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**Citation** (please note it is advisable to refer to the publisher's version if you intend to cite from this work)

**Quigg, Z, Butler, N, Hughes, K and Bellis, MA (2022) Effects of multi-component programmes in preventing sales of alcohol to intoxicated patrons in nightlife settings in the United Kingdom. Addictive Behaviors Reports. 15. ISSN 2352-8532**

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## Effects of multi-component programmes in preventing sales of alcohol to intoxicated patrons in nightlife settings in the United Kingdom

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### ARTICLE INFO

**Keywords:**  
Alcohol sales  
Intoxication  
Nightlife  
Prevention

### ABSTRACT

**Introduction:** Alcohol service to intoxicated patrons is common across nightlife settings and preventing such sales is a key priority globally. In England and Wales, three multi-component programmes have been implemented including: (1) community mobilisation, responsible beverage server (RBS) training and routine law enforcement; (2) community mobilisation and enhanced law enforcement; and, (3) community mobilisation, RBS training and enhanced law enforcement. This study estimates the association between sales of alcohol to pseudo-intoxicated patrons and implementation of three multi-component interventions in four nightlife settings.

**Methods:** Alcohol test purchases by pseudo-intoxicated actors were implemented at pre (n = 206) and post-intervention (n = 224). Actors/observers recorded venue and test purchase characteristics. Logistic regression assessed service refusal by intervention type, adjusting for venue/test purchase characteristics.

**Results:** Pre-intervention, 20.9% of sales were refused. Post-intervention, 42.1%, 68.8% and 74.0% of sales were refused in areas with intervention 1, 2, and 3 respectively. In adjusted analyses, compared to pre-intervention, the odds of service refusal were higher for all interventions, with the highest odds when the intervention included enhanced law enforcement (adjusted odds ratios, interventions 1, 2, 3: 2.6, 7.1, 14.4; p < 0.01). Service refusal was higher if the test purchase was implemented on a Saturday/Sunday night; and lower if implemented in a nightclub or if age verification was requested at the bar.

**Conclusion:** Community-based multi-component interventions were associated with significant increases in service refusal to pseudo-intoxicated actors in nightlife settings in England and Wales. Effects were stronger for interventions including enhanced law enforcement, and particularly if all intervention components were implemented.

### 1. Introduction

Reducing the harmful use of alcohol is essential to achieving the United Nations Sustainable Development Goals (World Health Organization [WHO], 2018). Whilst there has been a decrease in youth alcohol consumption in many high- and middle-income countries (WHO, 2018), nightlife settings are often identified as an environment associated with harmful drinking, intoxication and related harms (Burton et al, 2017; Hughes et al, 2008, 2011; Hyder et al., 2018; Miller et al, 2014; Sanchez et al, 2015). Excessive alcohol intoxication within nightlife settings places substantial impacts on drinkers (Maheswaren et al, 2018) and those around them (Bellis et al, 2015), with additional burdens on

health, criminal justice and local government services (Boshari et al, 2020; Burton et al, 2017; Parkinson et al, 2016). For example, across England and Wales, an estimated 42% of violent incidents in 2019/20 were alcohol-related, and one in ten occurred in a pub or club (Stripe, 2020). Despite this, high levels of alcohol consumption and intoxication are often an accepted social and cultural part of nightlife spaces (Hughes et al, 2019; Ross-Houle and Quigg, 2019). Such cultural acceptance is facilitated by an environment that by its very nature encourages alcohol consumption through alcohol sales and marketing (Ross-Houle and Quigg, 2019). Critically, despite many countries implementing legislation that prohibits the sale of alcohol to intoxicated patrons (WHO, 2014), a plethora of studies across countries strongly suggest that over-

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<https://doi.org/10.1016/j.abrep.2022.100422>

Received 7 January 2022; Received in revised form 3 March 2022; Accepted 17 March 2022

Available online 21 March 2022

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service of alcohol to intoxicated patrons in nightlife settings is commonplace (Grube et al, 2021; Holmes et al, 2021; Hughes et al, 2014; Lenk et al, 2006; Toomey et al, 2017).

Globally, studies have used alcohol test purchases by pseudo-intoxicated actors to evidence levels of alcohol service to intoxicated patrons. In studies of nightlife settings in Europe, North America and Asia, the majority of alcohol test purchases by pseudo-intoxicated actors were successful, with some evidence of upselling, and bar servers recognising signs of intoxication, yet continuing to serve alcohol (Grube et al, 2021; Gyeltshen et al, 2021; Hughes et al, 2014; Lenk et al, 2006; Toomey et al, 2017). In Great Britain, it is estimated that 43% of pure alcohol consumed in on-trade venues is consumed by patrons who are likely to be intoxicated (i.e., have consumed at least 48 g/64 g [women/men] of pure alcohol; Holmes et al, 2021). The Global Alcohol Strategy (WHO, 2014) advocates for the enforcement of legislation prohibiting the service of alcohol to intoxicated patrons, along with wider alcohol harm reduction measures such as responsible beverage service (RBS) training. Evidence on the impacts of RBS training however are mixed, and whilst evidence is still emerging, studies suggest that community level multi-component interventions may be more effective in preventing alcohol over-service and alcohol-related harms in nightlife settings (Burton et al, 2017). Such interventions include multi-agency partnerships implementing complementary activities such as community mobilisation, RBS training and enforcement of alcohol legislation. For instance, the STAD (Stockholm Prevents Alcohol and Drug Problems) programme in Sweden has been associated with significant reductions in alcohol over-service and alcohol-related harms in nightlife and other settings (Brännström et al, 2016; Elgan et al, 2021; Trolldal et al, 2013; Wallin et al, 2005). Despite the success of the STAD programme, evidence on the effectiveness of similar interventions across Europe (e.g. SALUTT, Norway [Skardhamar et al, 2016]; PAKKA, Finland [Holmila and Warpenius, 2013; Drink Less Enjoy More, England [Quigg et al, 2018]] and elsewhere (e.g., USA, Fell et al, 2017) is mixed. Studies suggest that programme impact may be influenced by the combination of components included in such interventions. Thus, whilst there is some evidence to suggest that RBS training alone can have impacts on bar server practice, these impacts are difficult to sustain and often not replicable across studies (Burton et al, 2017; Toomey et al, 2017). The strongest evidence suggests that programmes are most effective if multi-agency community partners are mobilised to address alcohol-related harms in nightlife; managers and bar servers are equipped to serve responsibly through training and wider support (e.g., through community mobilisation); and there is adequate monitoring and enforcement of alcohol legislation by authorities (Burton et al, 2017; Jones et al, 2011; Lenk et al, 2018; Trolldal et al, 2013).

In England and Wales, where the legal age for purchasing alcohol is 18 years, it is also illegal to knowingly sell alcohol to, or purchase alcohol for an intoxicated person, or to allow alcohol to be sold to such a person (HM Government, 2021). In recent decades various studies have highlighted limited awareness of, and adherence to legislation prohibiting sales of alcohol to intoxicated persons, and few prosecutions for flouting the law (Hughes et al, 2014; Ministry of Justice, 2016). Efforts to address sales of alcohol to drunks have started to emerge, with the provision of education materials (e.g. posters, videos) for use in licensed premises raising awareness of alcohol legislation (e.g. Pubwatch/British Beer & Pub Association, nd), and community based multi-component interventions driven by local law enforcement, public health and wider partners. In England and Wales, using evidence from the STAD model, multi-component interventions have and continue to be implemented across several nightlife areas (e.g., Drink Less Enjoy More, Quigg et al, 2018; VPU, 2020). Whilst interventions include the principles of the STAD model, there are variations in the number and scale of included components. This study aims to estimate the association between sales of alcohol to pseudo-intoxicated patrons and implementation of three community based multi-component interventions aiming to address sales of alcohol to intoxicated patrons in nightlife settings in

England and Wales.

## 2. The interventions

To prevent the sale of alcohol to intoxicated patrons in on-licensed premises (i.e., pubs, bars and nightclubs), a range of multi-component interventions were implemented at community level across four large nightlife settings. In all areas, nightlife settings were routinely monitored and managed by local multi-agency partnerships (e.g., local government, police, health, fire and rescue; with partners having established relationships with licensed premises) and patrolled by police (and where relevant wider partners), particularly during weekend nights. In the United Kingdom (UK), organisations or individuals who wish to sell or supply alcohol must apply for a licence from a licensing authority (e.g., local government), with local government having responsibility for upholding the four UK Licensing Act objectives (considered when granting licenses): the prevention of crime and disorder; public safety; the physical safety of people using the venue; the prevention of public nuisance; and, the protection of children from harm (HM Government, 2021). When licence applications are made responsible authorities, such as the police and health, and community members can make a case against a licence being granted or for conditions to be placed on a licence (e.g., restricted operating times); and these are considered by the licensing authority throughout the licensing process. Requests can also be made for a licensing authority to review a licence if there are issues that adversely impact on the licensing objectives (in 2017/18, <0.1% of alcohol licences were reviewed across England and Wales; Home Office, 2018).

Building on the Licensing Act and its objectives, to prevent over-service of alcohol, targeted interventions were developed and implemented by local multi-agency partnerships (modelled on existing interventions, e.g., Wallin et al, 2005; Skardhamar et al, 2016; Holmila and Warpenius, 2013). At baseline, no cities had dedicated multi-component intervention in place addressing the sale of alcohol to intoxicated patrons. At follow up, all cities had a multi-component intervention in place, including two or more of four components. Component 1, community mobilisation, included convening a multi-agency (e.g., public health, local government, law enforcement) steering group who met on several occasions prior to and during programme implementation (as relevant to the local partnership) and community awareness raising activity (e.g., press/social media on the intervention and UK alcohol legislation). Component 2, RBS training, covered UK alcohol legislation, the impacts of alcohol and practical solutions for identifying nightlife patrons intoxication levels and safely refusing alcohol sales, and was delivered either face-to-face (1 h session delivered by local government) or via an e-learning course. Component 3, routine law enforcement activity, included existing approaches to policing the nighttime economy (e.g., police patrols and visits to licensed premises on a weekly basis). Component 4, enhanced law enforcement activity, supplemented routine law enforcement approaches with partners informing venues that they were actively monitoring sales of alcohol to intoxicated patrons (e.g. through unscheduled or undercover visits to venues), and/or the provision to venues of their alcohol test purchase results (implemented at baseline as part of the study); and, information (verbal and in writing) reiterating alcohol legislation and consequences of not adhering to the law, and details of the intervention. Three combinations of components were implemented across the four cities: Intervention 1 (City A and B), community mobilisation, RBS training and routine enforcement activity (i.e., components 1, 2 and 3); Intervention 2 (City C), community mobilization and enhanced enforcement activity (i.e., components 1 and 4); and Intervention 3 (City D), community mobilisation, RBS training and enhanced enforcement activity (i.e., components 1, 2 and 4). More detailed information on intervention components are reported in Supplementary Table 1.

### 3. Materials and methods

The study took place in four nightlife settings in cities in North West England and South Wales, from 2013 to 2015. Based on existing research assessing sales of alcohol to intoxicated patrons (Hughes et al, 2014; Lenk et al, 2006; Wallin et al, 2005), alcohol test purchases using pseudo-intoxicated actors were implemented in each city at two periods: pre-intervention (pre-test) and post-intervention. In each city, 50–100 venues were subjected to an alcohol test purchase at pre-test and post-intervention (see Supplementary Table 1). In three cities (A, B, C), venues were purposely selected for inclusion in the study as they were associated with alcohol-related harms, thus the same venues were visited at pre-test and post-intervention. In the fourth city (D), venues were randomly selected on both occasions using proportionate allocation sampling with venues stratified by permitted operating hours (it is possible that the same venue was randomly visited on both occasions). This approach was taken as the local partnership sought to use the alcohol test purchases results as part of their law enforcement component in future stages of the intervention, demonstrating to on-licensed premises that any venue could be subject to an alcohol test purchase.

The method selected to establish bar server propensity to refuse alcohol sales to intoxicated patrons uses actors who portray signs of obvious intoxication whilst attempting to purchase an alcoholic drink at the bar (or table if table service). Male (n = 9) and female (n = 12) actors (aged between 18 and 25 years) were recruited from local drama schools through an audition process, which included training on acting overtly drunk. A standard act for pseudo-intoxicated alcohol purchase attempts was developed and approved by local partners including the police (who are legally able to act as expert witnesses for determining drunkenness in the UK) (see Hughes et al, 2014). The act ensured that a very high level of intoxication was portrayed through key indicators (e.g., difficulty focusing, unsteadiness on feet, slurred speech), and that sufficient interaction occurred between actors and bar servers to allow these indicators to be observed. Following training, all actors displayed this act to local partners, including the police, and only those individuals demonstrating a convincing ‘act’ were recruited to the study.

For each test purchase, two researchers entered venues first and found a suitable position (i.e., close to the bar) to surreptitiously observe purchase attempts (including the level of intoxication portrayed by the actor, ensuring comparable displays between tests) and venue characteristics. When instructed to do so (e.g., via text message), two actors then entered the venue, with one actor taking the role of the ‘drunk’ and the other a ‘sober’ friend. The act commenced once the actors had entered the venue, with the actors following a set script including the pseudo-intoxicated actor stumbling to the bar supported by their sober friend, and using loud, slurred speech asking the price of a particular alcoholic drink (with improvisation where required). Upon receipt of the price, the pseudo-intoxicated actor fumbled over their purse/wallet, asked for the drink and continued with the purchase as appropriate. If service was refused, actors left the venue immediately. If they were served, they moved to another part of the venue, and at a convenient and inconspicuous time, left the venue (having not consumed the alcoholic drink). Researchers left after the actors, again at a convenient and inconspicuous time. Researchers and actors then independently completed structured observational schedules detailing venue characteristics and, for actors, details of the alcohol test purchase (see Hughes et al, 2014). Venue characteristics included venue type, presence of door staff and ten markers indicating poorly managed and problematic venue, whilst test purchase characteristics included actor and server demographics, supervision and monitoring of alcohol sales, and time/day of test purchase (see Table 1 and 2; measures were developed based on existing tools and studies on bar environments [Graham et al, 2006; Hughes et al, 2014]).

Analysis was undertaken in SPSS (V.27). Bivariate analyses and logistic regression were used to examine associations between alcohol sales refusal and intervention type, venue and test purchase

**Table 1**

Alcohol service refusal to pseudo-intoxicated actor by area and venue characteristics (n = 430).

		% refused (n)	X <sup>2</sup>	p value
Area				
Intervention type	None (pre-intervention)	20.9% (43)	93.66	<0.001
	1. Community mobilisation, RBS and routine enforcement activity	42.1% (33)		
	2. Community mobilisation & enhanced enforcement activity	68.8% (32)		
	3. Community mobilisation, RBS and enhanced enforcement activity	74.0% (74)		
Venue				
Venue type	Pub/bar	45.1% (167)	8.57	0.003
	Nightclub	25.0% (15)		
Door staff	No	52.0% (78)	8.83	0.003
	Yes	37.1% (104)		
PMP: Low seating	No	44.7% (109)	1.27	0.259
	Yes	39.2% (73)		
PMP: Cheap drink promotions	No	42.7% (61)	0.01	0.922
	Yes	42.2% (121)		
PMP: Young bar staff (>50%)	No	44.2% (92)	0.60	0.439
	Yes	40.5% (90)		
PMP: Young customers	No	43.6% (160)	1.66	0.198
	Yes	34.9% (22)		
PMP: Noisy bar	No	48.1% (125)	8.91	0.003
	Yes	33.5% (57)		
PMP: Crowded bar	No	42.8% (142)	0.12	0.731
	Yes	40.8% (40)		
PMP: Poor lighting	No	43.8% (146)	1.39	0.238
	Yes	37.1% (36)		
PMP: Rowdy bar	No	44.1% (147)	2.00	0.157
	Yes	36.1% (35)		
PMP: Dirty bar	No	44.7% (160)	4.91	0.027
	Yes	30.6% (22)		
PMP: Drunk customers	No	47.0% (149)	10.81	0.001
	Yes	29.2% (33)		
Number of PMP markers	None	44.4% (20)	10.17	0.038
	1 or 2	48.0% (95)		
	3 or 4	41.8% (46)		
	5–7	25.0% (13)		
	8–10	32.0% (8)		



RBS = Responsible beverage service training; PMP = Poorly managed and problematic venue markers.

**Table 2**

Alcohol service refusal to pseudo-intoxicated actor by test purchase characteristics.

	% refused (n)	X <sup>2</sup>	p value
<b>Actor characteristics</b>			
Pseudo-intoxicated actor, female	46.8%	3.73	0.054
Pseudo-intoxicated actor, male	37.6%		
Pseudo-intoxicated actor pair, female only	52.7% (58)	6.58	0.037
Pseudo-intoxicated actor pair, mixed	38.5% (85)		
Pseudo-intoxicated actor pair, male only	39.4% (39)		
<b>Server characteristics</b>			
Server female	49.1% (79)	3.45	0.063
Server male	39.8% (99)		
Server appears aged under 26 years	43.9 (98)	2.75	0.098
Server appears aged 26 plus years	53.0% (70)		
<b>Test purchase characteristics</b>			
ID NOT requested (Entrance by door staff)	55.1% (125)	12.67	<0.001
ID requested (Entrance by door staff)	35.6% (47)		
ID NOT requested (at bar by bar staff)	50.8% (168)	13.76	<0.001
ID requested (at bar by bar staff)	14.3% (4)		
Bar area monitored by manager/supervisor	44.1% (173)	5.93	0.015
Bar area NOT monitored by manager/supervisor	23.7% (9)		
<b>Test purchase time/day</b>			
8 pm–11.59 pm	44.6% (136)	2.20	0.138
12am–3.59am	36.8% (46)		
Wednesday night through Thursday morning	47.2% (17)	11.16	0.025
Thursday night through Friday morning	35.7% (41)		
Friday night through Saturday morning	35.8% (43)		
Saturday night through Sunday morning	48.5% (63)		
Sunday night	62.1% (18)		

ID = age identification.

characteristics. Estimated marginal means were calculated to identify the mean response for each independent variable option (adjusting for other variables in the model); EMMs were then used to calculate the percentage change in alcohol service refusal between no intervention and intervention 1, 2, and 3. Due to variations in the methodology for venue selection between cities A-C and D, the logistic regression model was repeated including cities A-C (intervention 1 and 2) only as a sensitivity analyses (see Supplementary Table 2). Ethical approval was obtained from Liverpool John Moores University, and the study adhered to the Declaration of Helsinki.

#### 4. Results

Across all nightlife settings, the refusal of alcohol sales to pseudo-intoxicated actors increased from pre to post-test (see Supplementary Fig. 1). Combined, refusal of alcohol sales to pseudo-intoxicated actors was lowest (20.9%) at pre-test when no intervention was implemented across the areas, with increasing yet varying levels of service refusal across areas when interventions were implemented (Table 1). Areas implementing at least community mobilisation and enhanced enforcement activity (i.e., Interventions 2 and 3) had the highest levels of alcohol sale refusal (>68%). Pubs/bars (45.1%) had higher refusal rates than nightclubs (25.0%;  $p = 0.003$ ), as did venues with no door staff (52.0%) compared to those with door staff present (37.1%;  $p = 0.003$ ). Across 10 markers of poorly managed and problematic (PMP) venues, only venue noise level (less noisy), cleanliness (cleaner) and presence of drunk customers (no drunk customers) were associated with service refusal (Table 1). Service refusals varied by the number of PMP markers a venue had ( $p = 0.038$ ). There were significant differences in alcohol service refusal between actor pairs ( $p = 0.037$ ), with 52.7% of purchase attempts by female only pairs being refused compared to 39.4% of attempts by male only pairs and 38.5% by mixed sex pairs (Table 2). Venues requesting age verification, either at the venue entrance or at the

bar had lower levels of service refusal ( $p < 0.001$ ), whilst venues who were clearly monitoring alcohol sales at the bar (e.g., a supervisor was present observing sales) had higher levels of service refusal ( $p = 0.015$ ). Refusals were higher on Wednesday nights (a typical student event night), and Saturday and Sunday nights ( $p = 0.025$ ).

In logistic regression analyses, compared to pre-test, levels of alcohol sale refusals were significantly higher post-intervention, however the size of the association varied by intervention level (Table 3). Thus, compared to pre-intervention, the odds of alcohol sale refusals were 2.6–14.4 times higher when a multi-component intervention was in place, with the highest odds in areas implementing enhanced police enforcement activity (Interventions 2 and 3). Further, alcohol service refusal was significantly higher if the test purchase was implemented on a Saturday/Sunday night (adjusted odds ratio [AOR] 4.1,  $p = 0.012$ ); whilst refusals were less likely to occur in nightclubs (AOR 0.4,  $p = 0.03$ ) or if age verification was requested at the bar (AOR 0.3,  $p = 0.037$ ).

Compared to pre-test (estimated marginal mean [EMM], 0.08 [CI 0.03–0.19]), alcohol sale refusals increased by 138% if the intervention was multi-component including basic enforcement activity (EMM, 0.19 [CI 0.07–0.40]) (Fig. 1). However, refusals increased by 375% (EMM, 0.38 [CI 0.16–0.68]) and 600% (EMM, 0.56 [CI 0.31–0.78]) if the intervention included community mobilisation and enhanced enforcement activity, and multi-component with enhanced enforcement activity respectively (Fig. 1).

#### 5. Discussion

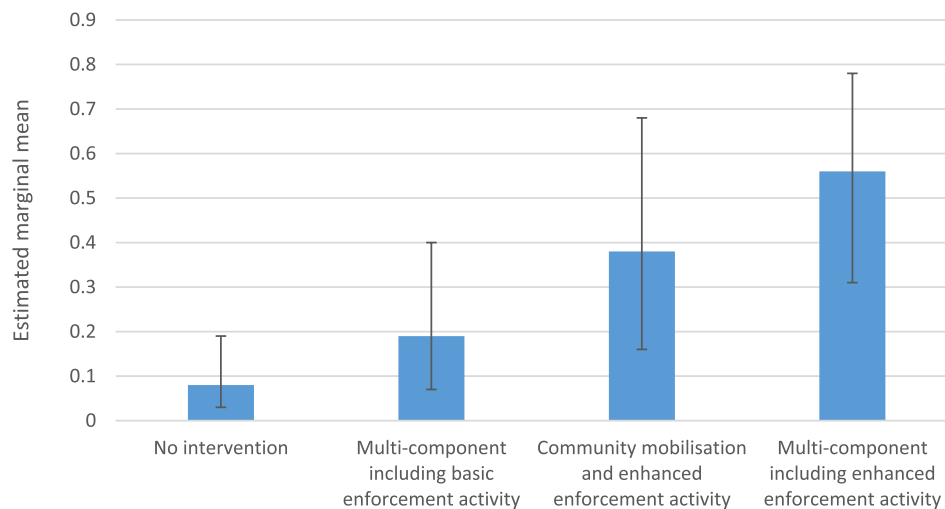
Our study suggests that community based multi-component interventions aimed at preventing over-service of alcohol to intoxicated patrons in nightlife settings are associated with positive impacts, with the greatest impacts seen when such interventions include enhanced enforcement activity. Despite restrictions prohibiting the sale of alcohol to intoxicated patrons, such alcohol sales were found to be commonplace in the absence of interventions focused on upholding this legislation. Thus, pre-intervention, overall, only one in five alcohol purchase attempts resulted in service refusal. Alcohol refusal rates increased substantially following the implementation of a multi-component intervention. While benefits were found for all combinations of interventions, odds of service refusal were greater in areas implementing enhanced enforcement activity rather than routine enforcement approaches and greatest in the most comprehensive package that incorporated community mobilisation, RBS training and enhanced enforcement activity; where odds of service refusal were >14 times greater compared with no intervention.

Our study adds to an emerging evidence base that supports the implementation of community based multi-component programmes aimed at addressing alcohol over-service and related harms in and around nightlife areas (Brännström et al, 2016; Burton et al, 2017; Elgan et al, 2021; Jones et al, 2011; Quigg et al, 2018; Trollidal et al, 2013). Our findings build on this evidence through illustrating how programme impacts can vary and may depend on the number and combination of programme components. Such findings are in accordance with an evaluation of the expansion and diverse implementation of the STAD programme across Sweden, which evidenced significant reductions in police-recorded assaults following programme implementation overall, and specifically a 3.1% reduction for each additional component included in programme implementation (Trollidal et al, 2013). We also found that the most comprehensive package had the greatest associated impact on our outcome measure, alcohol service refusal to pseudo-intoxicated patrons. However, Trollidal et al (2013), when examining individual programme components, found that whilst enforcement activity was associated with a decrease in violence, this was not significant; with only community mobilisation showing a significant reduction. The limited ability to define the type of enforcement activity implemented across areas, and if and how this differed from pre-intervention enforcement activity, was identified as a potential reason

**Table 3**  
Adjusted odds ratio for alcohol sale refusals; area, venue and test purchase characteristics.

		Adjusted Odds Ratio	P value	95% Confidence Interval	
				Lower	Upper
Area intervention level <sup>a</sup>	1. Community mobilisation, RBS and routine enforcement activity	2.60	0.008	1.28	5.28
	2. Community mobilisation & enhanced enforcement activity	7.09	<0.001	2.84	17.71
	3. Community mobilisation, RBS and enhanced enforcement activity	14.40	<0.001	6.24	33.21
Venue level	Nightclub <sup>b</sup>	0.40	0.030	0.17	0.92
	Door staff <sup>c</sup>	0.65	0.255	0.31	1.37
	Noisy <sup>d</sup>	0.55	0.142	0.24	1.23
	Dirty <sup>e</sup>	0.91	0.843	0.36	2.28
	Drunk customers <sup>f</sup>	0.46	0.051	0.21	1.00
	8–10 PMP <sup>g</sup>	5.81	0.068	0.88	38.34
	5–7 PMP	1.91	0.400	0.42	8.54
	3–4 PMP	2.22	0.184	0.68	7.24
	1–2 PMP	1.30	0.601	0.48	3.51
	Test purchase level	Pseudo-intoxicated actor pair, male only <sup>h</sup>	1.00	0.999	0.43
Pseudo-intoxicated actor pair, mixed <sup>h</sup>		0.63	0.184	0.32	1.24
ID requested (Entrance) <sup>i</sup>		1.06	0.855	0.56	2.03
ID requested (Bar) <sup>i</sup>		0.27	0.037	0.08	0.93
Bar area not monitored <sup>j</sup>		0.57	0.305	0.19	1.68
Sunday <sup>k</sup>		3.16	0.126	0.72	13.81
Saturday-Sunday		4.11	0.012	1.37	12.32
Friday-Saturday		1.55	0.432	0.52	4.61
Thursday-Friday		0.84	0.741	0.30	2.37

Binary logistic generalised linear model. Only variables significant in bivariate analyses are included in the model. Reference categories: <sup>a</sup> pre intervention/no intervention; <sup>b</sup> Pub/club; <sup>c</sup> No door staff; <sup>d</sup> Not noisy; <sup>e</sup> Not dirty; <sup>f</sup> No drunk customers; <sup>g</sup> Zero PMP markers; <sup>h</sup> Actor pair, female only; <sup>i</sup> ID not requested; <sup>j</sup> Not monitored; <sup>k</sup> Wednesday-Thursday.



**Fig. 1.** Estimated marginal means of intervention level.

for the lack of significance (Trolldal et al, 2013). Our study could identify changes and differences in enforcement practices, and thus provides insight into how variations in programme component implementation may affect programme outcomes, with enhanced enforcement activity showing substantially greater influence in preventing alcohol over-service than routine enforcement activity. Such findings can inform the development and implementation of interventions both in the UK and elsewhere.

Despite the benefits of increased enforcement of licensing legislation seen here, other studies have found mixed results, with for example positive impacts only sustained for short periods of time (Burton et al, 2017; Trolldal et al, 2013). In our study, in one city, enhanced enforcement included the provision of personalised alcohol test purchase results to premises by police officers; demonstrating that sales of alcohol to intoxication patrons were likely occurring, and that sales were being monitored by authorities through the pseudo-intoxicated actor test purchase methodology. Whilst this approach does not directly evidence sales of alcohol to intoxicated patrons, it is likely to be less

resource intensive than other approaches such as police visits to licensed premises, when officers may not be in venues long enough to identify levels of individual intoxication and alcohol sales, and bar servers may alter serving practices due to police presence. Future studies should explore the impact of enhanced enforcement activity using pseudo-intoxicated actors, implemented over regular and sustained periods of time, considering the costs and benefits of such an approach (Burton et al, 2017).

Community based multi-component interventions have been developed and implemented to address alcohol-related harms in nightlife in several countries (Brännström et al, 2016; Fell et al, 2017; Holmila and Warpenius, 2013; Quigg et al, 2018; Skardhamar et al, 2016; Trolldal et al, 2013). Like our study, emergent evidence suggests that such programmes are associated with reductions in alcohol over-service to pseudo-intoxicated patrons, and alcohol-related harms in nightlife (Brännström et al, 2016; Holmila and Warpenius, 2013; Quigg et al, 2018; Trolldal et al, 2013). However, evidence also highlights the difficulties in maintaining such positive impacts when interventions are

expanded or implemented at scale, both within and across countries (Quigg et al, 2019; Trolldal et al, 2013). Intervention fidelity, and/or variations in nightlife users' alcohol consumption and local partnership practices between intervention sites have been suggested as factors that can mediate programme success (Quigg et al, 2019; Skardhamar et al, 2016; Trolldal et al, 2013). Such factors were limited in our study through examining implementation in two UK countries in cities with similar nightlife settings, and consistent legislation and multi-agency working. Further, we aimed to examine variations in the multi-component programme approach, rather than implementation of the same intervention across areas. In doing so, we identify both the value of such interventions implemented in UK nightlife settings, and the importance of intervention components. Our study also found associations between alcohol sale refusals and test purchase and venue characteristics, with findings suggesting that intervention activities may need to be targeted towards nightclubs and during weekday nights (where the odds of refusals were lower). Whilst it may be envisaged that refusals would be lower on more busier weekend nights, when staff may have greater difficulty in identifying levels of intoxication, across our study sites the weekday nights were often busy 'student nights', which may have influenced bar serving practices, as well as the behavioural standards expected of patrons. Further, weekend nights are also more likely to have greater implementation of routine police enforcement activity, and thus bar servers may have been more cautious in their serving practices. Further, our study found that refusals were lower when the bar server had asked for age identification. Asking for age verification is standard practice in UK nightlife setting and exploring if bar servers use this process as they find it an easier mechanism to refuse an alcohol sale should be explored in future research.

This study should be considered in light some key limitations. As the study is a form of implementation research, areas were not pre-selected to be comparable and we did not include a control group, and thus causation cannot be established. Whilst the length of intervention implementation was similar between sites, the time between pre and post-test data collection periods varied. Venue selection methodology also varied, with one site using random selection rather than a repeated measures approach; our sensitivity analyses found comparable results however, adding weight to our findings (see Supplementary Table 2). Considering these limitations, whilst confidence in our findings may be increased through evaluation of programme implementation across four nightlife settings, it is important to acknowledge that other unmeasured factors may have influenced results. Future studies should aim to include a control site, and where feasible implement a repeated measures study.

Our study was conducted prior to the COVID-19 pandemic, which resulted in the closure of nightlife settings globally for some time, and upon reopening the implementation of a range of restrictions (Janssen et al., 2021). Safely opening nightlife with a view to limiting the risks of COVID transmission and other public health issues whilst protecting the night-time economy has been a critical challenge for local and national governments (Fitzgerald et al, 2020, 2021). Some restrictions have the potential to increase alcohol-related harms in nightlife, with for instance the introduction of table service (including via online applications) potentially leading to groups buying in rounds, which can increase intoxication, and limit supervision of alcohol service to intoxicated patrons (Janssen et al., 2021). Further, changes to staffing as a result of the pandemic may mean that substantial proportions of staff may require RBS training, whilst loss of income for venues may increase pressures for staff to sell alcohol. Policies to develop and protect nightlife settings and licenced premises should be balanced with the need to ensure nightlife settings are safe and impacts on the public's health are limited.

## 6. Conclusion

Globally, preventing harmful alcohol consumption in nightlife settings is a key priority. Evidence suggests that there are great potential benefits from addressing sales of alcohol to intoxicated patrons, through

reducing impacts on individuals' health and well-being and burdens placed on health, policing and other local authority partners, and improving the nightlife experience for all. Our study demonstrates that community based multi-component interventions addressing sales of alcohol to intoxicated patrons in nightlife settings are associated with significant increases in refusals of alcohol sales to pseudo-intoxicated actors across areas in England and Wales. Critically, effects were stronger for interventions including enhanced law enforcement activity, and particularly if all components were implemented. The development of such approaches and their integration into routine practice should be an important consideration for multi-agency partners responsible for managing nightlife areas.

## CRedit authorship contribution statement

**Zara Quigg:** Conceptualization, Funding acquisition, Supervision, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft. **Nadia Butler:** Investigation, Project administration, Writing – review & editing. **Karen Hughes:** Conceptualization, Methodology, Writing – review & editing. **Mark A Bellis:** Conceptualization, Methodology, Formal analysis, Writing – review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgements

With thanks to police forces and local authority teams across study areas for funding evaluation implementation, local theater schools for supporting the recruitment and training of actors, and actors and researchers for implementing alcohol test purchases and data collection.

## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.abrep.2022.100422>.

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