

## Perspective

# Retail Sales of Alcohol and the Risk of Being a Victim of Assault

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The relationship between alcohol sales, alcohol consumption patterns, and levels of violence is well established. In a meta-analysis of data from seven countries, Jason Bond and colleagues estimated that the fraction of violence-related injuries attributable to alcohol is between 28% and 43% [1]. There is a stronger link between alcohol impairment and being a victim of violence than between alcohol impairment and suffering from accidental injuries [2].

## Previous Studies on Alcohol Sales, Consumption Patterns, and Violence

Factors that have been shown to be important in the link between alcohol sales and violence include the volume of alcohol consumed and its pattern of consumption [3], cultural characteristics [4], social context [5], and income inequality [6]. Alongside socioeconomic and sociodemographic variables [7,8], alcohol outlet density (i.e., the number of alcohol retail outlets per unit population) has previously been found to influence levels of violence. In a spatial analysis looking at the relationship between alcohol outlet density and assaults, Michael Livingston found a positive and non-linear relationship, with an accelerating increase in violence beyond a threshold density of outlets [9].

A range of studies have examined the role of alcohol in violent incidents, beyond a simplified notion of consumption levels alone acting as a modifier. A synthesis of evidence on the relationship between alcohol and violence found that no firm conclusion could be drawn on the exact causal relationship between alcohol consumption and violent behaviour

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## Linked Research Article

This Perspective discusses the following new study published in *PLoS Medicine*:

Ray JG, Moineddin R, Bell CM, Thiruchelvam D, Creatore MI, et al. (2008) Alcohol sales and risk of serious assault. *PLoS Med* 5(5): e104. doi:10.1371/journal.pmed.0050104

In a population-based case-crossover analysis, Joel Ray and colleagues find that the risk of being a victim of serious assault increases with retail alcohol sales, especially among young urban men.

[10]. A telephone survey of 1,001 adults to assess alcohol-related aggression in the general population suggested that such aggression is associated with alcohol intoxication, rather than simply alcohol consumption [3]. Differences in drinking culture have an effect on the relationship between alcohol sales and levels of violence [4].

A previous study by Ulrika Haggård-Grann and colleagues used a case-crossover method to investigate the effects of alcohol and other drugs on triggering violence [11]. Their study focused on the risk of violence among the perpetrators [11]. Now, in a new study in this issue of *PLoS Medicine*, Joel Ray and colleagues use the same type of case-crossover design to establish the relative risk of assault per volume of alcohol sales from retail outlets in Ontario [12]. This new study focuses specifically on adult victims of assault.

## The Impact of Alcohol Sales on Risk of Assault

Ray and colleagues sought to add to the existing evidence on the link between alcohol sales and risk of assault. Survey data have been the preferred source of many previous studies, and the authors state that such methods tend to lack adequate controls. For this reason the authors used computerised medical records and accurate sales data from Ontario, Canada. Using an empirical

case-crossover method seldom used in studying alcohol and violence, the authors aimed to elucidate further the link between alcohol sales and risk of being a victim of assault.

The authors chose a case-crossover design as a way to address a number of concerns regarding potential bias in previous studies. The case-crossover method is used to address the high likelihood of between-person confounding in previous empirical work, where uncontrolled differences among individuals can affect results. Epidemiologists have long favoured such a study design, whereby a case's exposure prior to or during the event in question is compared with that case's exposure at other times [13]. This essentially allows a case to act as his or her own control. In Ray and colleagues' study, the exposure period was the day before an assault case's hospitalisation and the control period was seven days earlier. The volume of alcohol sold at the store in closest proximity to an assault victim's home on the day before the assault was compared to the volume of alcohol sold at the same store seven days earlier.

The authors found that increasing alcohol sales were associated with a 13% (95% confidence interval

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**Abbreviations:** CI, confidence interval

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[CI] 2–26) higher relative risk of hospitalisation for assault, for every 1,000 litres more alcohol sold per store per day. A 1,000 litre rise in alcohol sold per day equates to an approximate doubling in the level of usual daily sales. The relative risk was highest for spirits and lowest for beer. While a 1,000 litre rise in the daily sales of all alcohol proved significant for the relative risk of males being hospitalised (relative risk 1.18, 95% CI 1.05–1.33), this was not found for females (relative risk 0.89, 95% CI 0.68–1.18).

### Methodological Issues in the New Study

On first reading Ray and colleagues' paper, a number of questions come to mind, such as, is there any evidence that the incidents studied were indeed alcohol-related? Was any information collected on the victims' drinking behaviour, either at the time of the assault, or one week earlier (the control period)? Can the researchers be sure that alcohol was drunk within a few hours of purchase? Did the assault take place close to the victim's home (the latter being the basis for identifying the closest liquor outlet)?

The paper provides no clear answer to these questions, which may initially appear to be a weakness in a study linking assaults with alcohol sales. Yet paradoxically, the lack of clear answers can in fact *increase* our confidence in the conclusions. Answering "no" to any of the questions above would tend to mitigate any relationship between sales and assaults, making it less likely that a study would find such a relationship. The fact that Ray and colleagues did indeed find a link between alcohol sales and risk of assault, in spite of all of this lack of information, should lend considerable weight to their conclusion that the risk of being a victim of serious assault increases with alcohol sales.

A crucial challenge when using the case-crossover method lies in choosing an appropriate control. Ray and colleagues selected alcohol sales at the same store, one week earlier. This controls for the effects of day of the week, seasonality, and longer-term trends, but there are day-to-day fluctuations that will be missed by this control and that may account for the results. Specifically, events lasting less than a week, such as festivals and sporting fixtures, increase both

the volume of alcohol sold and the number of assaults [14]. The increase in violence may be the result of rivalry inherent in sport, or simply the effect of crowding. It would be interesting to see a similar analysis conducted with an additional coding to account for such events.

### Alcohol and Assaults: What Is the Mechanism Explaining the Link?

Whilst the simple empirical finding of an association between alcohol sales and violence is of value in itself, for a deeper understanding it is worthwhile considering possible mechanisms underlying this relationship. For alcohol bought and drunk on licensed premises, drinkers are already in a public place, surrounded by other people, with obvious opportunities for violence. For off-license (liquor store) sales, the focus of Ray and colleagues' study, the course of events is less obvious.

One possibility is that both drinking and assault occurred in the home; i.e., the assaults were instances of domestic violence. Although this possibility was not explicitly identified in the study, sexual assault and maltreatment by a spouse or partner were identified, and may be considered a proxy. The relatively small number of such incidents recorded makes it unlikely that they contribute substantially to the observed relationship, suggesting that most assaults were committed in public places.

Under what circumstances might people buy alcohol from an off-license, drink it, and then be in a public place in the course of a single day? Two scenarios suggest themselves. The first is that the alcohol is drunk in a public place, such as in a park or on the streets. This scenario would be consistent with the observed increase in alcohol sales in the summer months. Street drinking is known to be associated with anti-social behaviour and crime [15].

A second scenario is that people might start an evening drinking at home before going out to continue drinking at a pub or club. This phenomenon, known as "pre-loading", is recognised as an increasing problem [16]. It is driven by a discrepancy in alcohol prices between licensed premises and off-licenses (i.e., prices are higher in licensed premises). A recent study of pre-loading in United

Kingdom pubs found no difference between customers who had pre-loaded and those who had not in the amount drunk on-premises, meaning that those who had also drunk at home consequently drank more in total. Drinkers who pre-load are then more likely to become involved in violence during the night [16].

One might criticise Ray and colleagues for their failure to address the question of whether it is the assailant's drinking or the victim's drinking that underlies the connection between sales and assaults. Their mention of impaired judgement and the use of the victim's home address in locating the relevant liquor store both suggest the latter. However, this suggestion is not explicitly stated by the authors, and the discussion acknowledges that the researchers "do not know who had consumed alcohol—that is, the victim of the assault, the perpetrator, or both". Despite this apparent shortcoming, one can still make the valid interpretation that when a lot of alcohol has been consumed, the danger of being assaulted is greater. This interpretation shifts the focus away from the effect of alcohol on individuals to issues such as crowd behaviour. This approach is supported by the finding that most of the assaults observed in this study were the result of an "unarmed brawl or fight".

### Implications of the Study

This new study illustrates the role that alcohol sales from retail outlets play in affecting the risk of suffering a serious assault. The findings suggest that the relevant officials should consider restricting availability of alcohol from retail stores if they wish to reduce the likelihood of violence in their area of jurisdiction.

The use of a population-based case-crossover analytical method is to be welcomed in this area of research, and it shows that innovative empirical methods have much to offer those engaged in studying alcohol and violence. To continue this line of research, a future study could involve a direct comparison of the method used in this paper with a case-time-control or a time series analysis of similar data. ■

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