

Vulnerability to air pollution: To intervene or not to intervene

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INTRODUCTION

Exposure to high concentrations of pollution is not the only factor that influences a community's total health risk. In an effort to understand and address other factors, CSIR environmental health researchers initiated a household survey in a low-income community to assess the vulnerability of low-income communities to environmental pollution by finding associations between so-called vulnerability factors and environmentally-related health outcomes.

Other studies have shown that factors including socio-economic profile, social stress, location, nutrition, type of dwelling and social structures, have a bearing on susceptibility and therefore vulnerability^{1,2}. This survey has highlighted the need for novel methods that can more adequately address vulnerability.

While the debate on the development of new methods that can quantify vulnerability to air pollution continues, the need for **informed decision-making based on credible local information** is pressing^{3,4}.

The challenge: To identify what is needed to reduce vulnerability of low-income communities to air pollution and thereby improve their quality of life. This requires a multi-sectoral and multidisciplinary process.

VULNERABILITY ASSESSMENT SURVEY

The goal: To identify possible associations between vulnerability factors and two broad environmental health outcomes, i.e. respiratory and waterborne diseases.

- A vulnerability framework drawn up to consider vulnerability issues comprised three categories: differential exposure, susceptibility and coping mechanisms (see **Figure 1**)
- Applied to a survey consisting of 377 households
- Study conducted in eMbalenhle, a low-income peri-urban settlement
- Multivariate analysis applied to establish whether it was possible to derive a more concise questionnaire
- Health outcomes grouped together to form three health outcome clusters.

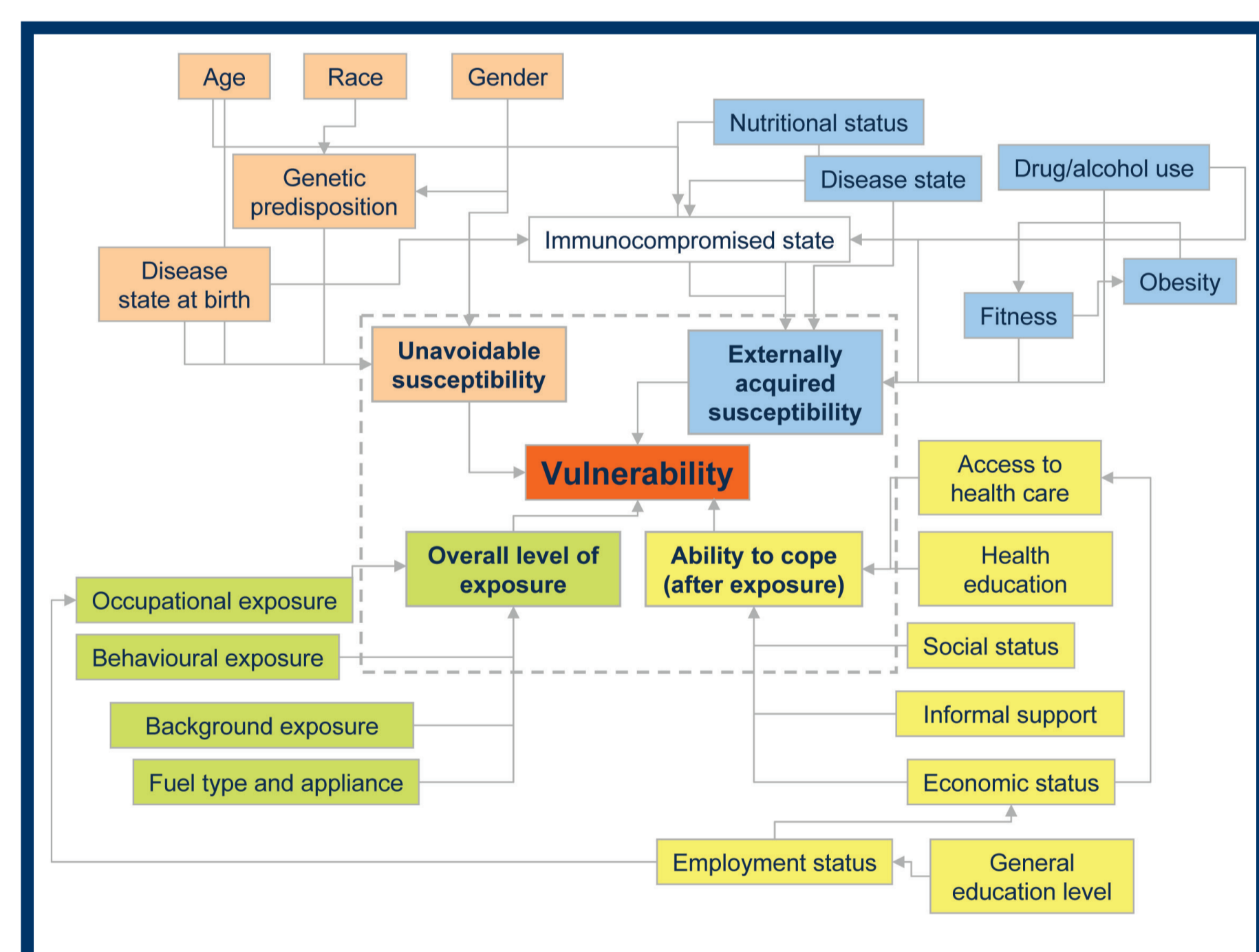


Figure 1: Vulnerability framework refined through a systems thinking process

Proxy exposure measures

Proxy exposure measures, e.g. type of fuel and appliance used, were used to approximate exposure to indoor air pollution.

Vulnerability survey results: Descriptive statistics

- The prevalence of health outcomes was very low for all health outcomes with 90% of households considering the health of the family to be good - respiratory health outcomes indicated in **Table 1**
- Only 11,7% of the households had access to medical aid
- Pest problems, a vulnerability factor, affected over 75% of households
- Several factors may contribute to overall vulnerability of households (**Table 2**).

Table 1: Prevalence of respiratory health outcomes at household and individual level

Health outcome	Prevalence (%) of affected households n=377	Total no. of individuals affected
Asthma	6,2	32
Chronic asthma	1,9	8
Pneumonia	1,9	7
Serious respiratory outcome*	8,5	-

*Serious respiratory outcome: at least one of asthma, chronic asthma or pneumonia was present in household.

Table 2: Potentially important vulnerability factors

Factor	% households
Pest problems (rats)	77
Pesticides use	73
Indoor smoking	45
Poor building material (corrugated iron)	63

Vulnerability survey results: Multivariate analysis

- To determine risk factors that could be significantly associated with health outcomes. Potentially important variables include:
 - Gender distribution in the household
 - Method of making a fire
 - Presence of existing diseases
 - Presence of proteins in diet.
- Identified variables will be included in a revised questionnaire that will be used to guide the vulnerability interventions approach.

Vulnerability interventions approach

Following on from the vulnerability assessment survey, a vulnerability interventions approach is being developed to inform decision-making by local government and important stakeholders:

- Combined data from the household survey with other existing research
- Collated data on potential vulnerability intervention methods (see **Table 3**)
- Started initiatives to optimise interaction between different sectors, i.e. local government, industry and the community to ensure long-term sustainability of applied methods.

Table 3: Examples of vulnerability interventions

Factor	Technology examples*	Intervention Benefit
Residence	Thermal insulation, e.g. Trombe wall, waterproofing technologies	Exposure
Solid waste	Techniques to do composting, re-use waste, recycling	Exposure, Economic
Sanitation	Different types of toilets appropriate for different conditions	Exposure, Coping, Economic
Hygiene behaviours	Handwashing dispenser	Exposure
Nutrition	Vegetable/Community gardens	Immunity
Energy use	Basa njengo magogo - fire low maintenance light bulbs	Exposure, Economic
Communication channels/ Awareness/ Education	Innovative ways need to be sought. Community buy-in, co-operation with local government. Using healthy municipalities principles. Networking with related organisations	Exposure, Behaviours

*Implementation at different levels, i.e. household/community/municipal level

The results of the initial survey, therefore, informed the refinement of the vulnerability framework (**Figure 1**) through a systems thinking process with the purpose of developing an interventions approach as shown in **Figure 2**.

For an intervention approach to be effective, it needs to be "imbedded within the local decision-making system"⁴.

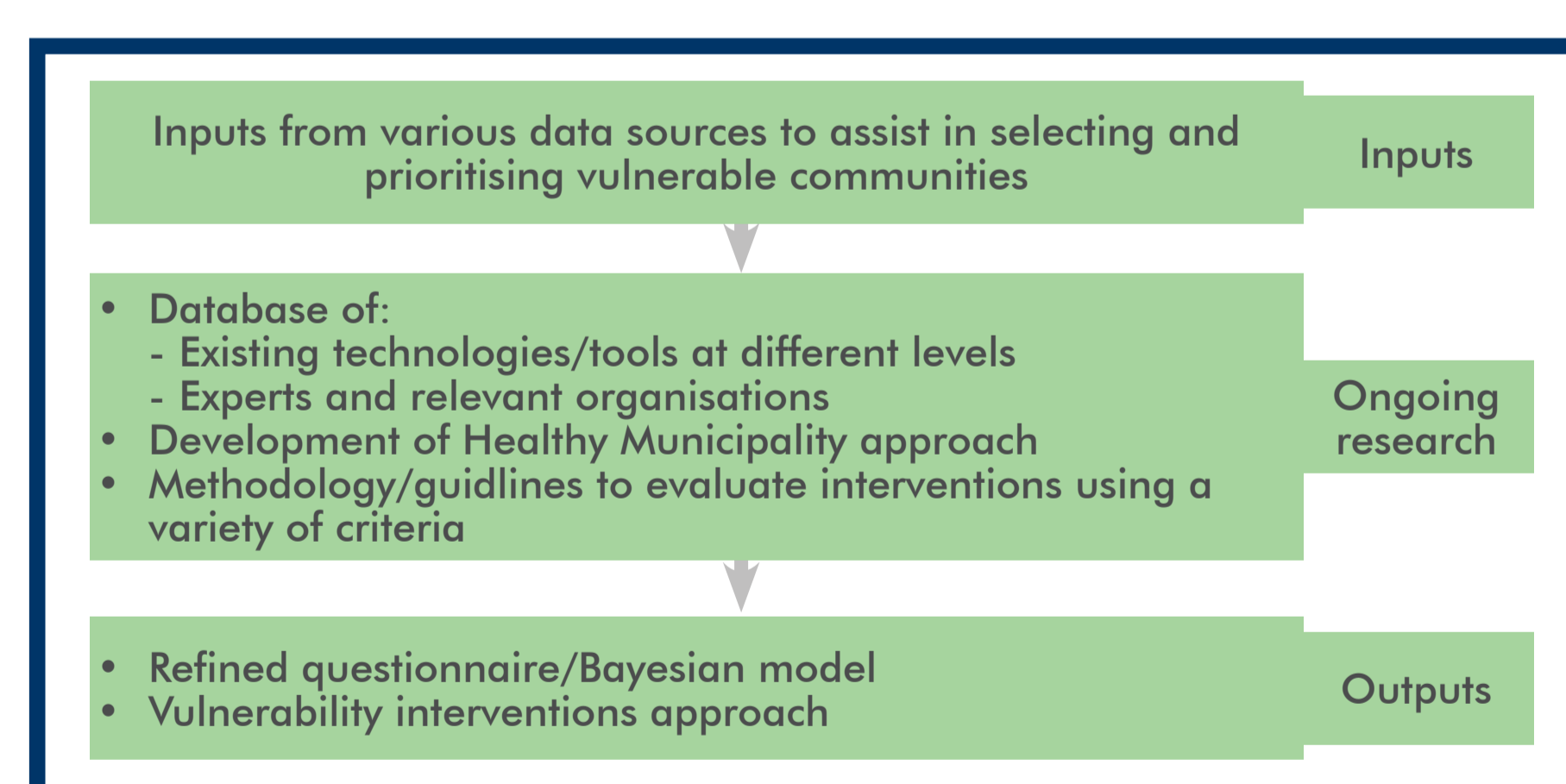


Figure 2: Vulnerability interventions approach

Successful implementation of technological interventions requires:

- Wide support network that involves all interested and affected parties
- Social acceptability, innovation and cost-effective techniques, e.g. reducing exposure to indoor air pollution by cooking outdoors or removing children from cooking spaces while cooking, improved ventilation, improved stoves, and the adoption of cleaner fuels^{5,6,7}
- Alternatives must be complemented with other interventions to counteract indirect vulnerability factors, such as nutrition, poor education levels, and poor access to health care^{8,9,10}.

TAKING THE RESULTS FORWARD

The ultimate goal of this project is to assist communities by reducing vulnerability to environmental pollution with a focus on existing intervention technologies. This is seen as a long-term project with various stages of implementation. Following preliminary analysis of the eMbalenhle survey data, public meetings, which included important stakeholders, were held to report on survey findings. Community perceptions about their vulnerability status were discussed to assist with identifying areas of concern regarding coping and adaptation, their strengths (or assets) and areas of need. They also identified ways in which they could optimise the usage of existing community assets and facilities towards vulnerability reduction.

Healthy municipality committee

A process is currently underway to establish a committee to work towards a healthy municipality, defined as a 'process that requires strong political conviction and support together with equally strong community determination, participation and action'¹¹. This committee will play an essential role in ensuring effective implementation of acceptable interventions in the community.

Vulnerability factors must be considered

People are exposed to a wide range of environmental pollutants and risks, spatially and temporally. Each individual has different susceptibilities to the observed effects and differ in terms of access to health treatment and care⁴. Vulnerability factors identified in this study will help to focus future research to ensure all of these issues are considered.

Strategic planning and a systematic approach, together with sustained collaboration between government, industry, the local community, as well as the scientific community, are therefore essential for successful implementation of the proposed vulnerability interventions framework.

Overcoming the challenges of air pollution: intervening to improve quality of life.



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ACKNOWLEDGEMENTS

The authors would like to acknowledge the NOVA Institute for conducting the community survey, and various people in the eMbalenhle community for participating and assisting in the study. A special thanks to professor Piet Becker from the Medical Research Council for his assistance with statistical analysis; also to Alta de Waal from the Meraka Institute; and Sonali Das and Renee Koen from CSIR Built Environment for their assistance with statistical analysis.