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The allure, and challenges, of complexity in epidemiological modelling of alcohol harm: Commentary on Rehm

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In his article, Rehm sets out the case for combining cause-specific studies when seeking to estimate the risks of mortality associated with different levels of alcohol consumption, rather than using studies where all-cause mortality is the endpoint (1). His primary argument is that individuals included in all-cause mortality studies are not demographically representative of the wider population and the proportion of deaths which are from alcohol-related health conditions will therefore also be somewhat unrepresentative. It is hard to disagree with this point and it can be extended to limit the validity of all-cause mortality studies to populations other than those from which the underlying data are drawn. More broadly, all-cause mortality studies embed not only the demographic characteristics of the included population, but also their patterns of alcohol consumption, such as levels of heavy episodic drinking, which are known to be related to mortality risks (2). Epidemiological studies do not usually capture drinking patterns and systematic differences in such patterns between study and general populations may further bias the results of all-cause studies.

Rehm's recommendation is that we should combine condition-specific estimates of alcohol-related risks. This approach addresses some of the limitations of all-cause studies and is used in several influential public health tools, including the Global Burden of Disease (GBD) study (3) and our own Sheffield Alcohol Policy Model (SAPM) (4). In particular, weighting the influence of each condition by its prevalence in the population of interest (e.g. a country), tailors the resulting risk curve to the real health risks faced by drinkers in a specific time and place.

Determining the weights to assign to each health condition is far from a trivial exercise. The GBD study referred to by Rehm used the aggregate prevalence of mortality from each health condition across the globe (3). There are two problems with this approach: the first is that, as Rehm notes, the 'correct' weights would be based on mortality rates in non-drinkers only. The GBD approach thus gives unduly high weight to health conditions for which alcohol is responsible for a substantial proportion of deaths, such as liver disease, while the 'correct' weights can only be determined through complex modelling processes. The second is that the resulting risk curve represents the average risk across all included populations modelled (e.g. countries) rather than the actual risks faced by an individual in a particular population. A further limitation is that conditions that are wholly-attributable to alcohol, such as alcohol poisoning, are excluded from the cause-specific approach, as non-drinkers have zero risk for such conditions by definition, and therefore their relative risk is undefined. We resolve this issue in SAPM through the use of additional absolute risk curves for wholly-attributable conditions. More complex approaches are also required in order for injuries and other health conditions associated with intoxication, rather than typical consumption, to be included in these calculations.

Finally, as Rehm notes, cause-specific mortality studies are also subject to many of the same biases as all-cause studies. He suggests overcoming this by including cause-specific studies undertaken in populations who are underrepresented in typical studies, such as the homeless or those in institutional accommodation. It is not clear, however, if these studies exist in practice, and precisely how to combine multiple studies in order to address issues of underrepresentation. Whilst Rehm presents a compelling case against all-cause studies, caution is required when moving from a simple

approach with well-understood and recognised limitations to a much more data intensive approach with less clear and, due to the complexity of the method, often less transparent inherent assumptions and limitations. The more complex approach may be preferable in many situations due to its greater specificity to the population of interest, but in situations where data are limited, or high-quality all-cause studies from similar populations are available, the simpler approach may still be appropriate.

References

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