CL/04

AIR QUALITY - Results

Integration of existing approaches toward (bio)surveillance in relation with indoor and outdoor air quality

Cluster of the research projects: MIC-ATR – PARHEALTH – ANIMO – SHAPES

DURATION OF THE PROJECT
15/12/2009 - 31/01/2012

BUDGET
99.990 €

KEYWORDS
Air quality, outdoor air, indoor air, human biomonitoring, environment and health, children's health, reference values

CONTEXT

The population health is affected by both indoor and outdoor air quality, with probably cumulated exposure and effects. In order to develop appropriate strategies to manage public health effects of indoor and outdoor air quality, different aspects should be considered in an integrated way and with a multidisciplinary approach. Therefore "time activity patterns" and "human biomonitoring" represent effective tools to assess personal exposure, link it to health effects, better understand potential risk factors and therefore integrate health and environment

Indeed human biomonitoring integrates the contribution of different sources of exposure, different routes of exposure or exposure during the whole lifespan. It also takes into consideration the differences between individuals with regards to exposure and uptake. In order to interpret results properly, these should be looked at while considering aspects such as emissions, immission, time activity patterns, exposure and health effects.

OBJECTIVES

The overall aim of the Cluster Air Quality was to integrate existing approaches towards health surveillance in relation with indoor and outdoor air quality, which was strongly supported by national and international strategies. This has been achieved through a multidisciplinary dialogue between scientists and authorities at different levels to on one hand identify existing methods, data, information and (bio)surveillance programs in relation with indoor and outdoor air, time activity patterns, health effects (particularly (cardio)respiratory diseases) and human biomonitoring; highlight strengths, weaknesses, gaps and further perspectives in terms of research needs or actions; and test data comparability for potential further integration; on the other hand initiate an active multidisciplinary network and support transfer of knowledge between disciplines.

RESULTS

Integration of existing projects and study of cohorts

In this cluster the relation between indoor exposure and respiratory health outcome has been investigated in both study cohorts from the ANIMO and the MIC-ATR project. Both projects assessed population exposure and health effects partly by means of a questionnaire. On one hand MIC-ATR focused on the environmental exposure of the patients, on the other hand ANIMO focused on the use of non-invasive biomarkers (exhaled NO (eNO)) for respiratory diseases in healthy children. The use of the same questions related to indoor exposure and health outcome in the framework of the cluster have allowed performing a statistical analysis to identify potential environmental risk factors and highlight the interest of such non analytical tool in a surveillance program. Exhaled NO measurements were also done while visiting MIC-ATR/LPI patients.

Correlation analyses were performed to study the effect of the indoor risk factors on the health outcome biomarkers

In the ANIMO cohort, significant positive correlations were found between rattling and the TCB (total chemical burden) (r=0.179, p=0.03), the sum score for using sprays (r=0.161, p=0.05) and the score for frequency of using sprays (r=0.21, p=0.01). The presence of mould was associated with eczema (r=0.165, p=0.04). For the MIC-ATR cohort (N = 77), cough was significantly associated with the presence of mould (n=72, r=0.237, p=0.04). Heating using a stove (coal/wood/open fire) was associated with wheezing (n=68; r=0.244, p=0.05) and rattling (n=65, r=0.333, p=0.01). Current asthma was associated with indoor burning (r=0.288; p=0.01). Indoor VOC exposure was identified as a risk factor for having allergy (r=0.246, p=0.03).

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The relation between health outcome parameters and indoor risk factors were further analysed in multiple regression models. Fixed confounders (age, gender, parental asthma/allergy and ETS) were included in all models. For the ANIMO cohort, significant positive associations could be demonstrated between rattling and TCB (sum score indoor use of household cleaning products) (Odds ratio 1.17, (95% confidence interval (CI) 1.02-1.35), p=0.02). For the MIC-ATR cohort, after correction for confounding variables no significant associations were found between eNO, bronchitis, cough, wheezing, shortness of breath, asthma ever, doctor diagnosed asthma and indoor parameters with exposure. Significant positive associations could be demonstrated between airway infections and the sum score of flame retardants (Odds ratio 1.43, (95% confidence interval (CI) 1.05-1.95), p=0.02), between rattling and the presence of a stove (Odds ratio 13.4 (95% CI 1.4-128.9), p=0.02), any allergy and VOC (Odds ratio 1.4 (95% CI 1.0-2.04), p=0.05), eczema and the use of pesticides (Odds ratio 1.15 (95% CI 1.0-1.3), p=0.04). Current asthma was negatively associated with moisture (Odds ratio 0.07 (95% CI 0.01-0.34), p=0.001).

Cohort studies to identify risk factors need to be large enough to draw reliable conclusions. Compared to other studies found in the literature investigating the relation of indoor exposure (chemical, biological) on respiratory health outcome the study populations in this cluster project were small. This restricted further potential assessment foreseen in the cluster. Nevertheless, significant associations were found between health outcome and indoor risk factors in both the healthy child cohort and the patient cohort. These results confirmed that children are a vulnerable group. Current findings emphasis the need to monitor health effect related to indoor air quality with regard to vulnerable groups (children, elderly) in changing housing technologies.

SWOT analysis

Information concerning Environment as well as Environment and Health is relatively segmented. Such fragmentation is part of the complexity of the Belgian institutional levels (federal, community, and regional, provincial and local levels) but also of the thematic itself. In order to tackle environmental and health issues in a sustainable way, decision makers have to ensure that policies and actions don't move one issue from one scientific network to the next one. Therefore a holistic view is necessary and efficient communication between scientific networks and all stakeholders needs to be supported. A good understanding of the complex picture is also a good way to achieve a sustainable development and induce long term behavioural change at all levels. The Cluster air quality has contributed to identify the concerned actors but also studies, programs, methods, data and information managed at the different levels. The SWOT analysis of the identified studies and programs has allowed highlighting gaps and opportunities for further researches and policy making.

Transfer of knowledge between scientific networks

The project implementation by the setting of an interdisciplinary dialogue has encouraged communication and collaboration between the scientific networks and identified working teams. Considering how the different "scientific networks" (indoor air quality, outdoor air quality, biomonitoring, time activity pattern and health) could benefit from each other's experience, two ways of integration have been highlighted: through *transfer of knowledge* from one field of expertise to another or through the implementation of a *global approach* which seeks for horizontal or integrative tools allowing further transfer of data and information.

Within those 2 potential processes of cooperation, a few priority themes of work have been identified. For the *transfer of knowledge*, the definition of "reference" values (threshold, guideline or target values) and their role, the development of sampling and recruitment strategies and the elaboration of communication processes addressing different target publics (participants, policy makers, large public,…) and precising which communication channels and tools have been efficient have been highlighted. With regards to the implementation of a *global approach,* integrative tools such questionnaires (content, format, process …), Geographic Information Systems (GIS), Time Activity Patterns and health analyses have been pinpointed.

As an example, the cluster focused on the different strategies developed to define "reference" values. Setting "reference" values aims to protect the population from adverse health effects resulting from environmental exposure through the suppression or at least the reduction of the level of pollution brought by the different potential sources of exposure and different pathways. It supports the decision making process in terms of policy making and risk management. It also has as objectives to assess population exposure or exposure of individuals and facilitate the communication addressing different targeted stakeholders.

Among the strategies developed to define “reference” values, the cluster identified: health based, statistically based, health observed based and mixed strategies. If the aim is to protect the population, the vulnerable ones are not necessarily protected by those “reference” values and adverse effects may appear at levels below or equal to defined, even health based, values. Besides, guidelines usually define values for substances considered individually (sometimes in a specific setting). Therefore they don’t take into account potential effects resulting from exposure to multiple chemicals (cocktail effect).

CONCLUSIONS

Top-down and bottom-up communication between stakeholders is a good way to translate findings into efficient strategies and actions aiming to reduce environmental exposure and improve public health and the related health costs. However information concerning Environment as well as Environment and Health is relatively segmented. Therefore a holistic view and a good understanding of the complex picture guaranteeing sustainable measures are necessary and efficient communication between all stakeholders needs to be supported. In order to better identify strategies and actions towards sustainable development for the next generations, the SWOT analysis of the existing data sets could eventually be completed by a PESTLE analysis assessing Political, Economical, Social (which includes public health), Technological, Legal and Environmental analysis of existing and emerging issues.

CONTRIBUTION OF THE PROJECT IN A CONTEXT OF SCIENTIFIC SUPPORT TO A SUSTAINABLE DEVELOPMENT POLICY

The SWOT analysis conducted in the framework of the Cluster Air Quality and identifying Strengths, Weaknesses, Opportunities and Threats of the existing data sets and tools developed in environment and health, as well as the integration exercise between projects contributed to a better understanding of whether collected data in the framework of different programs could be integrated in a more global approach. It also allowed highlighting needs for research or policy making and actions (for example, in terms of harmonisation between the monitoring programmes, etc.). By identifying concerned actors and supporting communication between the scientific networks, the cluster has contributed to build bridges between these networks which is a first important step to manage unavoidably interconnected issues that need to be tackled together to ensure a sustainable development.

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