STATE-OF-THE-ART REVIEW

A Review of Medication Use as an Indicator of Human Health Impact in Environmentally Stressed Areas

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Abstract

We reviewed from literature the feasibility of medication use as an indicator of health outcomes in environmentally stressed areas, especially where a paucity of typical epidemiological and other risk-based data are encountered. The majority of studies reported were about medication use as an indicator of adverse respiratory effects from air pollution in developed countries. Studies to a lesser extent pointed to medication use as indicator of health outcomes associated with other environmental health stressors such as water, noise pollution, and habitat conditions. The relationship between environmental stressors and medication use strongly suggests that medication use could be used to measure the impact of environmental stressors that otherwise could not be measured by epidemiological or other impact assessment studies, typically in settings where morbidity and mortality data might not be not accessible.

KEY WORDS adverse health outcomes, environmental health indicators, environmentally stressed areas, environmental stressors, medication use

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INTRODUCTION

The environment plays a significant role in shaping the health of a person and can cause significant burden of disease. The World Health Organization estimated that 24% of global disease burden and 23% of all deaths are caused by environmental stressors.[1] It is therefore important to know the key drivers of environmentally attributed disease to inform policy on reducing environmental risk factors to health.[2]

Environmentally stressed areas are geographical areas under any severe ecological influence or change[3] that causes an apparent and dramatic change in the biophysical (natural) environment. In the context of this review, this means environmental change directly or indirectly driven by natural phenomena or human activities—to the extent that environmental stressors result from this change and cause health effects in humans.[1]

Environmental stressors can be specific, such as traffic- and industry-related air pollution and noise,[4] outdoor smoke from vegetation fires,[5] indoor smoke from solid fuel combustion,[6] and naturally occurring chemical compounds (eg, arsenic and lead) found in contaminated drinking water, food, and soil.[7,8] These stressors can also be described in nonspecific terms, such as those often more broadly associated with environmental settings within urban environments,[9] or changes caused by resource development activities (eg, mining and natural gas extraction).[10]

Health effects commonly associated with living in environmentally stressed areas are often reported and, depending on the stressor, include effects on respiration (asthma), the central nervous system (headache, depression, and anxiety), and the gastrointestinal system (gastric reflux, stomach cramps, and diarrhea).[11,12] Epidemiological studies have found associations between a wide array of environmental stressors and specific health effects. For instance, long-term exposure to traffic-related particulate matter is associated with heart rate variability[13] and increased blood pressure.[14]

We can manage adverse health effects by prevention and or reduction of environmental stressors through suitable interventions and policies,[8] but this requires reliable information. Epidemiological as well as predictive environmental health risk and impact studies use indicators of morbidity and mortality that rely on data drawn from primary sources—a clear example being hospital admissions. These indicators are therefore more likely to reflect only the most critical cases leading to hospital admissions or deaths[15] and are often limited by a paucity of available or accessible data.[16] Hospital admission data would, for instance, exclude those who did not require hospitalization but who received other medical treatment from medical practitioners—usually including prescribed medications.[15] It would likely also exclude those who did not seek or require a medical treatment but "self-treated" using over-the-counter medications.

We argue that medication use is a source of data that can be used to indicate underlying health effects of environmental stressors. It could detect affected people who were issued prescription medication after receiving medical care from either a hospital or general medical practice and could detect those using over-the-counter medications. The types of medication dispensed could indicate specific health effects in a population, including those whose health might be affected by environmental stressors in particular geographical areas.

The aim of this review was to explore whether medication use (in the absence or paucity of other relevant health data) could be a feasible indicator of adverse environmental health stressors.

REVIEW STRATEGY

We conducted a narrative review of science and gray literature following a similar structure to Morrell et al.[17] We searched PubMed and Scopus databases for studies of medication use related to environmental health impact published between January 1993 and August 2013. The literature included science papers as well as gray literature such as reports in news media, conference papers, editorials, government publications, and lectures. Typical search terms were "medication use," "medication sales," "environmental hazard," "urban environment," "pollution," "chemical," "water," "air," and "noise."

The initial titles and abstracts of the retrieved reports (791) were scrutinized and allocated a relevance rank. This ranking—based on our own classification—refers to their relevance in terms of the aim of this review as well as the strength of evidence presented in the particular report. The 4 relevance categories were as follows:

Highly relevant reports had a very specific focus on medication use data in the absence of other health data of a population. The population in question was exposed to clearly definable environmental stressors or lived in specific environmentally stressed areas. The evidence we looked for in the report was whether a change in medication use reflected any health effect caused by the environmental stressors in the study population.

Relevant reports considered medication use but did not have it as a primary data source or specific focus and were more general in nature—that is, using broader sources of data about medication use as well as health outcome to explore adverse environment and health impact on populations. These reports were nevertheless relevant to this review because they contained information on medication use as part of outcome indicators such as symptoms, clinical diagnosis, and hospital admissions.

Low relevance reports referred, in some way, to medication use but did not report on whether environmental heath impact could be deduced from the medication use. For instance, some studies in this category collected medication use details to (i) adjust for potential confounders of health outcome attributed to medication use; (ii) alluded to a failure of medication adherence among population affected by potential environmental stressors; or (iii) recorded general and daily medication use without any further analysis of the data. The reports were included because they offered insight into how medication use could be used to indicate environmental stress in a population

Irrelevant reports were excluded from the review when they did not meet the requirements of the review aim. These included investigations about outcomes of medication use on the health of environment and people. For instance, the impact of medical waste on the environment, antibiotic drug resistance, and where medication would lead to increased but unrelated incidents (eg, falls among the elderly). Other examples were papers that (i) focused on nonenvironmental stressors (eg, persons living