



**AMPHORA – Alcohol Public Health Research Alliance**

**Deliverable D2.6 – Report on the impact of managing drinking environments on alcohol-related harm**

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## **Report impact of managing drinking environments on alcohol related harm**

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## 1. Introduction

Drinking environments such as pubs, bars and nightclubs are associated with high levels of alcohol consumption and can be peak locations for alcohol-related harms such as drunkenness, anti-social behaviour, violence and unintentional injury. Research shows that large proportions of alcohol-related problems within a given nightlife area are often concentrated within a small number of drinking premises. For example, a study of violence associated with licensed premises in five English cities found that, in each city, around 40% of licensed premises saw no violence while the 'top 15' premises (5-15% of all premises across the case study areas) accounted for between 42% and 79% of all nightlife violence (Newton and Hirschfield, 2009). This concentration suggests that certain factors in high-risk premises are contributing to increased alcohol-related harm. International research has suggested that a range of factors associated with the physical, social and staffing environment in bars are associated with increased levels of alcohol-related harm. By identifying these factors, strategies have been developed that seek to modify drinking environments to make them less conducive to alcohol-related problems.

The vast majority of research into risk and protective factors for alcohol-related problems in drinking venues has taken place in Australia (e.g. Homel et al, 2004) and North America (e.g. Graham et al, 2006). How relevant these factors are to European settings is largely unknown. The Amphora project aims to develop this knowledge by undertaking a study to examine risk and protective factors for intoxication and alcohol-related problems in four European drinking settings (Liverpool, UK; Palma, Spain; Utrecht, Netherlands; Ljubljana, Slovenia). The first stage in the project involved a systematic literature review to identify existing international research on factors associated with alcohol consumption and alcohol-related harm in bars, pubs and nightclubs. This report presents the methodology for, and findings from, the literature review. Findings have been used to inform the development of the Amphora study.

## 2. Methods

The systematic literature review aimed to identify studies that had examined associations between environmental factors in drinking venues and alcohol-related harm, including.

- Greater quantity or frequency of alcohol consumption
- Customer intoxication
- Service of alcohol to underage or intoxicated customers
- Aggression and violence
- Unintentional injury, including road traffic crashes
- Anti-social behaviour and crime

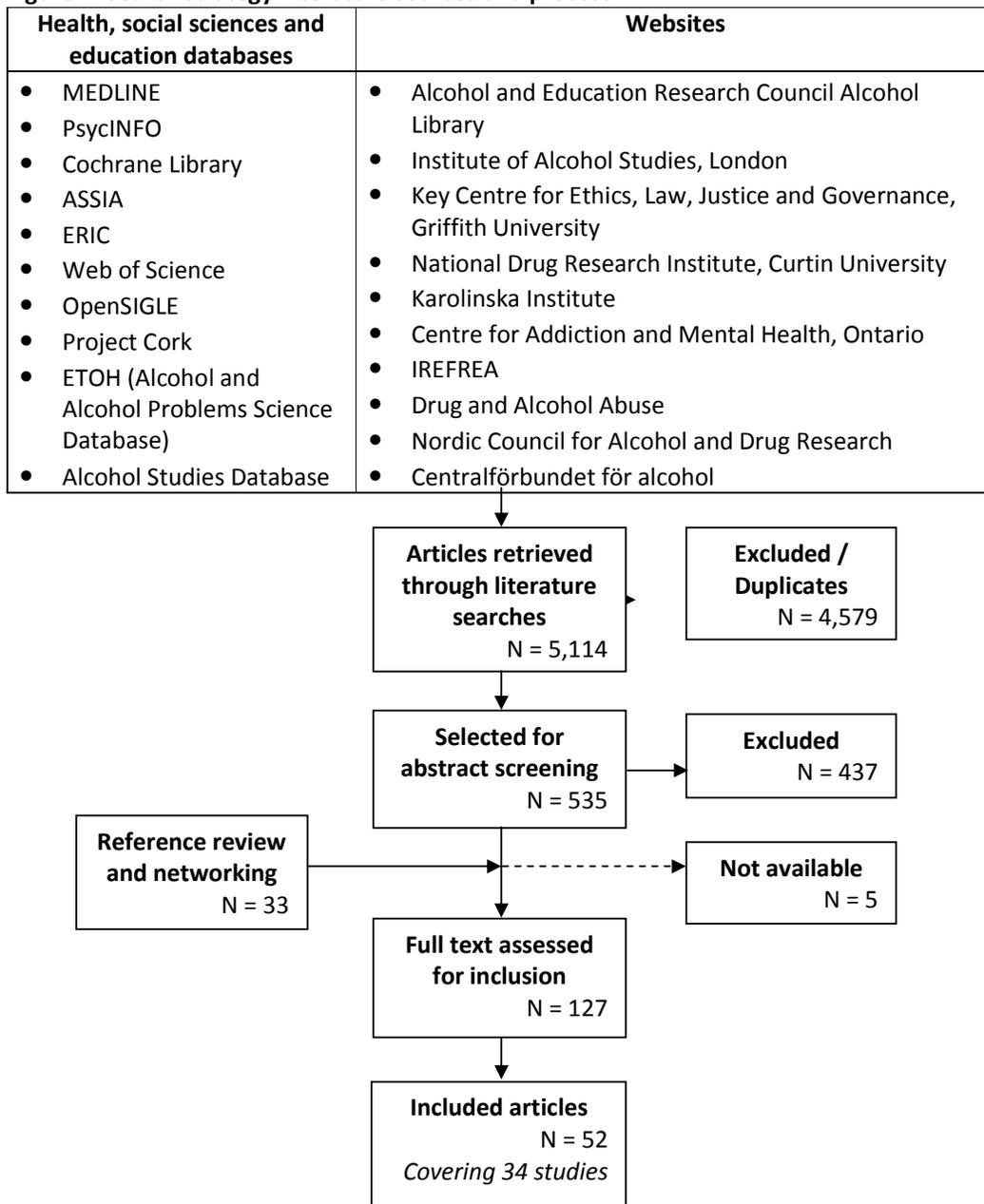
The environmental factors of interest included those associated with the physical environment in bars, the social environment and the practice of management. The review focused on environmental factors that could be identifiable through naturalistic observational research (the method to be used in the Amphora study) and modified locally through environmental interventions. Consequently, factors such as staff length of service and level of training, patron characteristics (e.g. age, ethnicity, individual activities, drinking group composition), and factors dependent on regulation such as hours of alcohol service, were not explored.

The review adopted broad inclusion criteria covering any study type linking environmental factors in drinking premises to higher alcohol use and related-harm. Thus, qualitative studies in which researchers had observed the circumstances surrounding alcohol-related harm were included, even if no statistical analysis had been undertaken, yet any study that solely hypothesised links was excluded. Both academic and grey literature sources were examined.

Ten health, social sciences and education databases, and ten key websites related to alcohol research were searched for studies published since 1990. A comprehensive search strategy was developed (see Appendix 1) using a combination of free text and controlled English language vocabulary terms, and adapted for each database. A total of 5,114 articles were retrieved through the combined searches. A database of retrieved literature was compiled in the Endnote software package. The titles of all articles were reviewed by two researchers independently to identify

those potentially relevant to the review. Following removal of duplicates, 535 articles were identified for abstract review. Abstracts were reviewed independently by two reviewers and 98 articles were selected for full text review. Database and website searches were supplemented by checking the reference lists of retrieved articles and relevant reviews and book chapters, retrieving a further 34 studies. Full text could not be accessed for five articles, leaving a total of 127 articles that were examined for inclusion. Of these, 52 articles were selected for inclusion in the review (see Figure 1; see Appendix 2 for the list of included articles).

**Figure 1: Search strategy: literature sources and process**



### 3. Results

#### 3.1 Study characteristics

The 52 articles covered 34 studies that had been conducted in nine countries: USA=12, Australia=8, UK=5, Canada=3, France=2, Bulgaria=1, Netherlands=1, Spain=1, Sweden=1. Data from the 52 included studies were extracted into tables outlining the characteristics of each study (Table 1) and the environmental measures and outcomes examined (alcohol consumption, Table 2, alcohol-related harm, Table 3).

Two thirds (n=22) of the studies had used observational research techniques, often in combination with other research methods including qualitative interviews, survey data, secondary data analyses (e.g. police recorded crime data), patron breathalyser tests and alcohol purchase attempts using pseudo-drunk actors. Most were naturalistic observations, although some included experimental techniques (e.g. adjusting music volume). Several studies had utilised similar research methods, incorporating tools initially developed by Graham et al. in Canada [e.g. Graham et al, 1980; Graham 1985; Homel and Clark, 1994; Hauritz et al 1998; Roberts 2007]. Other study types included retrospective surveys; cross-sectional and time series analyses; experimental studies; and randomised controlled trials.

Environmental factors associated with increased or reduced alcohol use and related harm in identified studies were grouped into three categories: physical factors; social factors; and staffing factors. Findings were then collated by country into two tables based on associations that had been found with measures of alcohol consumption (Table 4) or measures of alcohol-related harm (Table 5). Results are then reported based study findings for the three categories of environmental factors.

#### 3.2 Studies on environmental factors and measures of alcohol consumption

Table 4 presents environmental factors in bars and nightclubs that have been associated with increased or reduced measures of alcohol use and access (higher consumption, intoxication, service to drunk or underage customers), and the countries in which these links have been identified. The review identified thirteen studies in this area, five of which had

been conducted in Europe. Six of the identified studies reported on data that had been collected over a decade prior to the review (1998 or earlier; see Table 1), including three US studies and all studies from Australia, Canada and the Netherlands. Dates of data collection were not published for two French studies (Gueguen et al 2004; Gueguan et al 2008). The Swedish study identified was conducted at three different time periods (1996, 1999, 2001; Andreasson et al 2000; Wallin et al 2002; Wallin et al 2005 39-41) and findings relating to environmental factors were not consistent between study periods.

### **3.3 Studies on environmental factors and measures of alcohol-related harm**

Table 5 shows environmental factors in bars and nightclubs that have been associated with alcohol-related harm (e.g. aggression, crime, injury and drink driving), and the countries in which these links have been identified. Twenty three studies in this area were identified, seven of which had been conducted in Europe. Fifteen studies had concluded data collection over a decade prior to the review (1998 or earlier; see table 1). Dates of data collection were not provided for two studies published in 2000 (UK; Warburton and Shepherd, 2000) and 2007 (US, Roberts, 2007).

### **3.4 Physical factors associated with higher levels of alcohol use and harm**

A range of physical factors, including poor ventilation, poor cleanliness, crowding, noise, low lighting, high temperature, shabby decor and low maintenance, have been associated with increased aggression in bars and nightclubs in various countries; either individually or combined when measuring the overall bar environment (Table 5). However such combined measures can produce contradictory results and have been associated with lower levels of crime in UK nightclubs. In Canadian bars, many of these physical factors have also been associated with higher levels of patron intoxication (Table 4). In Europe, loud music volume has been linked to faster drinking speed and alcohol consumption in the Netherlands and France, yet to lower levels of over-serving (alcohol sales to pseudo-drunk customers) in Sweden (compared with 'conversational' music levels; although relationships between music level and over-serving were not seen in a follow-up study). Studies have also found over-serving to be higher in less crowded venues, while in Sweden, 'average' ratings of

cleanliness in washrooms have been related to a higher likelihood of over-serving than either 'good' or 'bad' ratings.

In the UK, low-impact resistant glassware (which breaks more easily) has been associated with increased injuries to bar staff. Here, the low-impact resistant glassware was marketed as 'toughened' glassware and was being tested for its utility in reducing injuries in bars.

### **3.5 Social factors associated with higher levels of alcohol use and harm**

A permissive environment, the availability of cheap alcoholic drinks, and a focus on music and dancing in bars have been associated with higher levels of alcohol use, intoxication and aggression across a range of studies and countries (Tables 4 and 5). In Australia, visiting venues where entertainment focused on music and dancing was linked to increases in a combined 'alcohol-related harm' category covering injury, drink driving, crime, argument or fight, accident or time off work. The type of music being played (e.g. pop, hip-hop, house music) has also been highlighted as a contributor to drinking behaviours and alcohol-related harm in several studies, although this was not explored in detail in this review. In qualitative research in Bulgaria, cheap drinks promotions have also linked to underage drinking. Despite the relatively consistent link between permissive environments and aggression across studies and countries, in Sweden, venues in which overall order was under control showed higher levels of over-serving.

The presence of games (e.g. pool tables) in drinking venues has been linked to increased aggression in a range of countries. However, in Australia, higher levels of aggression have been related to boredom in bars, with entertainment including game machines, stage shows and quizzes found to relieve boredom. Illegal activities such as drug use, drug dealing and prostitution in drinking venues have been associated with aggression in the US, Australia and Canada. In UK nightclubs, however, higher aggression has been found in venues with less illicit drug use. Sales of beer, spirits and high alcohol content drinks have been associated with increased aggression and drink driving, and sales of non-alcoholic drinks with reduced police complaints. The availability of food has also been linked to lower levels of police complaints, as well as to lower intoxication and aggression. The presence of high

proportions of drunk customers in bars and nightclubs has been associated with increased aggression across a range of countries.

### **3.6 Staffing factors associated with higher levels of alcohol use and harm**

No European studies were identified that linked staffing factors to levels and patterns of alcohol use (Table 4). Elsewhere, venues with friendly or all female staff have been associated with lower levels of patron intoxication, while younger staff have been found to be more likely to serve pseudo-drunk customers. A low staff to patron ratio has been associated with increased aggression in Australia; in Canada, staff to patron ratio was not found to be related to incidence of aggression, but a high staff to patron ratio was associated with increased severity of staff aggression (factors associated with severity of aggression only were not included in Table 5).

Poor staff control and practice (e.g. ability to handle problems, continuing to serve drunk customers, drinking whilst working) has been associated with increased alcohol consumption, aggression, crime and other harms in several non-European studies. Although staff practice has been explored in observational studies in the UK, no clear relationships between staffing, aggression and crime have been identified. However, in one UK study that showed participants scenarios of staff intervention practices in bars, levels of violence in bars were perceived to be higher when staff used physical rather than non-physical intervention with disorderly customers. Staff intervention with drunk customers has been associated with increased aggression in observational research in Australia. ID checking has also been associated with reduced aggression in Australia. In US studies, however, it has been linked to both increased aggression and reduced crime. Several studies have found the presence of door supervisors to increase aggression, although in the US findings have been mixed. However, ineffective door supervisors (e.g. aggressive, permissive) have been consistently linked to aggression in several countries, and observed to be involved in many incidents of violence in Bulgaria. Over-serving has been found to be less likely in venues that have warning signs against the service of alcohol to drunk customers. Over-serving has itself been associated with higher levels of patron alcohol consumption.

## 4. Discussion

This systematic literature review has identified a range of studies that have explored relationships between environmental factors in pubs, bars and nightclubs and levels of alcohol use and related harm. Through these, numerous physical, social and staffing factors in drinking environments have been associated with higher or lower alcohol consumption, alcohol access and alcohol-related problems (Tables 4 and 5). Factors that appear particularly important in contributing to alcohol-related problems include a permissive environment, cheap alcohol availability, poor cleanliness, crowding, loud music, a focus on music and dancing, and poor staff practice. However, findings from studies have not always been consistent. For example, while several studies have found associations between crowding and aggression, others have found no such relationships (e.g. Canada, UK), and in Australia, increased crowding was seen alongside reduced aggression. Further, while crowding has been linked to increased intoxication (Canada), it has also been associated with reduced over-serving to pseudo-drunk customers (US, Sweden). In Sweden, researchers suggested that higher over-serving in less crowded venues may have been due to financial reasons, with venues that have fewer patrons being less likely to turn customers away (Wallin et al, 2002). In Australia, the effects of crowding on aggression were thought to have been offset by improvements in other factors, such as reduced permissiveness, reduced cheap drinks promotions and improved staff practices. The inconsistencies seen between studies demonstrate the complex nature of drinking environments, and the need to better understanding how environmental factors impact on alcohol-related harm across different social, physical, cultural and legislative environments.

The purpose of this literature review was not to review in-depth the strength of associations between various environmental factors and alcohol use and harm, but rather to gain a better understanding of existing literature and study methods to inform the Amphora study. Of the 52 articles and 34 studies identified in the review, over two thirds of articles (n=37) and studies (n=23) had been conducted in the USA, Australia or Canada. Just twelve studies had been conducted in Europe, with five of these in the UK. Of European studies that were identified, six had used some form of observational research, and two had used internationally tested research tools originally developed in Canada. These studies,

conducted by Forsyth et al in Glasgow, used naturalistic observation in pubs (Forsyth, 2005) and nightclubs (Forsyth, 2006). The pub study findings were largely consistent with international research (Tables 4 and 5); venues that had more environmental risk factors (as identified in international studies) were found to have higher levels of aggression/police-reported crime. However, findings from the nightclub study showed some differences. For instance, whilst illicit drug use was associated with increased aggression in international studies, in the UK study higher aggression was associated with lower illicit drug use. Contrary to other research, the Scottish nightclub study also found higher police reported crime in venues that did not have an 'unhealthy ambience' (a combined variable covering physical factors such as poor ventilation, noise and crowding).

Despite the smaller literature base in Europe, most European studies had been conducted within the last decade, whilst the majority of non-European studies had taken place more than a decade prior to the review. This suggests a growing awareness and interest in preventing alcohol-related harm in pubs, bars and nightclubs in Europe, but also a general need for further research in modern drinking venues. Drinking behaviours, nightlife environments and their management change over time, and can vary widely between countries. Further, some European countries (e.g. UK) have strict regulations governing the operation of bars and nightclubs, whereas elsewhere legislation and its enforcement can be more relaxed (e.g. Slovenia has no formal alcohol licensing system). Such factors can affect both the findings of studies in these countries and their relevance in different nightlife settings. For example, several non-European studies and one early UK study have associated the presence of door supervisors in bars and nightclubs with increased aggression, and stressed the need for door supervisors to be trained. Nowadays in the UK, however, the employment of door supervisors in late night drinking establishments is typically mandatory, and a national registration scheme requires all individuals working as door supervisors to have undertaken a recognised training course. Consequently the presence of door supervisors may no longer be considered as a risk factor in late night drinking environments in the UK, yet whether or not they apply their training in practice can be critical. Also in the UK, licensing regulation permits local authorities to apply conditions to individual drinking environments based on their experience of crime and disorder. This can include, for example, a requirement to check age identification, use of safer (e.g. non glass) drinking

vessels and monitor crowding. Thus, whilst in some drinking environments these practices may be signs of social responsibility, in others they may be reactive measures introduced to address existing alcohol-related problems. Such factors can again complicate the interpretation of study findings and their relevance across different drinking environments.

The experience gained through research identified in this review has been used to inform the development of the Amphora project. The study has built on existing knowledge and experience and utilised internationally-developed research tools and methods that were identified in the review and have previously been used in Canada, Australia, the US and the UK.

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**Table 1: Study characteristics**

Study	References	Study	Country	Period of data collection	Study type	Detail
1	Buddie and Parks, 2003	Women's bar-related victimization study	USA	NR (post 1997)	Retrospective survey	Study of 198 female drinkers that frequent bars
2	Chikritzhs and Stockwell, 2002	Extended Trading Permits	Australia	1991-1997	Time series analysis	Analysis of police assault data to test relationships between assault and extended alcohol hours (granted to 24% of premises in study area).
3	Hughes et al, 2008	Daphne study	Spain	2007	Retrospective survey	Study of 3,003 British, German and Spanish holidaymakers visiting Majorca and Ibiza (Spain)
4	Fox and Sobol, 2000	2 bars study	USA	1995	Qualitative observational study	Structured observations in two urban bars
5	Graham et al, 2006	Toronto Safer Bars study	Canada	2000-2002	Quantitative observational study	Structured observations in 118 bars/clubs
6	Graham et al, 2006					
7	Graham and Wells, 2001	London, Canada, Observational study	Canada	1996-1997	Observational; qualitative and quantitative	Structured observations in 12 bars and interviews with young adult drinkers who had been involved in bar aggression
8	Graham et al, 2000					
9	Wells et al, 1998					
10	Graham and Wells, 2003					
11	Gruenewald et al, 1999	Drink drivers study	Australia	1989-1993	Time series cross-sectional study	Analysis of features of bars where 2,411 individuals arrested for drink driving over 4 years had their last drink
12	Homel et al, 1997	Surfers Paradise Safety Action Project	Australia	1993-1994	Quantitative / qualitative observational study	Structured observations in 18 nightclubs, before and after an intervention
13	Homel et al, 1997			1993-1996		

Study	References	Study	Country	Period of data collection	Study type	Detail
14	Hauritz et al, 1998	North Queensland Safety Action	Australia	1994-1996	Quantitative observational study	Structured observations in licensed venues in 3 cities
15	Hauritz et al, 1998					
16	Hauritz et al, 1998					
17	Homel et al, 2004					
18	Homel et al, 1992	Sydney Qualitative study	Australia	1989	Qualitative observational study	Unstructured observations in up to 23 licensed premises
19	Tomsen et al, 1991					
20	Homel and Tomsen, 1991					
21	Johannessen et al, 2001	Homecoming Alcohol Policy changes	USA	1994-1998	Cross-sectional surveys, secondary data analysis, intervention evaluation	Annual surveys among students attending homecoming event; structured observations in bar tents, and analysis of law enforcement problems over five years to assess impacts of policy change
22	Lang et al, 1995	Perth random household survey	Australia	1990	Retrospective survey	Random household survey of 1160 adults.
23	Stockwell et al, 1993					
24	Leather and Lawrence, 1995	Vignettes	UK	NR	Experimental design	Analysis of participants' perceptions of violent incidents after viewing images of bar settings
25	Leonard et al, 2003	Buffalo Study	USA	1998-2000	Retrospective survey	Surveys and interviews among frequent bar patrons and those involved in, observing, or threatened by, violence in a bar
26	Leonard et al, 2003					
27	Quigley et al, 2003					
28	Collins et al, 2007					

Study	References	Study	Country	Period of data collection	Study type	Detail
29	Roberts 2007	Hoboken Study	USA	NR	Quantitative observational study	Structured observations in 25 licensed premises
30	Warburton and Shepherd, 2000	Toughened glassware study	UK	NR	Randomized controlled trial	Survey of 1229 bar workers in 57 bars; intervention evaluation.
31	Homel and Clark, 1994	Sydney Quantitative Study	Australia	1991	Quantitative observational study	Structured observations in 36 licensed premises
32	Marsh and Kibby, 1992	England Study	UK	1989-1991	Interviews, qualitative	Observations and semi-structured interviews with key informants in five UK nightlife areas
33	Forsyth et al, 2006	Glasgow Club Study	UK	2006	Quantitative observational study	Structured observations in eight nightclubs and interviews with nightclub patrons
34	Forsyth et al, 2005	Glasgow Pub Study	UK	2004	Quantitative observational study	Structured observations in eight pubs; questionnaires and interviews with bar workers.
35	Macintyre and Homel, 1997	Surfers Paradise Crowding Study	Australia	1993	Observational; data incidents	Structured observations in six nightclubs
36 37	Graham 1985 Graham et al, 1980	Vancouver study	Canada	1978	Quantitative observational study	Structured observations in 185 licensed premises
38	Kuo et al, 2003	College Alcohol Study	USA	2001	Observational study and survey	Survey of >10,000 students and structured observations in >2500 licensed premises
39	Lenk et al, 2006	Alcohol Risk Management (ARM) Trial	USA	2001	Observational study	Alcohol purchase attempts by pseudo-drunk actors in 231 licensed premises; telephone survey of owners/managers

Study	References	Study	Country	Period of data collection	Study type	Detail
40	Thombs et al, 2008	Breath Test Study	USA	2006-2007	Cross-sectional study	Surveys and breath tests among 291 patrons exiting college bars
41	Toomey et al, 2004	Illegal alcohol purchase attempts	USA	1999-2000	Observational study	Alcohol purchase attempts by pseudo-drunk actors in 355 licensed premises
42	Gueguen et al, 2008	Music volume study	France	NR	Observational experimental study	Observations of 40 male drinkers in two bars with music level varied by researchers
43	Schaefer 1985	Montana Study	USA	1960s 1970s	Qualitative observational study	Observations in licensed premises
44	Babor et al, 1980	Happy hours studies	USA	1970s	Experimental studies	Two experimental studies examining the impact of happy hours on drinking behaviours (n=34, n=16)
45						
46	Tutenges, 2009	Danish holidaymakers	Bulgaria	2007	Observation, ethnographic	Ethnographic fieldwork; structured observations in 12 licensed premises
47	Knibbe et al, 1993	Netherlands Study	Netherlands	1987	Quantitative observational study	Structured observations of 8 venues and measurements of young patrons (n= 385) drinking rates
48	Van de Goor, 1990					
49	Van de Goor, 1990					
50	Wallin et al, 2005	STAD	Sweden	1996-2001	Observational study; intervention evaluation	Alcohol purchase attempts by pseudo drunk actors with structured observations; repeated implementation as part of evaluation study
51	Wallin et al, 2002					
52	Andreasson et al, 2000					
53	Gueguen et al, 2004	Noise levels	France	NR	Observational experimental study	Observations of 120 drinkers in two bars with music level varied by researchers

NR = not reported

**Table 2: Study measures related to alcohol consumption**

Study number	Environmental factors:			Outcomes measured
	Physical factors	Social factors	Staffing factors	
22,23		Live bands / juke boxes Dancing	Service to drunk customers	High risk drinking
36	Ventilation Cleanliness Crowding Noise/music level Decor Maintenance	Live bands/juke boxes Dancing Food availability	Permissive environment Staff behaviour Staff gender	Intoxication
38		Drink prices Drink promotions		Binge drinking
39	Crowding Upscale establishment		Staff age Written signs and staff policies	Over serving
40		Drink prices Drink promotions		Intoxication
41			Young staff	Illegal alcohol sales
42	Noise/music level			Drinking speed
43	Crowding Venue style	Cheap drinks/promotions Live bands/juke boxes Dancing		Abusive drinking behaviour Alcohol use
44,45		Price of drinks/promotions		Alcohol use
46		Price of drinks/promotions		Underage drinking
47,48,49	Noise/music level			Drinking speed
50,51,52	Cleanliness Crowding Noise/loud music		Permissive environment	Over serving
53	Noise/music level			Drinking speed

**Table 3: Study measures related to alcohol-related harm**

Study number	Environmental factors:			Outcomes measured
	Physical factors	Social factors	Staffing factors	
1		Young patrons (aged <25 years)		Minor physical aggression Severe physical aggression
2		High strength alcohol		Assaults
3	Games (e.g. pool tables) Loud music	Cheap alcohol	Permissive environment	Involvement in violence
4			Permissive environment Door supervisors	Aggression Sexual predation
5, 6	Smokiness / ventilation Crowding Noise level Cleanliness	Movement Number of drinks at closing time Sexual contact/competition Intoxication level Dancing	Permissiveness/rowdiness Security staff Staff behaviour Staff/patron ratio Staff monitoring Staff coordination	Frequency of aggression Severity of aggression
7,8,9,10	Crowding	Intoxication level	Permissive environment Staff behaviour Ineffective door supervisors	Aggression Severity of aggression Aggressive staff behaviour Staff handling of violence
11		High strength alcohol		Drink driving
12,13	Crowding Cleanliness Bar access Music genre	Drink promotions Sexual activity Male intoxication Food availability	Permissive environment Door supervisors Host responsibility	Aggression
14,15,16,17	Ventilation Crowding Cleanliness Lighting Spacing and comfort	Happy hours/drink promotions Intoxication Sexual activity Food availability	Host responsibility Permissive environment Door supervisors Staff behaviour	Aggression

Study number	Environmental factors:			Outcomes measured
	Physical factors	Social factors	Staffing factors	
18,19,20	Crowding Comfort Ventilation Seating	Boredom Cheap drinks and promotions Intoxication level Atmosphere Food availability	Door supervisor permissiveness Staff behaviour	Aggression
21		Non-alcoholic drink sales Food availability	ID checks	Police complaints
22,23		Entertainment Dancing	Service to intoxicated customers	Alcohol-related harm
24	Tidiness		Door supervisors/Interventions	Violence
25,26,27,28	Smokiness/ventilation Crowding Cleanliness Lighting Noise/loud music Temperature	Pool tables Bar environment Illegal activities Dancing	Door supervisors	Aggression Violence Opponent injury
29	Smokiness Crowding Cleanliness Temperature Comfort Venue style	Drink promotion Dancing	Door supervisors Staff intoxication ID checks Server behaviour	Aggression Violence
30	Drinking vessels			Bar staff injury
31	Smokiness/ventilation Crowding Cleanliness Lighting Seating	Drug dealing Sexual competition Intoxication Disco Food availability	Permissive environment Door supervisors Staff/patron ratio Server responsibility	Frequency of aggression Severity of aggression

Study number	Environmental factors:			Outcomes measured
	Physical factors	Social factors	Staffing factors	
32		Pool tables		Violence
33	Crowding Cleanliness	Patron age Illegal drug use Intoxication	Staff behaviour	Aggression Police call outs / crime
34	Smokiness/ventilation Noise Crowding Cleanliness	Pool tables Movement Sexual tension Intoxication	Permissive environment Staff behaviour	Crime Aggression
35	Crowding Venue style	Rowdiness and hostility		Aggression
36,37	Ventilation Crowding Cleanliness Noise Venue style Table layout	Entertainment/activities Sexual contact Dancing Food availability Pool tables Prostitution Illicit drug use Intoxication	Permissive environment Staff gender Staff behaviour Staff control	Aggression
46			Door supervisors	Violence

**Table 4: Environmental factors associated with alcohol use and service practices**

Environmental Factor		Country in which links identified						
		USA	Australia	Canada	Netherlands	France	Sweden	Bulgaria
Physical Factors	Poor ventilation			↑●				
	Poor cleanliness			↑●			◆ <sup>a</sup>	
	Crowded venues	↓◆		↑●			↓◆	
	Crowded dance floors	↑■ <sup>b</sup>						
	Noisy, loud music			↑●	↑▲	↑■	↓◆ <sup>c</sup>	
	Lighting	↑■ <sup>b</sup>						
	Venue style	↓◆ <sup>d</sup> ■ <sup>b</sup>		↑● <sup>e</sup>				
Social Factors	Cheap drinks, drinks promotions	↑●■						↑+ <sup>b</sup>
	Permissive environment <sup>f</sup>			↑●			↓◆	
	Live bands, juke boxes, discos, dancing	↑■ <sup>b</sup>	↑■	↑●	↑▲			
	Food availability			↓●				
Staff Factors	Younger staff	↑◆						
	Friendly staff			↓●				
	All female staff			↓●				
	Warning signs, staff policies <sup>g</sup>	↓◆						
	Continuing to serve drunk customers		↑■					
References		38-41,43,44	23,22	36	47-49	42,53	50-52	46

Key to symbols	
●	Intoxication
■	Alcohol use, binge drinking, high risk drinking, abusive drinking
◆	Over-serving (to pseudo-drunk customers)
+	Underage drinking
▲	Drinking speed
↑	Indicates an increase associated with the environmental factor
↓	Indicates a decrease associated with the environmental factor

<sup>a</sup> ‘Average’ hygiene in restrooms was associated with reduced service refusal to pseudo-drunk customers, compared with ‘good + bad’ hygiene; <sup>b</sup> Linked through qualitative/ethnographic research without statistical analysis - moderate lighting observed to be associated with increased risk of alcohol abuse, compared with bright or low lighting; Tranquil artwork observed to be associated with controlled social drinking; <sup>c</sup> probability of over-serving was higher at a communicable noise level, than at high level, low level or no music; <sup>d</sup> Upscale establishment; <sup>e</sup> Shabby decor, no theme, low expenditure on furnishings, low maintenance; <sup>f</sup> Canada: ‘Anything goes’ atmosphere, swearing and overt sexual contact. Sweden: overall order at the premises; <sup>g</sup> against the service of alcohol to drunk customers  
*Only findings that have been associated with increases or reductions in alcohol measures are shown. Thus findings where associations were absent, mixed or unclear are not*

**Table 5: Environmental factors associated with alcohol-related problems**

Environmental Factors		Countries in which a link has been identified					
		USA	Australia	Canada	UK	Spain	Bulgaria
Physical Factors	Poor ventilation/smokiness	↑●	↑●	↑●			
	Poor cleanliness	↑●	↑●	↑●	↑●■		
	Crowded venues/dance floors/bars	↑●	↑●	↑●			
	Noisy, loud music	↑●	↑● <sup>a</sup>	↑●		↑●	
	Low lighting		↑●				
	High temperature	↑●					
	Combined variable including the above	↑●			↑●↑↓■		
	Seating		↑● <sup>b</sup>	↑● <sup>c</sup>			
	Low impact-resistance glassware				↑+		
	Unattractive bars (e.g. shabby)	↑●		↑●			
Line up			↑●				
Social Factors	Cheap drinks and drinks promotions	↑●	↑●			↑●	
	Permissive environment <sup>d</sup>	↑● <sup>a</sup>	↑●	↑●	↑●■	↑●	
	Games (e.g. pool, billiards)	↑●	↓● <sup>e</sup>	↑●	↑●■	↑●	
	Dancing, juke boxes, discos, bands etc.	↑●	↑●▲	↑●			
	Illegal activity (e.g. drugs, prostitution)	↑●	↑●	↑●	↓● <sup>f</sup>		
	Beer, spirits, high volume alcohol sales		↑●◆				
	Non-alcoholic drinks on sale	↓■					
	Drunk customers		↑●	↑●	↑●■	↑●	
Availability of food	↓■	↓●	↓●				
Staff Factors	Staff characteristics	↑●(Most ♂)	↓● <sup>g</sup>	↓●(All ♀)			
	Poor staff control/practice	↑● <sup>h</sup>	↑●▲ <sup>i</sup>	↑● <sup>jk</sup>	↑■ <sup>l</sup>		
	Staff intervention	↑● <sup>m</sup> ↓■ <sup>m</sup>	↑● <sup>n</sup> ↓● <sup>m</sup>		● <sup>o</sup>		
	Ineffective door supervisors	↑●	↑●	↑●			↑● <sup>a</sup>
	Presence of door supervisors	↑↓●	↑●	↑●	↑● <sup>p</sup>		
	Low staff:patron ratio		↑●				
References	1,4,21,25-29	2,11-20,22,23,31,35	5-10,36,37	32-34,24	3	46	

Key to symbols
● Aggression, violence, assaults
■ Crime, police complaints/ call-outs
◆ Drink driving
⊕ Staff injury
▲ Alcohol-related harm (injury, drink driving, crime, violent argument or fight, accident, time off work)
↑ Indicates an increase associated with the environmental factor
↓ Indicates a decrease associated with the environmental factor

<sup>a</sup> Linked through qualitative/ethnographic research without statistical analysis; <sup>b</sup> lack of seating, low comfort; <sup>c</sup> seating in rows; <sup>d</sup> e.g. decorum expectancies, rowdiness, swearing, sexual contact, underage patrons; <sup>e</sup> Boredom associated with aggression; entertainment (e.g. game machines, quizzes, stage shows) reduced boredom. <sup>f</sup> Higher drug use; <sup>g</sup> friendlier door supervisors; <sup>h</sup> staff drinking; <sup>i</sup> continuing to serve drunk people; <sup>j</sup> ability to identify and handle problems; <sup>k</sup> Customers having 2+ drinks/hanging around at closing

time; <sup>l</sup> presence of underage customers; <sup>m</sup> ID checks; <sup>n</sup> staff intervention with drunk customers; <sup>o</sup> physical staff intervention (cf non-physical) with disorderly customers increased perceptions of violence in a venue; <sup>p</sup> based on perceptions of violence in venues with or without door supervisors.

*Only findings that have been associated with increases or reductions in alcohol-related harm are shown. Thus findings where associations were absent, mixed or unclear are not included in the table.*

## Appendix 1: Search strategy

#	Search History
1	Exp Alcohol Drinking/
2	Exp Alcohol-Related Disorders/
3	Exp Alcohol-Induced Disorders/
4	Exp Alcoholic Intoxication/
5	Exp Alcoholic Beverages/
6	(alcohol\$ or beer or wine\$ or cider or alcopop\$ or spirit or spirits).ti,ab.
7	(drink\$ or alcohol\$ adj2 (problem\$ or binge\$ or excessive or risk\$ or harm\$ or heavy or misus\$ or abus\$ or consum\$ or behavio\$ or underage\$)).ti,ab.
8	(intoxicat\$ or inebriat\$ or drunk\$).ti,ab.
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10	exp Accidents/
11	exp "Wounds and Injuries"/
12	exp Violence/
13	exp Aggression/
14	exp Suicide/
15	exp Self-Injurious Behavior/
16	exp Poisoning/
17	exp Death, Sudden/
18	(injur\$ OR death\$ OR mortalit\$ OR fatalit\$ OR trauma\$ OR fall OR falls OR falling OR burn\$ OR fire\$ OR flame\$ OR drown\$ OR abus\$ OR violen\$ OR suffocat\$ OR fractur\$ OR laceration\$ OR ruptur\$ OR wound\$ OR scald\$ OR crash\$ OR accident\$ OR suicid\$ OR crim\$ OR offen\$ OR assault\$ OR murder\$ OR homicid\$ OR attack\$ OR stab OR stabbed OR stabbing\$ OR danger\$ OR drunk\$ OR driv\$ OR impair\$ OR convict\$ OR arrest\$ OR anti-social behavio?r OR antisocial behavio?r).ti,ab.
19	(poison\$ adj2 alcohol\$).ti,ab.
20	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21	(serve\$ OR serving OR pub OR pubs OR bar OR bars OR nightclub\$ OR club\$ OR restaurant\$ OR hotel\$ OR staff\$ OR shop\$ OR outlet\$ sell OR selling OR sale OR supply\$ OR supplier\$ OR supplied OR purchas\$ OR licens\$ OR licenc\$ OR nightlife OR night-life).ti,ab.
22	(industr\$ adj2 (alcohol OR beer OR brewery OR liquor OR wine)).ti,ab.
23	((alcohol OR drinking OR nightlife) adj2 (environment\$ OR setting\$)).ti,ab.
24	21 OR 22 or 23
25	exp intervention studies/
26	exp program evaluation/
27	exp harm reduction/
28	(educat\$ or train\$ or promot\$ or interven\$ or program\$ or administer\$ or campaign\$ or evaluat\$ or assess\$ or control\$ or compar\$ or prevent\$ or safe\$ or strateg\$ or scheme\$ or incentive\$ or trial\$ or policy or policies or reduc\$ or approach\$ or enforce\$).ti,ab.
29	25 or 26 or 27 or 28
30	9 and 20 and 24 and 29
31	(comment OR letter OR editorial).pt
32	30 NOT 31
33	32 not (rat or rats).mp.
34	33 not (pregnan\$ or anorexi\$).mp.
35	34 not (drink\$ adj2 water).mp.
36	limit 35 to (humans/ and yr="1990 - 2008")

## Appendix 2: Included article list

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