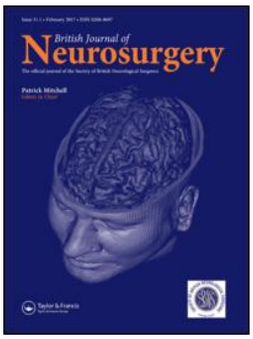

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The impact of minimum unit pricing on traumatic brain injury in Scotland: a retrospective cohort study of routine national data

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ABSTRACT

Background: Traumatic brain injury (TBI) is a common cause of disability and mortality and is associated with alcohol consumption. On 1st May 2018, the Scottish Government introduced Minimum Unit Pricing (MUP) legislation which set the floor price at which alcohol can be sold to 50 pence per unit. While MUP has led to a 7.6% decrease in off trade alcohol purchases, there are limited studies investigating the clinical impact of this legislation. This study aims to explore the impact of MUP on traumatic brain injury in Scotland.

Methods: Retrospective cohort study using routinely collected national data collated by the Scottish Trauma Audit Group. Data were requested for all TBI incidents from 1st May to 31st December for both 2017 and 2018. Primary outcome was alcohol-related TBI. Secondary outcomes were injury mechanism, injury severity, clinical course, and short-term mortality. Analysis was conducted using multiple regression models adjusted for age, sex, season, and deprivation.

Results: A total of 1166 patients (66% male, and 46% in the 60–79-year bracket) were identified. Alcohol-related TBI was evident in 184 of 509 (36%) patients before MUP and in 239 of 657 (36%) patients injured after its implementation ($p = 0.638$). Further, there was no change in injury mechanism, injury severity, hospital course and short-term mortality of TBI after MUP.

Conclusions: MUP has not resulted in a change in alcohol-related TBI nor in the mechanism and severity of TBI. Limitations in two-point analysis mean that findings should be interpreted with caution and further studies investigating the clinical outcomes of MUP must be conducted.

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Brain injuries; trauma; alcohol; public health

Introduction

Traumatic brain injury (TBI) is defined as 'a disruption to normal brain function due to insult to the brain from an external mechanical force.'[1] The annual incidence of TBI in Europe is almost 300 per 100,000 population[2] and it represents a major cause of morbidity and mortality worldwide,[3] accounting for 37% of all traumatic deaths.[2] In addition, physical and psychological sequelae are regularly significant, reduction in cognition is often life-changing[4], and the consequent development of anxiety and depression is common for both patients and carers.[5] Further, TBI is an independent risk factor for the development of stroke[6] and dementia.[7] There are also extensive financial costs associated with the immediate care and rehabilitation of patients with TBI as well as the accommodation for long-term disability and resultant loss of productivity, estimated to be 20 million US dollars per 100,000 people.[8,9]

Alcohol intoxication is recognised as a key risk factor in the aetiology of TBI.[10] About half those suffering a TBI were under the influence of alcohol at the time,[11] many of whom were previously identified as heavy drinkers.[12] Further, alcohol consumption is associated with falls,[13] moving vehicular accidents (MVAs)[14] and assaults,[15] all key mechanisms of TBI.[2]

In 2018, 24% of the Scottish adult population was drinking alcohol at harmful levels,[16] defined as consumption above the "Low Risk Guideline" of 14 units of alcohol per week.[17] Efforts to improve this aspect of public health by increasing the price of alcohol have been effective in Russia, which saw a *per capita* decrease in alcohol consumption of 43% from 2003 to 2016 with the associated reduction in mortality[18] (Russia's alcohol policy: a continuing success story 2019), and in Canada, where an elevation of 10% in alcohol pricing was associated with a 32% reduction in alcohol-attributable mortality[19].

In May 2018, as a public health measure, the Scottish Government introduced Minimum Unit Pricing (MUP) legislation for all alcoholic beverages, raising the minimum legal sale price of alcohol to 50 pence per unit.[20] Soon after the implementation, a 7.6% decrease in off-trade alcohol purchasing was evident nationally.[21] Purchasing reductions were greatest in lower-income households and these were sustained consistently.[22] Similar legislation was introduced in Wales in March 2020 with comparable results.[22]

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The objective of this study was to investigate the hypothesis that the introduction of MUP in Scotland led to a change in the odds, severity, and short-term mortality of TBI.

Methods and materials

Study design

A retrospective cohort study of routinely collected data from the Scottish Trauma Audit Group (STAG) (https://www.stag.scot.nhs.uk[23]) was conducted to compare the incidence, mechanism, and severity of TBI before and after the introduction of MUP in Scotland on 1st May 2018. The primary outcome measure was alcohol related TBI, secondary outcomes pertained to injury mechanism, incident severity, clinical course in hospital and short-term mortality.

Data source

Secondary analysis was conducted on pseudonymised data held by STAG, part of the Scottish National Audit Programme. STAG collects and collates data on emergency (within seven days) trauma admissions to hospitals in Scotland, but excludes those with a length of stay of less than 3 days, minor injuries, and frailty associated injuries (https://www.stag.scot.nhs.uk[23]). It is a validated and representative dataset comprised from nearly all emergency departments in Scotland, including all hospitals with recognised trauma capabilities. Contributing centres digitally record patient demographics, a complete injury profile and details of each patient's hospital admission. STAG provides outcome data of hospital discharge or death at 30 days, whichever happened first, and data linkage with the Scottish Index of Multiple Deprivation (SIMD).[24]

STAG is continually improving data collection. Cases recorded within STAG increased by 18% between pre- and post-MUP time periods and STAG attributes this principally to an improvement in data completeness. During this time, STAG also increased the number of contributing sites (though no additional major trauma centres) and expanded additionally its inclusion criteria to include all patients admitted to an ICU regardless of their length of hospital stay. These measures contributed marginally to the increase in the size of post-MUP cohort.

Population

Data were requested from STAG for 8-month time periods, 1st May to 31st December, for both 2017 and 2018. This dataset was interrogated using all abbreviated injury scale (AIS) codes deemed possible to relate to a TBI. These codes were defined *a priori* and independently by a consultant neurosurgeon (PB) and a consultant emergency physician (JGC); all codes selected by either were utilised. (Appendix 1). Cases were then manually screened and those who did not have a complete record were excluded. The request was not limited by patient age, so as to include those under 16 years of age who may have suffered alcohol-related injuries.

Data extraction and preparation

Patient demographics extracted included age, sex, and SIMD decile, and injury data contained mechanism, injury severity score (ISS) and Glasgow Coma Score (GCS) at presentation. Based on the STAG coding of cases with alcohol involvement as those with "documentation that patient or other person involved in incident has suspected or confirmed alcohol intake", association with alcohol was extracted. Consequently, TBI cases with an association with alcohol were defined as alcohol-related TBI. Dates of hospital admission, details of any surgical procedures undertaken (not limited to surgery for their TBI), and requirement for intensive care unit (ICU) or high dependency unit (HDU) admission were recorded along with the total length of hospital stay and in-hospital mortality at 30 days.

For analysis, a variable for season was derived from the admission date: Spring, March 1st to May 31st; Summer, June 1st to August 31st; Autumn, September 1st to November 30th; Winter, December 1st to February 28th. Age was recoded into five ordinal groups with widths of twenty years, GCS score was dichotomised into severe, GCS $\leq$8, and non-severe, GCS $>$8[25] and SIMD deciles were grouped into ordinal quintiles. Cases with isolated TBI were defined as having injury codes only pertaining to TBI. As STAG only records data up to 30 days, length of stay data were only available up to this time. Thus, these data were dichotomised, and cases defined as prolonged if length of stay was $\geq$21 days, in line with previous literature.[26,27]

As 2018 data included all patients admitted to an ICU regardless of length of stay, these cases were identified and excluded ensuring that the inclusion criteria remained homogenous between both cohorts.

Transfer and permissions

Data access was authorised by STAG, Caldicott guardian approval was obtained (reference: IR 2020 – 00368.) and the project was registered with the NHS Grampian Quality Improvement and Assurance Team (Institutional Project ID #4969). The project was considered within the audit/service evaluation bracket and so formal ethical approval was not required.

Encrypted data was sent electronically by STAG on the 1 April 2020 and subsequently stored securely in line with NHS guidance and national legislation.

Analysis

Data were expressed as frequencies and percentages, or as mean with standard deviation (SD) or median with an interquartile range (IQR), dependent on data type and distribution. Baseline characteristics were compared between pre- and post-MUP cohorts using Chi-squared tests, as appropriate, for categorical variables; and independent t-tests or Mann–Whitney tests, as appropriate, for continuous data. Additional analyses were also conducted comparing baseline characteristics and outcomes between TBI cases that were and were not associated with alcohol.

STAG received 3774 all-injury cases in 2017 and 4459 in 2018 resultant on previously described improvements in data collection. Consequently, proportions, rather than absolute TBI counts, were used for analysis.

A binary multiple logistic regression model was used to evaluate association between MUP and alcohol related TBI. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were obtained after adjusting for age, sex, SIMD quintile and season as these have known associations with TBI and alcohol consumption.[28,29] Adjusted analyses for secondary outcomes were assessed

using binary multiple logistic regression for binary outcomes and multiple linear regression for continuous outcomes.

To investigate the hypothesis that MUP disproportionately impacted lower-income households, stratified sensitivity analysis of the primary outcome was repeated in the lowest-income group (SIMD 1).

A *P*-value of <0.05 was considered to be statistically significant and statistical analysis was undertaken using SPSS version 25.0 for Windows[30] (SPSS Inc., Chicago, IL, USA).

Results

Systematic search of the STAG database resulted in extraction of 1257 cases of TBI. After exclusion of those with incomplete data ($n = 56$) and those 2018 cases that appeared only due to STAG's expanded inclusion criteria ($n = 35$) a study population of 1166 patients remained (Figure 1).

Overall, TBI was more common in males (66%), amongst adults aged 60–79 years (46%), and was associated with deprivation (34% of cases in SIMD quintile 1). Falls were the most prevalent mechanism of injury (62%), isolated TBI cases comprised 15%, and mean ISS was 18.9 (SD 11.0).

Severe TBI (GCS $\leq$ 8) comprised 21% of cases, and 27% of cases required surgical intervention for their injuries. Patients were admitted to ITU, and HDU in 33% and 31% of cases respectively. Hospital stay $\geq$21 days was required in 24% of cases and 18% died within 30 days of injury. Overall, alcohol-related TBI comprised 36% of cases. Populations before ($n = 509$) and after the introduction of MUP ($n = 657$) were broadly similar in baseline characteristics and in all outcomes (Table 1).

Comparison between alcohol-related and non-alcohol-related TBI are displayed in Table 2. Alcohol involvement was positively associated with traumatic brain injury in males ($p < 0.001$), in younger individuals ($p < 0.001$) and amongst patients from more socially deprived backgrounds ($p = 0.001$). Alcohol was positively associated with assaults ($p < 0.001$) and negatively with MVAs ($p < 0.001$) and falls ($p = 0.025$). There was no difference between groups in the requirement for surgical intervention, ITU and HDU admission, or in prolonged length of stay. A higher proportion of alcohol-related cases were GCS $\leq$ 8 ($p = 0.013$) however, interestingly appeared to have less severe injuries ($p = 0.42$) and lower mortality ($p = 0.026$).

Primary outcome: alcohol-related traumatic brain injury

The proportion of alcohol related TBI was 36% both before and after the introduction of MUP. Using multiple logistic regression, and after adjusting for age, sex, season and SIMD quintile, there was no significant difference in alcohol related TBI with the introduction of MUP, OR = 1.06 (95% CI 0.82 to 1.37) (Table 3).

Secondary outcomes

Multiple regression models which assessed secondary outcomes are displayed in Table 4. No significant differences in mechanism of injury, hospital course and outcome at 30 days were identified after adjusting for age, sex, season, and deprivation.

Results of stratified sensitivity analysis of the lowest income group are presented in Table 5. Like other groups, there was no change in odds of alcohol related TBI after MUP instruction (OR 1.095, 95% CI 0.87 to 1.67).

Discussion

Summary

This retrospective cohort study using routinely collected national data demonstrates that the introduction of alcohol MUP in Scotland in May 2018 has not resulted in a change in alcohol-related traumatic brain injuries. Further, there has been no

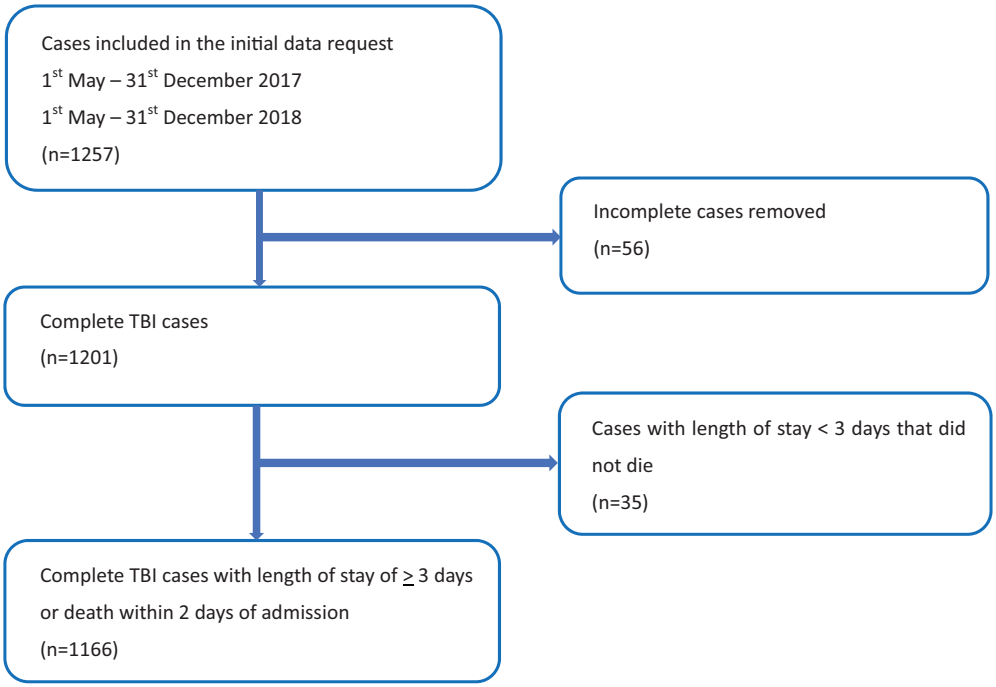

Figure 1. Flow Chart Displaying Stages of Dataset Refinement.
TBI, traumatic brain injury

Table 1. Demographic summary for all participants and for those before MUP and after its implementation.

		All cases of TBI ($n = 1166$)	Pre-MUP ($n = 509$)	MUP ($n = 657$)	p value
Males (n, %)		773 (66%)	337 (66%)	436 (66%)	1.000
Age group, years (n, %)	<20	76 (6%)	31 (6%)	45 (7%)	0.179[a]
	20–39	204 (18%)	86 (17%)	118 (18%)	
	40–59	317 (27%)	157 (31%)	160 (24%)	
	60–79	535 (46%)	220 (43%)	315 (48%)	
	≥80	34 (3%)	15 (3%)	19 (3%)	
SIMD quintile (n, %)	1 (most deprived)	391 (34%)	172 (34%)	219 (33%)	0.612[a]
	2	235 (20%)	105 (21%)	130 (20%)	
	3	202 (17%)	80 (16%)	122 (19%)	
	4	179 (15%)	85 (17%)	94 (14%)	
	5 (least deprived)	159 (14%)	67 (13%)	92 (14%)	
Season (n, %)	Autumn	476 (41%)	212 (42%)	264 (40%)	0.302[b]
	Winter	156 (13%)	68 (13%)	88 (13%)	
	Spring	144 (12%)	61 (12%)	83 (13%)	
	Summer	390 (33%)	168 (33%)	222 (34%)	
Fall (n, %)		724 (62%)	311 (61%)	413 (63%)	0.307
Moving Vehicular Accident (n, %)		235 (20%)	109 (21%)	126 (19%)	0.384
Assault (n, %)		135 (12%)	59 (12%)	76 (12%)	1.000
Isolated TBI (n, %)		174 (15%)	85 (17%)	89 (14%)	0.153
ISS (mean, SD)		18.9 (11.0)	19.5 (11.1)	18.5 (11.0)	0.161[c]
GCS ≤8 (n, %)		240 (21%)	112 (22%)	128 (20%)	0.967
Surgery (n, %)		316 (27%)	153 (30%)	163 (25%)	0.053
ITU usage (n, %)		383 (33%)	181 (36%)	202 (31%)	0.094
HDU usage (n, %)		363 (31%)	211 (32%)	152 (30%)	0.578
Length of stay ≥21 days (n, %)		283 (24%)	113 (22%)	170 (26%)	0.167
30-day mortality (n, %)		205 (18%)	97 (19%)	205 (18%)	0.277
Alcohol related TBI (n, %)		509 (36%)	184 (36%)	239 (36%)	0.985

TBI: traumatic brain injury; MUP: Minimum Unit Pricing; SIMD: Scottish Index of Multiple Deprivation; ISS: injury severity score; SD: standard deviation; GCS: Glasgow Coma Scale; ITU: intensive treatment unit; HDU, high dependency unit.
p value obtained from Chi Squared test with continuity correction except for: [a] Chi squared test for trend; [b] Pearson's Chi Squared test and; [c] Student's t test.

Table 2. Comparison of baseline data between TBI associated with, and not associated with alcohol.

		Non-alcohol related ($n = 743$)	Alcohol related ($n = 423$)	p value
Males (n, %)		451 (61%)	322 (76%)	<0.001
Fall (n, %)		443 (60%)	281 (66%)	0.025
Moving Vehicular Accident (n, %)		195 (26%)	40 (10%)	<0.001
Assault (n, %)		56 (8%)	79 (19%)	<0.001
Isolated TBI (n, %)		118 (16%)	56 (13%)	0.258
Age group, years (n, %)	<20	64 (9%)	12 (3%)	<0.001[a]
	20–39	98 (13%)	106 (25%)	
	40–59	164 (22%)	153 (36%)	
	60–70	385 (52%)	150 (36%)	
	80+	32 (4%)	2 (1%)	
SIMD quintile (n, %)	1 (most deprived)	196 (26%)	195 (46%)	0.001[a]
	2	148 (20%)	87 (21%)	
	3	147 (20%)	55 (13%)	
	4	134 (18%)	45 (11%)	
	5 (least deprived)	118 (16%)	41 (10%)	
Season (n, %)	Autumn	322 (43%)	154 (36%)	0.139[b]
	Winter	96 (13%)	60 (14%)	
	Spring	86 (12%)	58 (14%)	
	Summer	239 (32%)	151 (36%)	
ISS (mean, SD)		19.4 (11.5)	18.1 (10.0)	0.042[c]
GCS <8 (n, %)		136 (18%)	104 (25%)	0.013
Surgery (n, %)		204 (28%)	112 (27%)	0.770
ITU usage (n, %)		231 (31%)	152 (36%)	0.103
HDU usage (n, %)		231 (31%)	132 (31%)	1.000
Length of stay ≥21 days (n, %)		184 (25%)	99 (23%)	0.653
30-day mortality (n, %)		145 (20%)	60 (14%)	0.026

TBI: traumatic brain injury; MUP: Minimum Unit Pricing; SIMD: Scottish Index of Multiple Deprivation; ISS: injury severity score; SD: standard deviation; GCS: Glasgow Coma Scale; ITU: intensive treatment unit; HDU: high dependency unit.
p value obtained from Chi Squared test with continuity correction except for: [a] Chi squared test for trend; [b] Pearson's Chi Squared test and; [c]Student's t test.

consequent change in injury mechanism or severity, patient clinical course or 30-day mortality.

Strengths and limitations

The principal strength of this study is that the STAG national dataset is comprehensive and includes data from up to 27 of 30 hospitals with an emergency department in Scotland, and all facilities with designated trauma capabilities. The dataset is recognised as being highly complete, robust, and representative (https://www.stag.scot.nhs.uk,[23,31,32] and therefore results of this study are generalisable to Scotland as a whole, and may have importance to other nations.

Table 3. Complete multiple logistic regression model investigating the impact of MUP on odds of alcohol related traumatic brain injury correcting for season, age group, sex and SIMD quintile.

Variables	Adjusted OR	95% CI		*p* value
MUP	1.063	0.824	−1.371	0.638
Season				
Autumn	ref		ref	ref
Winter	1.269	0.857	−1.879	0.234
Spring	1.363	0.908	−2.048	0.135
Summer	1.274	0.949	−1.71	0.107
Age group				
<20	ref		ref	ref
20–40	5.556	2.802	−11.017	<0.001
40–<60	5.451	2.803	−10.598	<0.001
60–<80	2.519	1.305	−4.862	0.006
80+	0.437	0.091	−2.102	0.302
Sex				
Female	ref		ref	ref
Male	1.638	1.226	− 2.186	0.001
SIMD quintile				
1	ref		ref	ref
2	0.579	0.412	−0.814	0.002
3	0.386	0.264	−0.562	<0.001
4	0.376	0.251	−0.563	<0.001
5	0.384	0.252	−0.584	<0.001

OR: odds ratio; CI: confidence interval; MUP: minimum unit pricing; SIMD: Scottish Index of Multiple Deprivation.

Table 4. Multiple regression models for secondary outcome measures corrected for season, age group, sex and SIMD quintile.

	Adjusted OR	95% CI		*p* value
Fall	1.068	0.815	−1.399	0.632
MVA	0.874	0.647	−1.180	0.380
Assault	1.042	0.701	−1.549	0.838
ISS	−0.845	−2.116	−0.426	0.192[a]
Length of stay ≥21 days	1.1233	0.937	−1.622	0.134
GCS <8	1.162	0.869	−1.553	0.313
Surgery	0.796	0.608	−1.042	0.097
ITU usage	0.828	0.641	−1.071	0.150
HDU usage	1.124	0.871	−1.450	0.368
30-day mortality	1.243	0.913	−1.243	0.168

OR: odds ratio; CI: confidence interval; MVA: moving vehicular accident; ISS: injury severity score; GCS: Glasgow Coma Scale; ITU: intensive treatment unit; HDU: high dependency unit.
Multiple logistic regression was performed except [a] where multiple linear regression was performed. Adjusted OR in this case refers to beta value.

Table 5. Stratified sensitivity analysis of primary outcome measure restricted to the most deprived group.

	Adjusted OR	95% CI		*p* value
Alcohol-related TBI	1.095	0.8710	−1.658	0.705

OR: odds ratio; CI: confidence intervals; TBI: traumatic brain injury.

There are predictable limitations with the conduct of a retrospective cohort study.[25] First, though we believe the sample was representative, the principal limitation was the conduct of a two-point analysis instead of a time series analysis, an appropriate study design for the investigation of a policy intervention. While this was the initial intention, limitations second to the COVID-19 pandemic prevented acquisition of a dataset large enough to conduct time series analysis – a method that permits characterisation of trends over time, rather than simply comparing between two points. Second, MUP was introduced during a Football World Cup year, a time during which alcohol consumption, violent crime and trauma workload is increased,[33,34] and may have diminished in some way any effect of MUP. The obscuring effects of this global event might have been mitigated by controlled analysis with corresponding data from England where this legislation does not exist.[21,22] Third, STAG data are limited to hospital admissions and therefore patients with more 'minor' head injuries, regardless of the development of subsequent significant sequelae,[35] may not be adequately represented in our population. Fourth, STAG records outcome data as either discharge from the hospital, or mortality at 30 days. It is therefore conceivable, though unlikely, that a discharged patient who subsequently died within 30 days would be missed. Fifth, STAG received more complete data from more hospitals in 2018 than in 2017 and this difference in size meant that absolute number of TBI admissions could not be used as an outcome measure. Larger datasets such as the Scottish Morbidity Record may enable this but lack the granularity of data offered by STAG. Lastly, STAG does not include information about important covariates, including the level of education, which has associations with alcohol consumption[36] and alcohol-related medical events.[37]

Interpretation of the result in the wider context

In Scotland, MUP has been successful in reducing off-trade alcohol purchases[21,22] but we found that MUP has not effected any corresponding changes in the odds, severity and outcomes of patients with TBI in the eight months since implementation. These findings are similar to those by[38] who carried out a multi-component mixed-methods study investigating the clinical and non-clinical impact of MUP. They found that MUP led to no change in a controlled analysis of alcohol-related emergency department attendance and suggest that the price set by MUP was perhaps too low to result a significant clinical difference. Another clinical study found a decrease in patients discharged with alcohol-related liver disease in a large teaching hospital after MUP was implemented.[39] MUP has also been shown to be associated with a relative reduction in MVAs in Scotland[40] but this did not translate to a change in MVA-associated TBIs in our study.

Similar legislation has been implemented in Canada, Russia and, more recently, Australia. For the past 40 years, provincial regulatory bodies in Canada have been able to set the MUP for alcoholic beverages, demonstrating that a 10% increase in alcohol price is associated with a 32% reduction in wholly alcohol attributed deaths.[19] Similar declines were also seen in violent crimes and nighttime alcohol-related driving offences, but only in young men.[41] In women over 25 years of age, emergency department admissions second to alcohol-related MVA also decreased six months after implementation.[42] In Russia, MUP on vodkas was introduced in 2003, the first of a series of aggressive alcohol policies including advertising restrictions, increasing taxes on ethyl alcohol, and sales restrictions.[43] Follow-up studies showed a 43% reduction in *per capita* alcohol consumption and a decrease in all-cause mortality by over 36% over a 13-year period (Russia's alcohol policy: a continuing success story 2019).[18] In Australia, MUP, combined with the introduction of local policy enforcement in the form of police officers stationed at alcohol vendors, resulted in a 4.5% absolute risk reduction in alcohol-related ICU admissions.[44] There was no research from these regions or indeed in the wider literature, to allow direct comparison of the impact of MUP on TBI in Scotland with other populations with similar legislation.

Several hypotheses can be proposed to explain why TBI did not change after the implementation of MUP in Scotland. Reductions in alcohol purchases have only been demonstrated in the off-trade sector in Scotland. It may be that trade alcohol consumption, responsible for 31% of alcohol purchases in Scotland (www.drinkaware.co.uk[45]), has not changed after MUP and may

be disproportionately associated with intoxication leading to TBI. In addition, the immediate decrease of 9.5 grams of weekly alcohol purchased per adult per household following MUP[21] may not have been large enough to effect change in TBI, which may potentially manifest with more sizeable reductions, something previously suggested.[38] Other regions saw success when MUP was incorporated parallel to other alcohol policies, so it may be that MUP implementation has limited clinical impact alone, but may have interactive effects when combined with other interventions such as advertising and sales restrictions. Furthermore, this study analysed the effect of MUP on TBI in a period encompassing the first eight months following its implementation. This may be too early to demonstrate a change and others have shown a lagged effect with similar legislation.[41] Finally, it is noted that the Kantar Worldpanel's household shopping panel data utilised by[21] and[22] for the investigation of the impact of MUP legislation on alcohol purchases is not representative of males who are heavy drinkers, a group which have high rates of TBI. Heavy drinkers and alcohol dependent individuals may exhibit compulsive use[46] and economic legislation, on its own, may not reduce drinking in this group. Interestingly, qualitative research exploring the impact of MUP on perceptions and consumption patterns of heavy drinkers found little difference in self-reported consumption in this group.[47] Although members of this group were found to have a high awareness of MUP, they seemed to have a limited understanding of how the legislation works. Perhaps specific targeted campaigns may be delivered alongside economic legislation to improve outcomes and understanding in high-risk subgroups.

Our incidental finding that patients with alcohol-related TBI have lower mortality rates has interestingly been described in animal models and in clinical practice.[48,49] However, adjusted clinical models seem to demonstrate that the apparent protective effect of alcohol is second to several covariates including mechanism of injury, and these effects are eliminated when these variables are included in analyses[50,51]

Future work

Any future work on the effects of MUP on alcohol-related TBI, or other clinical outcomes, should be conducted using a time series analysis in order to characterise changes beyond a limited two-point comparison and should be controlled for trends in neighbouring populations. If possible, these data should also contain detail of important covariates including alcohol consumption and dependency. Most importantly, there is a need for qualitative research to explore the lived experiences of alcohol consumption in the context of MUP. An in-depth understanding of the attitudes, behaviours and wider social determinants of alcohol consumption behaviour is required to help direct any future public health legislation.

Conclusion

The introduction of minimum unit alcohol pricing in Scotland was not associated with a change in the number, severity or outcome of patients with TBI. While limitations in analysis mean that results should be considered with caution, these findings warrant further quantitative and qualitative research into the clinical and behavioural impact of MUP.

Disclosure statement

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