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Health impact assessment of industrial development projects: a spatio-temporal visualization

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Abstract. Development and implementation of large-scale industrial projects in complex eco-epidemiological settings typically require combined environmental, social and health impact assessments. We present a generic, spatio-temporal health impact assessment (HIA) visualization, which can be readily adapted to specific projects and key stakeholders, including poorly literate communities that might be affected by consequences of a project. We illustrate how the occurrence of a variety of complex events can be utilized for stakeholder communication, awareness creation, interactive learning as well as formulating HIA research and implementation questions. Methodological features are highlighted in the context of an iron ore development in a rural part of Africa.

Keywords: developing country, health impact assessment, industrial development project, spatio-temporal visualization.

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Background

Implementation of industrial development projects in complex, eco-epidemiological settings in the tropics can trigger a variety of complex events, including resettlement, influx of young adults seeking employment opportunities, infrastructure enhancements such as new or improved roads and bridges with subsequent increase in traffic loads and informal trading activities. Remote rural areas can rapidly transform into neighbourhoods similar to peri-urban settlements. New social-ecological contexts alter – positively and/or negatively – vulnerability, resilience and livelihood of the resident people. Patterns of endemic diseases, injuries and risk factors change at the local, sometimes even regional scale (Lerer and Scudder, 1999; Jobin, 2003; Utzinger et al., 2005; Krieger et al., 2008). In order to minimize negative health outcomes and maximize health benefits, health impact assessment (HIA) is used as a decision-making tool to evaluate and quantify the potential health effects of a project, programme and policy for the subsequent devel-

opment of mitigation measures (Quigley et al., 2006). Modern HIA pursues a systematic and evidence-based approach, usually employing qualitative and quantitative methods with broad stakeholder involvement (Krieger et al., 2010). HIA represents the first stage of monitoring and surveillance of environmental, social and health conditions of impacted communities, setting the basis for adaptive tuning of intervention/mitigation strategies that can, in the best of circumstances, elevate the local population's general living standards.

Commitment of different stakeholders, such as project proponents, health authorities and potentially affected populations is a key HIA component. In this process, communicating information in a manner readily understood by key stakeholders is crucial as activities from consultation to negotiation and resolution of grievances depend on accurate and timely project information, its potential impact and any other aspects that may affect local communities (IFC, 2007). Our own experience when carrying out HIAs in developing country settings is that true communication, rather than simply passing on information, is challenging, especially since the time allocated for this often is limited (Winkler et al., 2010, 2011, 2012). In addition, the task is complicated by high levels of illiteracy in local communities, language barriers, cultural, demographic, gender and social differences between stakeholders. In search of an effective strategy for information, education and communication

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(IEC) that can be used in different socio-cultural contexts, we have developed an approach for visualization that was motivated by the following questions:

- (i) What mechanisms might be triggered by the implementation of an industrial development in a rural setting of a low-income country?
- (ii) How can we visualize these potential mechanisms for people who have no comparative references and scarce comprehension of what a project development entails?
- (iii) How can we illustrate the different stages, tools requirement and methods that are commonly used in HIA for strengthening the required evidence-base?

The specific context of the present visualization is a mining project under development in a rural part of sub-Saharan Africa. Different components of the presentation are tailored to specific audiences. For example, the level of simplicity *versus* theoretical content is tailored to the background and interest of the stakeholders (e.g. no written text when presenting to poorly literate local communities, while key messages must be encapsulated in text format when presenting to Ministry of Health personnel or local authorities). Moreover, our specific project type (i.e. mining) can be readily adapted to other industrial projects (e.g. development of petroleum and pipeline projects, management projects, agriculture/bioenergy projects and water resources). Concurrently, the pictorial elements are changed to fit the project at hand (e.g. replacing the mine symbol with a pictogram showing an oil pipeline, etc.) (Box 1).

We present here an advanced version of our HIA visualization which was first introduced in a symposium entitled “A picture is worth a thousand words: visualization of health using geospatial tools”

Box 1. Purpose of the visualization.

- A visual tool for communicating complex information as part of a broad stakeholder engagement process (e.g. local communities in remote rural areas, Ministry of Health and project technical staff).
- An educational tool for the illustration of methodological features and concepts (e.g. teaching in class rooms).

Box 2. Applied software.

- Content visualization, including geospatial components: Microsoft PowerPoint 2007 (Microsoft Corporation; Redmond, WA, USA), using the programme’s embedded custom animation function, images from the Clip Art collection, as well as shapes, charts and a collection of the authors’ own photo galleries.
- Production of video for Internet streaming: Camtasia Studio 7.1 (TechSmith Corporation, Okemos, MI, USA).

(Utzinger et al., 2011) at the 60th annual meeting of the American Society of Tropical Medicine and Hygiene in Philadelphia, USA. Our visualization gives a general introduction to HIA of industrial development projects in complex eco-epidemiological settings, covering the following elements:

- (i) an illustration of a variety of potential events and mechanisms triggered by a large-scale natural resource development project in a typical rural setting of the developing world;
- (ii) the overall concept and the different phases of HIA, including a set of methodological features for the proposed approach; and
- (iii) a case study of an iron ore project in the Republic of Guinea, including spatially explicit results obtained from a modular baseline health survey.

Outlook

We illustrate how complex concepts and methodologies can be disseminated in an entertaining and coherent manner to different stakeholders. As shown by Krieger et al. (2012) in the same issue of *Geospatial Health*, visualization of the key findings of HIA in the form of short video reports facilitates communication with upper-level management of corporations, government offices and financial institutions, which rarely study reports of several hundred pages. Spatial images can incorporate relationships among a complex set of ideas, objects and phenomena in an easily understood and flexible form. We believe our visualization of HIA is an important step forward, and we invite the impact assessment communities to further develop spatio-temporal visualizations of the health, environmental, social and human rights impacts of complex infrastructure projects.

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