Relevance of exposome research for policy

No. 2022/02e, The Hague, 9 February 2022

Executive summary

Health Council of the Netherlands

Exposome research: the potential of an integrated approach

The Committee for Identification of Environmental and Health Issues, part of the Health Council of the Netherlands, is tasked with bringing relevant developments in the field of health and the living environment to the attention of the government and parliament. It has identified that a relatively new field of research, exposome research, can be of added value for policy, but that alignment between research and policy is currently limited and needs to be reinforced. The committee has therefore performed an analysis to determine the added value offered by exposome research and how this type of research can be used more effectively for living environment and health policy.

The exposome is a scientific concept that refers to all environmental factors to which humans are exposed throughout their lives. Traditionally, health research has focused on understanding the effects of a single factor of the living environment on a specific disease. The reality, however, is more complex. Exposome research reflects the reality in which humans are constantly and simultaneously exposed to a number of factors from the environment and respond to these factors. This means that the exposome is a wide-ranging concept. It is about physical environmental factors (such as air pollution, medicines and green spaces in the living environment), social environmental factors (such as level of education and family composition), behaviour (such as dietary habits and physical activity) and substances that are formed in the body itself (for example, as a result of metabolism, ageing or immune responses). The aim of exposome research is to provide a comprehensive picture of all these environmental factors.

Relevance for policy

Research into environmental factors is important because the burden of disease in humans is explained to a large extent by environmental factors. Moreover, unlike genetic predisposition, environmental factors can be adapted, which provides a basis for preventive and health-promoting strategies. According to the committee, the exposome approach provides opportunities to develop preventive strategies that are potentially more effective than traditional approaches, because it sheds light on the accumulation of, and interactions between, various environmental factors. As a result, the exposome approach could better explain health differences between population groups. Exposome research also has the potential to detect the emergence of new risks, for example resulting from the introduction of certain innovations.

Exposome research in practice

Methods and techniques

In order to gather information about the exposome, measurements are performed in both the external environment and the body (for example, in blood, urine or bodily tissue). A technique that is often used to measure a whole range of substances at the same time is

'suspect and non-targeted screening', which can also include unknown substances. Environmental factors are measured via sensors and mobile phone apps that allow the collection of more detailed information (on matters like physical activity or ambient temperature) as compared to traditional methods such as questionnaires, sampling devices or measurements at fixed locations. In adjacent fields of research, new statistical methods are being developed for the simultaneous analysis of many factors.

Ongoing research

The first exposome studies commenced in the United States in 2010. The European Union set up a number of research projects in 2013, followed by greater investment in nine research projects in 2020. Within these projects, much work is still being done on standardising methods and techniques, merging data from various data sources and developing data analysis techniques. The emphasis seems to be mainly on the influence of physical environmental factors and less on the influence of the social environment, dietary intake and behaviour. Collaboration between science and policy in relation to the exposome has been limited to date.

Recommendations for the translation from science to policy

The committee agrees that exposome research can have added value for living environment and health policy. However, it is also clear that this field of research faces considerable challenges. The policy domains of health promotion and regulation of environmental factors operate largely independently of each other. Within the domain of health promotion, there is regular cooperation between different policy areas. However, legislation to prevent harmful effects caused by environmental factors is still strongly focused on the regulation of individual factors. The committee is making a number of recommendations with the aim of making better use of the integrated approach from exposome research for the purpose of policy and legislation. The research field is still young and in the development stage, but the committee believes that implementing these recommendations should start before exposome research has produced more results.

Connection to policy

For policymakers, comprehensive information on exposure may raise questions about policy responsibility. After all, there are multiple environmental factors that can cause physical or psychological symptoms (such as lack of exercise, unhealthy diet, air pollution and limited social contact). In order to use information from exposome research for policy purposes, concerted cooperation is needed between the different policy domains. The committee recommends the use of exposome research to further develop integrated living environment and health policy. To this end, the research can be linked to existing interdepartmental and other structures that seek to achieve an integrated approach to health and quality of the

environment. Examples at national level include the ‘Healthy green living environment’ programme and the ‘Impact on health’ steering committee. At local level, the research can be used to help shape the environmental strategy.

Adopt precautionary policy

Exposome research will be able to detect new exposures or establish new links between exposures and adverse health effects. When it comes to new exposures or new combinations of exposures, there will be a degree of uncertainty (Have the measurements been carried out properly? Have they been interpreted correctly? Could this be a chance finding?). Such uncertainty can cause reluctance to take measures. The committee advises national government policymakers to adopt proportional precautionary policy in good time in the event of uncertainty regarding the exact nature and scale of warning signs from exposome research.

The committee recommends that techniques that are also used in exposome research (such as suspect and non-targeted screening) be adopted when setting up monitoring programmes (human biomonitoring and environmental monitoring) to enable the faster identification of new undesirable exposure.

Develop additional criteria for weighting research results

Where the current guidelines are used to assess risks due to exposure to environmental factors, results obtained through exposome research may be passed by. The current guidelines were developed for the assessment of a single environmental factor, whereas exposome research concerns combinations of substances and other factors, as well as their interactions. Moreover, when weighting evidence of causality (in order to demonstrate a causal relationship), the commonly used criteria can be insufficient to apply to exposome research. The committee advises scientists within academic and regulatory bodies at European and international level to develop criteria that define the position of exposome research in this weighting of evidence of causality. These criteria should be generally applicable to all domains. There is also a need for criteria that define how exposome research results fit within protocols for risk assessment of chemical substances. This could tie in with developments in risk assessment (such as New Approach Methodologies).

Encourage interdisciplinarity in research and policy application

The committee recommends further expansion of the research field through the inclusion of all domains relevant to the exposome. More attention is needed here for the social domain, diet and behaviour. Data analysis and interpretation of the results of large-scale exposome studies requires more than the usual analysis techniques in epidemiology. The committee therefore recommends the use of knowledge from adjacent disciplines, such as artificial intelligence. In addition, when working towards policy applications of exposome research, it recommends involving expertise in areas such as risk govern-

ance, innovation science, philosophy of science, sociology, ethics and law.

In the development of new research techniques in exposome research, the committee also recommends that work processes be standardised and relevance and reliability criteria be laid down in order to limit uncertainty, improve alignment to criteria for the weighting of results and strengthen the applicability of results to legislation and policy.

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Preferred citation:
Health Council of the Netherlands. Relevance of exposome research for policy.
The Hague: Health Council of the Netherlands, 2022; publication no. 2022/02e.