



Review

The temporal relationship between per capita alcohol consumption and harm: A systematic review of time lag specifications in aggregate time series analyses[☆]

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ABSTRACT

Background: Changes in per capita alcohol consumption are temporally linked to changes in rates of alcohol-related harm. Methodological approaches for analysing this relationship have been suggested, however, the problem of time lags is not well-addressed. This study provides a review of time lag specifications, looking at (a) time to first effect on harm, (b) time to full effect and (c) the functional form of the effect accumulation from first to full effect to inform modelling of the relationship between changes in aggregate alcohol consumption and changes in rates of harm.

Methods: Bibliographic databases were searched and citation and reference checking was used to identify studies. Included studies were time series analyses of the relationship between aggregated population alcohol consumption and rates of alcohol-related harms where time lag specifications had been derived or tested.

Results: 36 studies were included with liver cirrhosis, heart disease and suicide dominating the evidence base. For a large number of alcohol-related harms, no literature was identified. There was strong evidence of an immediate first effect following a change in consumption for most harms. Recommended lag specifications are proposed for a set of alcohol-attributable harms.

Conclusions: Research on time lag specifications is under-developed for most harms although we provide suggested specifications based on the findings of the review. Greater methodological attention needs to be given to the rationale for choosing or applying lag specifications and the inherent complexity of the time lag process. More consistent and transparent reporting of methodological decisions would aid progress in the field.

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Contents

1. Introduction	8
2. Methods	8
3. Results	8
3.1. Methodological findings	9
3.2. Liver cirrhosis	10
3.3. Heart disease	10
3.4. Suicide	11
3.5. Other harms	11
3.6. Harms not covered	11
4. Discussion	12
5. Limitations	13
6. Conclusions	13
Role of funding source	13
Contributors	14

[☆] Supplementary material can be found by accessing the online version of this paper at <http://dx.doi.org>. Please see Appendix A.

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Conflict of interest	14
Acknowledgements	14
Appendix A. Supplementary data	14
References	14

1. Introduction

Average levels of alcohol consumption in the population are widely recognised as a relevant public health indicator. Such aggregate levels of consumption have been associated with the incidence and prevalence of a range of alcohol-related harms including morbidity and mortality from various health conditions and also rates of crime, unemployment and workplace absences (Purshouse et al., 2009). These associations can be seen in cross-sectional studies; however, stronger evidence comes from time series analyses showing that changes in per capita alcohol consumption are temporally linked to changes in rates of alcohol-related harms. Although methodological approaches for such analyses have been suggested (Norström and Skog, 2001; Rehm and Gmel, 2001) debates on aspects of applying these continue. One such aspect is the time lag problem.

Given that much alcohol-related harm is the accumulated result of years of harmful individual drinking behaviours, the full effect of changes in consumption may not be immediately apparent in harm data. Instead, the effect of changes in aggregate consumption may be delayed and distributed over a number of years. In response to this problem, it is commonplace to incorporate a lag structure into time series analyses to ensure the full long-term effect is captured.

Studies which have explored time lags in depth have tended to focus on liver cirrhosis and have found that, despite the anticipated long-term effect, much of the impact on cirrhosis mortality rates occurs in the first year following a change in consumption (Kerr et al., 2000; Skog, 1984). This somewhat paradoxical finding of immediate effects at the aggregate level on a harm which develops after many years of heavy drinking at the individual level can be clearly observed in the sharp falls in cirrhosis deaths following alcohol rationing in Paris during World War Two (Norström, 1987).

The notion of critical thresholds has typically been used to explain this paradox (Norström, 1987, 1989; Skog, 1980). It is postulated that, at any given time, there are a group of people with advanced liver cirrhosis for whom a change in alcohol consumption could prompt or prevent liver failure. It is changes in the mortality rate within this group that are often used to explain the rapid effects of changes in aggregate alcohol consumption (Norström and Skog, 2001). Simultaneous changes in alcohol consumption amongst those who are not at this critical threshold also need to be accounted for and Skog (1984) and Norström (1987) have obtained consistent results modelling lag structures specifying both short- and long-term effects for the UK and Sweden respectively. However, other work has suggested time series models accounting only for a short-term effect adequately fit the data (Kerr et al., 2000; Roizen et al., 1999).

The primary concern of this paper is to provide the first systematic review of aggregate time series lag structures which have been applied to different alcohol-related harms with a focus on three pieces of information: the time to first effect, the duration to full effect and the functional form of the accumulation of effect. Referred to hereafter as the lag specifications, these pieces of information are illustrated in Fig. 1.

2. Methods

The search was conducted across the following databases between December 2010 and February 2011: ASSIA, Campbell Collaboration, CINAHL, Econlit, IBSS,

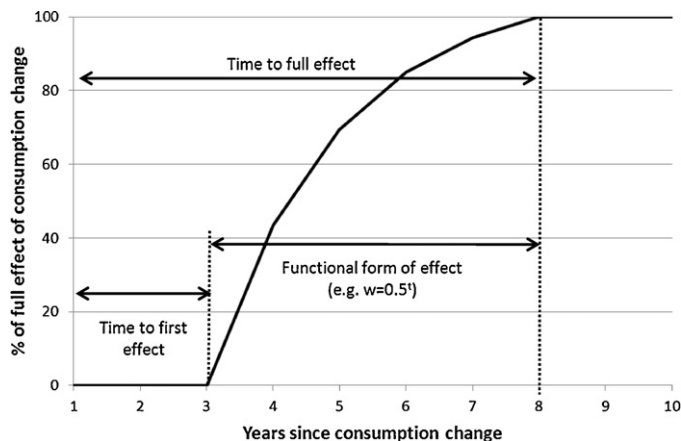


Fig. 1. Time lag specifications for the effect of consumption change on harm.

Embase, Medline, PsychINFO, Scopus, Social Care Online, Sociological Abstracts, Web of Knowledge and World Political Science Abstracts.

The full search terms can be seen in the [online supplementary material](#). The search was conducted in three stages using a set of alcohol terms combined in turn with three sets of terms relating to lags. These three sets were progressively less precise to account for the anticipated diffuseness of the literature with lags typically not mentioned in abstracts. A search of the first twenty pages of Google Scholar results using the same search terms and reference and citation checking of all relevant studies were used to identify further studies.

Search results were first assessed by title and then abstract. This process was initially undertaken independently on small samples of papers by two researchers with high rates of agreement obtained. Studies not rejected at this stage were obtained and read in greater depth to assess relevance.

Inclusion criteria were that studies should (1) be aggregate level time series analyses with sufficient data points to assess lag specifications; (2) examine effects of changes in alcohol consumption on rates of alcohol-attributable health, crime or employment harms; (3) conduct analyses of at least one of the three lag specifications of interest. The main exclusion criteria were that (1) studies should not simply include lag specifications without mentioning any testing of alternative specifications and (2) that lag specifications should be empirically analysed, not simply inferred from inspection of time series graphs or raw data.

Data extraction was undertaken by the lead author. The key data extracted were location of study and time period, modelling approach employed, specific consumption and harm measures used, the lag specifications and the method used for deriving them.

No meta-analysis was attempted as the resulting lag specifications are insufficiently homogenous in structure or varied in duration for this to be meaningful.

3. Results

The results of the literature search are shown in Fig. 2. Of 3342 studies initially identified, 18 were included in the narrative synthesis with a further 18 studies identified through reference and citation checking of those studies. Reporting of the results is structured as follows: a summary of the different methods used to derive lag specifications and their implications are presented first, followed by the lag specifications used for liver cirrhosis, heart disease and suicide in turn. Finally, a brief summary of results for other harms is presented. For each harm section, the results for time to first effect are discussed first followed by the results for the functional form and finally the time to full effect. The full results can be seen in the [online supplementary material](#).

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