about the implications of their findings. However, as explained here, their work serves to emphasize the results with greatest reliability and, taken in the context of what is already known, helps to clarify the overall risks and benefits of alcohol consumption. For the age group included in the EPIC study (i.e., older adults), accounting for prevalent illness, the risks of death were lowest in men with lifetime patterns of alcohol consumption of >2–24 g/day and consumption at enrolment of 15–20 g/day; corresponding levels for women were >1–12 g/day and around 10 g/day. The evidence indicates that it is advisable to avoid heavy drinking throughout life. If taken as causal, these findings are consistent with most public health advice about alcohol, except that most advice recommends an upper limit to alcohol consumption, but does not actually encourage drinking. In fact, the evidence goes further than this and indicates that, in later life, on average and bearing in mind the priorities and risks of specific individuals, drinking at least some alcohol, but not too much, is likely to minimize the overall risk of death.

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References
what we admire most is that the authors were prepared to stand back and say, in effect, their analyses may tell us as much about systematic bias operating in large cohort studies as about the relationship between alcohol use and cause of death.

The key results reported in Figures 3 and 4 appear to show reduced risk of death from heart disease at all levels of consumption, in contrast to J-shape risk curves for most other causes of death. So is this confirmation that alcohol consumption is good for health? It’s worth quoting the authors’ conclusion on this point for emphasis: ‘The apparent health benefit of low to moderate alcohol use found in observational studies could therefore in large part be due to various selection biases and competing risks’.

Highlights of the thinking underlying this conclusion run something like this:

(i) Cohort studies that recruit healthy individuals across the adult lifespan (here mainly between 25 and 70 years of age) in effect are selecting survivors who were well enough to participate, a bias that increases with age.

(ii) Selection biases begin to operate during the teenage and young adult years because those who elect to be total abstainers also tend to have lower income and poorer health. This means that from the outset all drinkers are biased towards looking good compared with people in the abstainer comparison group.

(iii) The practice, now widely adopted, of removing former drinkers from the abstainer reference group reduces one form of bias because, as confirmed here, they have tend to have poor health profiles even if they had previously been only light drinkers. However, removing them from all the other drinking categories still creates bias by systematically weeding out less healthy drinkers.

(iv) The practice of removing from analysis individuals who had compromised health at baseline only adds to the effectiveness of the above selection biases. Indeed, significant protection of drinking against coronary heart disease was found in this study only after performing this incision.

(v) The mean age of death from coronary heart disease tends to be several years later than from cancer and many years after deaths from acute causes. As the authors note, the appearance of protection against heart disease in this study may be caused by drinkers being more likely to die of other causes before heart disease gets them. This would especially be the case for heavier drinkers.

Echoing the conclusions of Fillmore et al., Bergmann et al. speculate that moderate drinking may be a sign of good health than a cause of it. In line with this scepticism, it’s interesting to note that, again in Figures 3 and 4, J-shape risk curves are apparent for a range of causes of death including those for which plausible a priori physiological mechanisms for protection from light to moderate drinking are not only lacking but highly implausible e.g. injury, cancer and respiratory disease. The existence of multiple studies claiming or apparently indicating health benefits of moderate consumption in connection with a range of conditions for which a causal explanation would best be described as surprising have been recently highlighted by Fekjaer. This review identified studies showing apparent protection against deafness, hip fractures, the common cold, various cancers and liver cirrhosis, to name but a few.

Another significant challenge to the alco-protective hypothesis comes from studies that have demonstrated moderate drinkers to be mostly healthier than abstainers. Naimi et al. compared abstainers and moderate drinkers in the USA on the prevalence of 30 different risk factors for heart disease. The abstainers had elevated rates of cardiac risk on 27 of these indices (including obesity) compared with moderate drinkers. It is unfortunately impossible to control adequately for so many potential confounders in longitudinal research.

A relatively recent meta-analysis concerning the relationship between alcohol consumption, coronary heart disease and all-cause mortality identified 84 studies and estimated significant health benefits associated with light to moderate drinking. Reanalysis of these 84 studies indicated that, when duplicates and studies with serious design flaws were eliminated, only two remained and they had mixed findings. The present study would constitute a third. It is of course important to acknowledge that there are well-designed laboratory studies which support the idea that low doses of alcohol may have some benefits for the circulatory system. However, high doses of alcohol can also be damaging to heart health, for example by increasing blood pressure.

The important question, therefore, is how in practice do these theoretical health benefits translate at the population level? Further, why do studies such as this one indicate alcohol is protective against heart disease regardless of consumption level? The authors’ speculation and the analysis above suggest this is due to the operation of systematic biases in uncontrolled observational studies.

What can future researchers do to try and minimize the effects of these types of bias in longitudinal studies concerning alcohol and health? Bergmann et al. have already taken some important steps such as removing former drinkers from the lifetime abstainer group and, unusually, also presenting results separately for individuals who previously drank at a low versus higher levels. Even former low-level drinkers had elevated risks of death for most outcomes compared with lifetime abstainers. Liang and Chikritzhs have argued that an ‘intention to treat’ approach
should be used so that former drinkers are classified with current drinkers to reduce systematic bias. Bergmann et al.’s\textsuperscript{1} use of a reference group of occasional drinkers also partly avoids problems with former drinker bias. Unlike lifetime abstainers, occasional drinkers should not be biased towards poorer health\textsuperscript{2} and nor will they be drinking enough to receive any theoretical health benefits (e.g. drinking less than one drink per week). However, beyond these considerations, much further thought needs to be given to the problem of systematic bias in longitudinal research due to, for example, the inclusion or exclusion of former drinkers, occasional drinkers and individuals in poor health at baseline.

Until such time as these issues are resolved ‘a healthy dose of scepticism’\textsuperscript{12} is warranted for the hypothesis that light/moderate alcohol consumption is beneficial to health.

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