of the HIA process, justified as follows. First, the selective stakeholder engagement and limited community involvement in this initial phase reduces costs and the risk of survey fatigue, enables coordination with other impact assessment teams for joint data collection and promotes critical stakeholder input at the initiation of the project. Second, the orientation of the impact assessment process on a selected number of health outcomes and determinants of major concern allows focusing of the HIA on the essential variables from evidence-based considerations. Third, the structured analytical framework puts the assessors in a position where they can face the challenging task of developing a comprehensive study design for a baseline health survey that is (i) oriented towards the required outcomes, (ii) adapted to the local context, and (iii) facilitates local and national health authority engagement. The scoping study methodology presented here is applicable to different levels of a HIA. It may also lead to the conclusion that no additional data collection is required. However, what is the value of HIA in developing countries without the monitoring of future project-related health impacts and community development programmes? Epidemiological data allows the proponent to measure, and thus monitor health impacts and outcomes accurately. At the same time, there are many health-related indicators that go beyond health *per se* and allow characterisation of general wellbeing, vulnerability and resilience of entire communities (e.g. malnutrition and access to health care, clean water and adequate sanitation). The potential of

epidemiological indicators must be emphasised as it is a promising way to monitor the return on social investment programmes.

7. Conclusion and outlook

Scoping is a rapid-appraisal process that uses information of varying quality from diverse sources enroute to providing a synthesis of the likely routes to project-related health impacts and a distillation of baseline data. Despite the central importance of this phase in the overall HIA process, and the fact that in some instances it serves as the HIA itself, reporting of scoping results has been remarkably informal and lacking in transparency about the rationale behind critical judgements made by assessors. As the demand for, and scrutiny of, HIA increase, there will be a growing need for a more structured scoping process than heretofore.

We have presented details of a systematic scoping methodology and reporting framework with illustration of its implementation for a mining project in the Republic of Guinea. Although the details of the findings are project-specific, the systematic structure is generic for scoping. The evidence-based selection of major health outcomes and determinants of major concern, including quality assessment of data/information sources and explication of rationale for 'best professional judgements' is an innovation of our methodology that enhances the transparency of the scoping process.

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Jürg Utzinger (born 1968) is a Professor in epidemiology and heads the Ecosystem Health Sciences unit at the Swiss Tropical and Public Health Institute. Jürg's research, teaching and training interests pertain to the epidemiology and control of tropical parasitic diseases, particularly schistosomiasis, soil-transmitted helminthiasis, food-borne trematodiasis and malaria with ongoing collaborative projects in Côte d'Ivoire, the People's Republic of China and elsewhere in Africa and Asia. Together with Gary and Marci, Jürg pursued the health impact assessment (HIA) of the Nam Theun 2 hydroelectric project in Lao People's Democratic Republic. Jürg is currently engaged in monitoring health and wellbeing of rural communities in the Taabo health demographic surveillance system in Côte d'Ivoire.