Modelling the public health and safety impacts of liquor licensing changes on communities: Enhancing evidence-based liquor licensing decisions

NATIONAL DRUG RESEARCH INSTITUT, HEALTH SCIENCES, CURTIN UNIVERSITY

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STAGE 2, PROJECT COMPLETION REPORT

Modelling the public health and safety impacts of liquor licensing changes on communities: enhancing evidence-based liquor licensing decisions

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1. PROJECT OVERVIEW

There is currently intense interest in finding efficient and reliable ways to inform evidence-based liquor licensing decisions. The WA Liquor Control Act currently identifies harm minimisation as a primary objective of the Act. This project, organised into 4 stages, will develop a model to assist decision makers and others (possibly the general community) in making an unbiased and independent prediction of the likely impacts of proposed/planned licensing changes on a range of alcohol-related indicators (e.g. emergency department presentations, road crashes, assaults) within WA and other Australian jurisdictions. The model will take into account the features of a specifically proposed change to the liquor licensing landscape in a particular region (e.g. new liquor store, extended trading permit for existing hotel) and the demographic and socio-economic characteristics of the location in which it will occur. Indicators of alcohol-related harms will be drawn from a range of reliable sources including alcohol sales data, hospital admissions, emergency department presentations, deaths and police reported assaults and road crash data. The aim of this project is to enhance the process by which evidence-based decisions regarding liquor licensing applications are carried out. Enabling an evidence-based approach underpinned by reliable research evidence which will ultimately reduce the harms associated with alcohol supply and reduce the burden of injury and disease borne by health, police, communities and individuals.

Stage 1 of the project (18 months), involved the formation of three longitudinal datasets which will support modelling of the various effects that changes to outlet density and other known influencing characterises such as trading hours and trading conditions (e.g. licence type, restaurants vs. hotels) have on indicators of alcohol-related harm. The three historical databases include: (i) liquor licensing outlet data (e.g. alcohol sales volumes, trading hours, licence type and special conditions of trade); (ii) a range of health and offence data; and (iii) demographic and socio-economic data (e.g. population estimates, income, employment, SEIFA). Stage 1 also involved the geocoding of licenced outlets and the coding of harm indicators to postcodes.

Stage 2 aims to widen the national relevance of this project by investigating whether reliable proxy measures for alcohol sales can be identified using readily accessible data. By establishing a reliable proxy or suite of composite measures for alcohol sales, Stage 2 will enhance the generalizability of the model to other jurisdictions but will also enable the impact of newly proposed outlets to be estimated at the time of application. From this, a matrix of characteristics for predicting range of alcohol sales will be constructed for application to forecasting models in Stage 3.

Stage 3, to commence upon completion of Stage 2, will focus primarily on analysis and modelling. Stage 4 will centre on establishing a web-based interface which will allow users to enter basic information on a region of interest and produce up to date reports on the estimated impact on harm indicators of liquor licensing changes. Funding will be sought for Stages 3 & 4 once Stage 2 is completed.

The project objectives are to:

- Construct historical databases containing details of licensed outlets, alcohol-related harm indicators and demographic/socio-economic characteristics for WA (Stage 1).
- Geocode all licensed outlets trading in WA from 1990 onwards (Stage 1).
- Identify reliable proxy measure[s] of alcohol sales volumes purchased by licensed outlets (Stage 2).
- Conduct predictive analyses on comprehensive longitudinal data to enable the impact of future changes in liquor licensing to be forecast at regional levels (Stage 3).
- Inform, enhance and support evidence-based liquor licensing decisions in WA by constructing a web-based tool that produces region-specific estimates of alcohol-related harm under varying liquor licensing scenarios (Stage 4).

This report details the methods and results from Stage 2 which focused on identifying potential proxy measures for alcohol sales.

2. POTENTIAL PROXY MEASURES FOR ALCOHOL SALES

WA liquor licensing regulation outlines several major types of liquor trading licenses. These include hotels, taverns, restaurants, liquor stores, clubs, nightclubs and small bars, as well as special facility licences which are further broken down by type. Sales of alcohol for consumption on or off the premises are determined by licence type. For example, in WA, liquor stores can only sell alcohol for consumption off the premise, nightclubs can only sell alcohol for consumption on the premises and hotels and taverns may sell alcohol to be consumed either on or off the premises. Table 1 summarises WA licence types, types of alcohol sales allowed and the number of outlets in 2015/16 according to the Department of Racing, Gaming and Liquor Annual Report 2015-2016. We undertook to identify whether these distinctions and other measurable characteristics of licensed outlets might be useful for construction of proxy measures for alcohol sales including: outlet trading/brand name; physical size of outlets; and other physical characteristics such as car parking bays, patron capacity and fridge space. A summary of methods applied to determine associations between alcohol sales, brand name, and other characteristics have been detailed below.

Table 1. Licence types in WA, types of sales allowed and number of outlets[1]

Licence code	Licence type	Grouping in analyses	Sales for consumption on/off premises	Number of outlets (n)
601	Hotel	Hotel	On & off	276
602	Tavern	Tavern	On & off	393
603	Liquor Store	Liquor Store	Off	584
604	Club	Club	On & off (restrictions to off)	413
605	Hotel Restricted	Other	On & off (restrictions to off)	57
606	Restaurant	Other	On	977
607	Nightclub	Other	On	42
616	Wholesaler	Not included	Off	N/A
618	Producer	Not included	On & off (restrictions to on)	N/A
619	Club Restricted	Other	On	569
621	Casino	Other	On	1
634	Small Bar	Other	On	111
638	Tavern Restricted	Other	On	49
608 – 615, 620, 622 – 633, 635 – 637, 688	Special Facility – Winehouse, canteen, theatre, transport, ballroom, reception centre, Australian wine, refreshment room, tourism, supplier, education & training institute, sports arena, food hall, caterer, bed & breakfast, room service, amusement venue, wine club, liquor auction, education & training course, transitional, other	Other	Varies	570

[1]Data source: Department of Racing, Gaming and Liquor Annual Report 2015/2016, p17.

2.1 Trading name of outlets

2.1.1 Methods

Brand names of off-site outlets

In WA, branding and franchising for on-site outlets is very rare and the vast majority of hotels/taverns retain individual trading names. However, this is not the case for liquor stores where a core set of store brands (e.g. Thirsty Camel, BWS, Liquorland, Bottlemart) make up a large proportion of all off-site outlets. It was postulated that off-site outlets with the same brand would also share other characteristics (e.g. management approach, size and layout, marketing and advertising strategies, stock range, product pricing) and therefore be more similar in terms of sales by volume and type to each other than they would be to off-site outlets as a whole. Common brand names for outlets with an off-site component (i.e. alcohol sold for consumption off the premises) are readily identifiable through the Department of Racing, Gaming and Liquor (DRGL) on-line 'find a licence' search tool (https://portal.rgl.wa.gov.au/forms/fr/search/findalicence/new).

A complication, however, was that in WA, alcohol can be purchased for off-site consumption from both liquor stores and premises licensed as hotels or taverns: liquor stores exclusively sell alcohol to be consumed off the premises; and outlets with a hotel or tavern license are permitted to sell alcohol for consumption both on and off the premises. Outlets which sell alcohol that may be consumed off the premises also vary in terms of their physical setting. For example, some are stand-alone bottle shops situated on their own site or separately located within a shopping centre, while many others are placed as detached bottle shops and adjoin a hotel or tavern e.g. drive through bottle shops attached to hotels. Importantly, many bottle shops that are adjoined to a hotel/tavern are also licensed under the hotel/tavern licence rather than a separate off-site outlet licence. This meant that identifying off-site outlets by searching for those licensed specifically as liquor stores (i.e. licence code 603) would exclude many outlets for which a large proportion of total sales is for off-site consumption (i.e. hotels/taverns with bottle shops). Added to this, many bottle shops linked to a hotel/tavern may trade and market themselves to the public under common brand names but are registered with an alternative name that only identifies the hotel/tavern. Discussion with the Department of Racing Gaming and Liquor indicated that it was not possible to directly identify hotels/taverns with detached bottle shops from existing electronic records. It was necessary therefore to establish a reliable means of identifying detached bottle shops using an alternative source of information available to the general public (described below).

Identifying detached bottle shops

Detached bottle shops are off-site outlets which are co-located with a hotel or tavern and operate under the same licence as that hotel or tavern but commonly have a different trading name (e.g. Thirsty Camel, Bottlemart). As they share the same licence number, alcohol sales from detached bottle shops would be indistinguishable from sales made through the hotel or tavern licence component under which they operate. In order to appropriately classify outlets and include all brand names for off-site outlets, it was necessary to identify outlets with detached bottle shops and their brand names.

Detached bottle shops were identified by manually searching current Google and Google Maps for outlets with hotel or tavern licences. Table 2 summarises outlets with a hotel or tavern licence with a detached bottle shop. For a small number (n = 23, 4%) of outlets could not be identified via Google or Google Maps, hence presence of a detached bottle shop is unknown. These outlets were classified as being without a detached bottle shop.

Table 2. Detached bottle shops at hotels/taverns in WA[1]

Hotel or tavern with a detached bottle shop?	Metro		Non-metro		Total	
Yes	136	46%	96	29%	232	37%
No	166	56%	235	71%	397	63%
Total	298	100%	331	100%	629	100%

[1]Search conducted throughout 2015/16

Alcohol-related keywords in outlet names

It was also postulated that use of alcohol-related keywords within the trading names of outlets may indicate whether a business's income is solely or partially derived from alcohol sales and the likely proportion of sales that can be attributed to alcohol sales. For example, an outlet with a tavern licence (where both on-site consumption and take away packaged liquor is permitted) that trades under a name containing the words 'liquor', 'beer', 'wine', or 'tavern' is likely to consider the sale of alcohol their primary business. Other outlets that do not include such keywords in their trading names may be more likely to use other commodities, such as food or coffee as their main income, with the sale of alcohol a smaller contributor. Application of alcohol-related keywords in outlet names was therefore also explored as a means of further defining/categorizing outlets within a licence type.

Outlets were firstly classified according to brand name. This was only relevant for off-site outlets, i.e. those with a bottle shop licence or a detached bottle shop trading under a tavern or hotel licence. Where off-site outlets did not have a brand name, i.e. they were not part of a chain or consumer group of outlets, they were classified according to the presence of an alcohol-related keyword in the outlet name, i.e. they either had an alcohol-related name or not. Outlets were considered as having an alcohol related name if they contained ‘liquor’, ‘wine’, ‘beer’, ‘cellar’, ‘pub’ or ‘tavern’. On-site outlets were also classified according to alcohol-related trading name. Note that outlets could not be classified according to both brand name and alcohol-related name as the former was designated to take precedence. In the case of taverns or hotels with a detached bottle shop, only the trading name of the bottle shop was classified, i.e. those with detached bottle shops were treated as bottle shops. See Table 3 for a summary of WA licensed outlets with alcohol-related names by licence type.

Table 3. Number of WA off-site outlets by brand name and liquor store type

Brand name	Detached bottle shop (hotel/tavern licence)	Stand-alone liquor store (liquor store licence)	Total
BWS	19	92	111
Bottlemart	95	0	95
Liquorland	1	82	83
Thirsty Camel	56	3	59
Cellarbrations	14	37	51
Liquor Barons	8	31	39
IGA Liquor	1	23	24
Non-chain DBS	19	0	19
Dan Murphy's	4	10	14
Vintage Cellars	0	12	12
Bottle-O	6	3	9
First Choice	4	6	10
Bucks Off Liquor	3	0	3
Woolworths	1	1	2
Down Under Cellars	1	0	1
Total	232	300	532

Statistical analysis

The feasibility of using outlet name characteristics to predict alcohol sales and thereby the suitability of their application as proxy measures, was initially gauged by using Multiple Linear Regression in two stages. The first stage modelled 2011/12 postcode-level volumes of sale by beverage type as the dependent variable and counts of liquor store brand names, as well as counts of outlet type with and without alcohol-related keywords as predictors, to identify the proportion of variance in alcohol sales accounted for at the postcode level. The results indicated that the presence of a brand name and alcohol-related keywords in outlet trading names predicted a large proportion of variance in alcohol sales from liquor stores and therefore warranted further analysis. In order to confirm the generalisability of the 2011/12 model over time, the second stage analysis repeated the first, but used 2008/09 WA total sales volumes by beverage type at

local government area level as the dependent variable. Results from both models were similar, suggesting that brand names and alcohol-related keywords had the potential to be used as proxy measures for alcohol sales at the postcode level.

Linear regression analysis was then used to develop a model for predicting postcode-level sales of *pure* alcohol from beer, wine and spirit sales and for total pure alcohol purchased by licensed outlet type in WA in 2012/13. Outlets with licences other than hotel, tavern, liquor store or club were aggregated into the category 'other' due to small numbers when considered individually (See Table 1 for grouping of licence type for analyses). Volume of pure alcohol sold for each beverage type was the dependent variable. Predictor variables included counts of outlets with a particular brand name, outlets with a non-brand name detached bottle shop (i.e. independently run detached bottle shop) and outlets with and without trading names with alcohol-related keywords by outlet type. Volumes of pure alcohol were calculated according to the National Alcohol Sales Data Project methodology [link to NASDP report here]. The conversion factors applied to total volumes sold to determine pure alcohol volumes are shown in Table 4. Table 5 summarises total and pure alcohol volumes by beverage type.

To test the effect of region (metro or non-metro) on the association between brand name, alcohol-related name and alcohol sales, interaction effects with region were added to the regression model. Results showed that for only a small number of outlet types (particular brand or with/without alcohol-related keywords in the trading name) region modified the effect on sales.

Table 4. Pure alcohol conversion factors applied to alcohol sales volumes

Beverage type	Beverage strength	Conversion factor
Beer	high beer	0.0476
	low beer	0.0348
Wine	high wine	0.1230
	low wine	0.0350
Spirits	spirits	0.1060

Table 5. Alcohol sales volumes by beverage type

Beverage type	Total alcohol volume (L)	Pure alcohol volume (L)
Beer	262,911,547	11,723,003
Wine	61,005,932	7,480,255
Spirits	40,764,050	4,320,989
Total	364,681,529	23,524,247

2.1.2 Results

The most common licence type was defined as ‘other’ and was made up of restaurants, nightclubs, small bars, casinos and special facility licenses (59%). Hotels made up 7% of outlets, 10% were taverns, 14% were liquor stores and 10% were clubs. (See Table 1 for details of licence type aggregation.)

A total of 14 off-site, liquor store brands were identified with BWS, Bottlemart, Liquorland and Thirsty Camel the most common. Half of all liquor stores (50%, n = 294) were classified according to brand name, while 36% of hotels (n = 98) and 34% of taverns (n = 135) were categorized according to an off-site outlet brand name. After categorization according to brand name, just 8% of outlets were categorized as having an alcohol-related outlet name. Under a third (28%) of liquor stores, 25% of taverns and less than 1% of hotels were categorized as having an alcohol-related outlet name. Descriptive statistics for alcohol-related outlet names are shown in Table 6.

Regression models for each beverage type and for total pure alcohol were statistically significant ($P<0.05$). Individual beverage type models were able to account for 90% of variance in pure alcohol sales from beer, 86% of variance in pure alcohol sales from wine, and 78% of variance in

sales of pure alcohol from spirits. The model for total pure alcohol was able to account for 92% of variance in sales. The regression coefficients are shown for each beverage type in Table 7. Figures 1 – 4 present the predicted alcohol sales against the actual sales by beverage type and for total pure alcohol.

These results suggest that when combined in a comprehensive model, alcohol-related outlet names and off-site outlet brand names have the potential to be used as proxy measures for alcohol sales at a postcode level, where reliable sales data are not available. However, to confirm generalizability, these results need to be replicated using data from other jurisdictions.

Table 6. WA licensed outlets with alcohol-related names by licence type

Licence type	**Categorised according to brand name**	**Alcohol-related name**	**Total**
Hotel	98	2	267
Tavern	135	97	393
Liquor Store	294	163	584
Club	-	0	413
Other	-	72	2376
Total	527	334	4042

Table 7. Regression model results for total pure alcohol volumes per postcode by beverage type, with predictor variables for bottle shop brand name and alcohol-related keywords in trading names

R2	0.9008			0.8636			0.7809			0.9197		
	Sales of pure alcohol from beer (L)			**Sales of pure alcohol from wine (L)**			**Sales of pure alcohol from spirits (L)**			**Total pure alcohol sales (L)**		
	Coef.	95% CI		Coef.	95% CI		Coef.	95% CI		Coef.	95% CI	
Brand name variables												
Hotel with DBS: A	2653.35	-409.51	5716.21	181.08	-2397.45	2759.60	1403.54	-404.67	3211.74	4237.96	-1269.77	9745.70
Hotel with DBS: B	21373.45	-830.57	43577.47	13992.90	-4699.95	32685.75	376.55	-12731.91	13485.01	35742.89	-4185.11	75670.89
Hotel with DBS: C	147730.80*	113331.70	182130.00	57262.61*	28303.05	86222.17	8396.87	-11911.17	28704.91	213390.30*	151532.60	275248.10
Hotel with DBS: D	14656.32*	7028.03	22284.61	1229.08	-5192.93	7651.09	4590.82*	87.35	9094.29	20476.22	6758.78	34193.66
Hotel with DBS: E	25058.80	-12465.71	62583.31	-345.10	-31935.77	31245.58	2913.48	-19239.65	25066.61	27627.19	-39850.62	95104.99
Hotel with DBS: G	52874.76*	19892.70	85856.83	25258.82	-2507.72	53025.36	15509.91	-3961.53	34981.34	93643.49*	34334.05	152952.90
Hotel with DBS: H	72599.44*	24088.82	121110.10	8325.62	-32513.91	49165.15	582.84	-28056.10	29221.78	81507.90	-5725.50	168741.30
Hotel with DBS: J	-20014.30	-57252.43	17223.83	-8031.02	-39380.60	23318.56	-1738.94	-23723.00	20245.12	-29784.26	-96747.09	37178.56
Hotel with DBS: K	12989.84	-31792.02	57771.69	12697.73	-25002.67	50398.13	-8888.09	-35325.70	17549.51	16799.47	-63728.73	97327.67
Hotel with DBS: L	40332.38*	24618.94	56045.82	6605.41	-6623.23	19834.04	5803.80	-3472.85	15080.45	52741.58*	24485.16	80998.00
Hotel with DBS: M	17379.61*	6513.31	28245.91	-4017.58	-13165.56	5130.41	2958.95	-3456.12	9374.03	16320.99	-3219.15	35861.12
Tavern with DBS: A	-14602.97	-48465.03	19259.08	-7136.18	-35643.55	21371.20	-7154.81	-27145.76	12836.14	-28893.97	-89785.83	31997.89
Tavern with DBS: B	3867.82*	39.44	7696.20	7498.83*	4275.84	10721.82	1055.97	-1204.17	3316.11	12422.62*	5538.29	19306.94
Tavern with DBS: C	13421.92	-2032.52	28876.36	17684.47*	4673.88	30695.07	-1010.22	-10133.97	8113.53	30096.17*	2305.48	57886.85
Tavern with DBS: D	4393.95	-21066.94	29854.85	2354.64	-19080.07	23789.34	2741.32	-12289.89	17772.52	9489.90	-36294.71	55274.52
Tavern with DBS: E	24049.81*	16210.89	31888.73	4429.72	-2169.62	11029.05	8500.51*	3872.70	13128.33	36980.04*	22883.84	51076.24
Tavern with DBS: F	301386.40*	251533.90	351239.00	2042.22	-39927.05	44011.49	1596.16	-27835.01	31027.34	305024.90*	215378.30	394671.40
Tavern with DBS: H	5819.94	-9769.71	21409.59	8399.50	-4724.93	21523.92	4878.55	-4325.02	14082.13	19097.99	-8935.84	47131.81
Tavern with DBS: I	1940.14	-26366.25	30246.52	37161.77*	13331.54	60992.00	13525.81	-3185.27	30236.88	52627.72*	1726.25	103529.20
Tavern with DBS: J	22268.96	-5254.60	49792.52	19255.62	-3915.58	42426.82	-377.93	-16626.86	15871.00	41146.65	-8347.13	90640.42
Tavern with DBS: L	103124.80*	34417.25	171832.40	26095.18	-31747.52	83937.88	7657.34	-32905.16	48219.84	136877.30*	13325.12	260429.60

Tavern with DBS: M	4165.89	-19915.56	28247.35	-4116.54	-24389.94	16156.86	4583.20	-9633.63	18800.03	4632.54	-38671.52	47936.61
Liquor store: A	-6133.78	-22591.97	10324.41	-7858.31	-21713.93	5997.31	8251.25	-1465.08	17967.58	-5740.83	-35336.49	23854.82
Liquor store: B	15308.22*	6129.83	24486.61	10469.17*	2742.18	18196.15	3303.27	-2115.32	8721.87	29080.66*	12575.79	45585.54
Liquor store: E	2641.02	-2212.23	7494.27	2236.67	-1849.13	6322.46	3812.01*	946.82	6677.19	8689.70	-37.57	17416.97
Liquor store: F	2547.11	-2805.15	7899.37	1378.14	-3127.75	5884.04	1684.31	-1475.48	4844.09	5609.56	-4015.05	15234.17
Liquor store: I	23722.17*	18200.65	29243.68	13991.07*	9342.69	18639.45	6397.69*	3137.98	9657.39	44110.92*	34181.96	54039.89
Liquor store: J	-48691.04*	-88891.42	-8490.66	-35544.79*	-69388.20	-1701.39	-16324.78	-40057.64	7408.09	-100560.60	-172850.20	-28270.97
Liquor store: K	2553.56	-6165.10	11272.21	3653.81	-3686.14	10993.76	1080.82	-4066.36	6228.01	7288.19	-8389.98	22966.36
Liquor store: M	37985.92*	19492.90	56478.93	46232.88*	30664.21	61801.56	14586.67	3669.06	25504.29	98805.48*	65550.73	132060.20
Liquor store: N	66788.48*	44364.68	89212.28	5309.20	-13568.67	24187.08	7964.35	-5273.86	21202.56	80062.03*	39738.81	120385.20
Alcohol-related name variables												
Hotel with alcohol-related name	-594.81	-11070.93	9881.32	6064.71	-2754.80	14884.22	6376.41*	191.68	12561.14	11846.31	-6992.20	30684.82
Hotel without alcohol-related name	-9758.05*	-18824.18	-691.92	2664.72	-4967.77	10297.20	-3502.09	-8854.41	1850.23	-10595.42	-26898.44	5707.59
Tavern with alcohol-related name	23044.15*	16751.46	29336.85	4532.50	-765.11	9830.11	5865.77*	2150.79	9580.75	33442.42*	22126.70	44758.14
Tavern without alcohol-related name	-8069.28	-40215.14	24076.58	17207.11	-9855.46	44269.67	469.16	-18508.61	19446.92	9606.98	-48198.76	67412.73
Liquor store with alcohol-related name	-7144.29	-23024.17	8735.59	-2923.16	-16291.92	10445.59	-10862.13*	-20237.04	-1487.21	-20929.58	-49485.30	7626.14
Liquor store without alcohol-related name	5344.54*	575.37	10113.71	8361.59*	4346.58	12376.60	5395.55*	2580.01	8211.10	19101.69*	10525.61	27677.76
Club without alcohol-related name	-5848.79*	-8867.25	-2830.34	-2794.94*	-5336.08	-253.80	-1281.76	-3063.75	500.23	-9925.49	-15353.38	-4497.61
Other licence without alcohol-related name	2351.68*	1755.69	2947.67	1468.80*	967.06	1970.55	1021.42*	669.57	1373.28	4841.91*	3770.17	5913.64
Other licence with alcohol-related name	-12072.78*	-15700.48	-8445.08	623.45	-2430.59	3677.49	-2811.73*	-4953.40	-670.07	-14261.06	-20784.50	-7737.61
Constant	320.83	-3796.72	4438.39	-481.67	-3948.11	2984.77	-1684.00	-4114.86	746.86	-1844.83	-9249.16	5559.49

*$P < 0.05$. CI, confidence interval; DBS, detached bottle shop.

Figure 1. Relationship between beer pure alcohol concentration volume (PACV) per postcode and predicted beer PACV

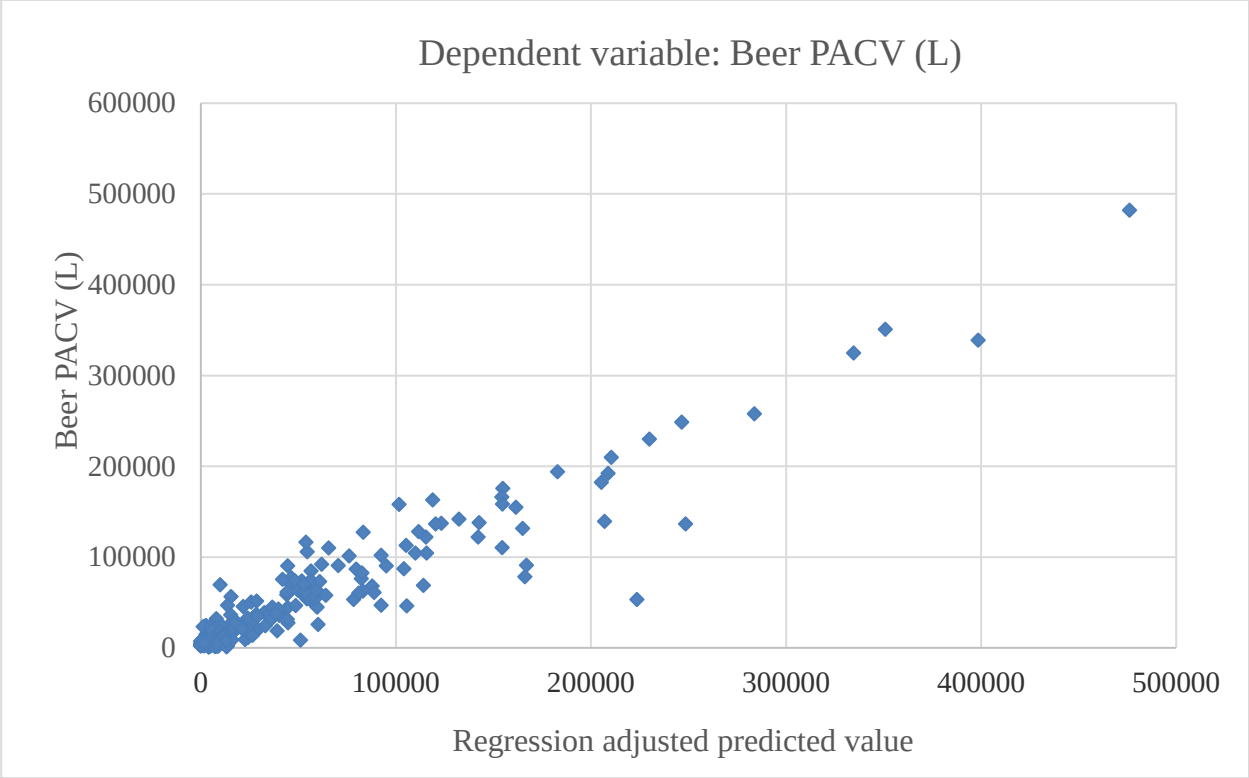


Figure 2. Relationship between wine PACV per postcode and predicted wine PACV

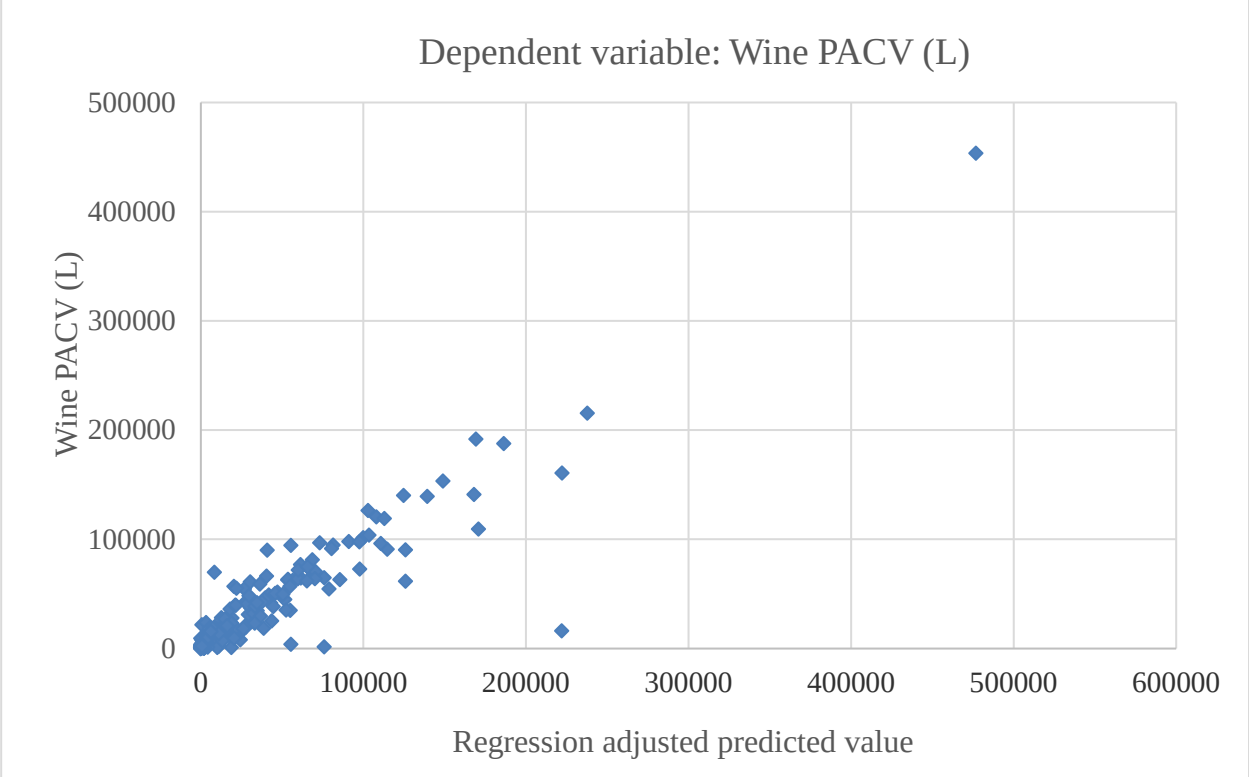


Figure 3. Relationship between spirit PACV per postcode and predicted spirit PACV

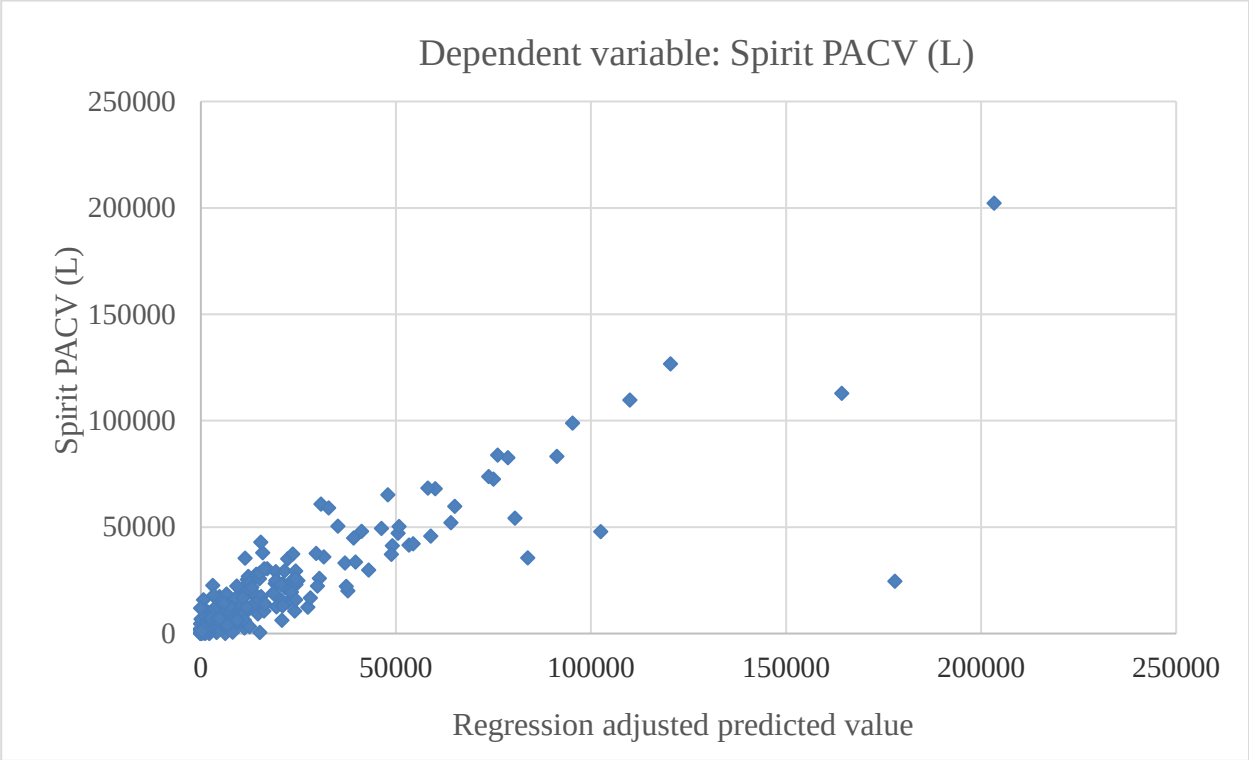
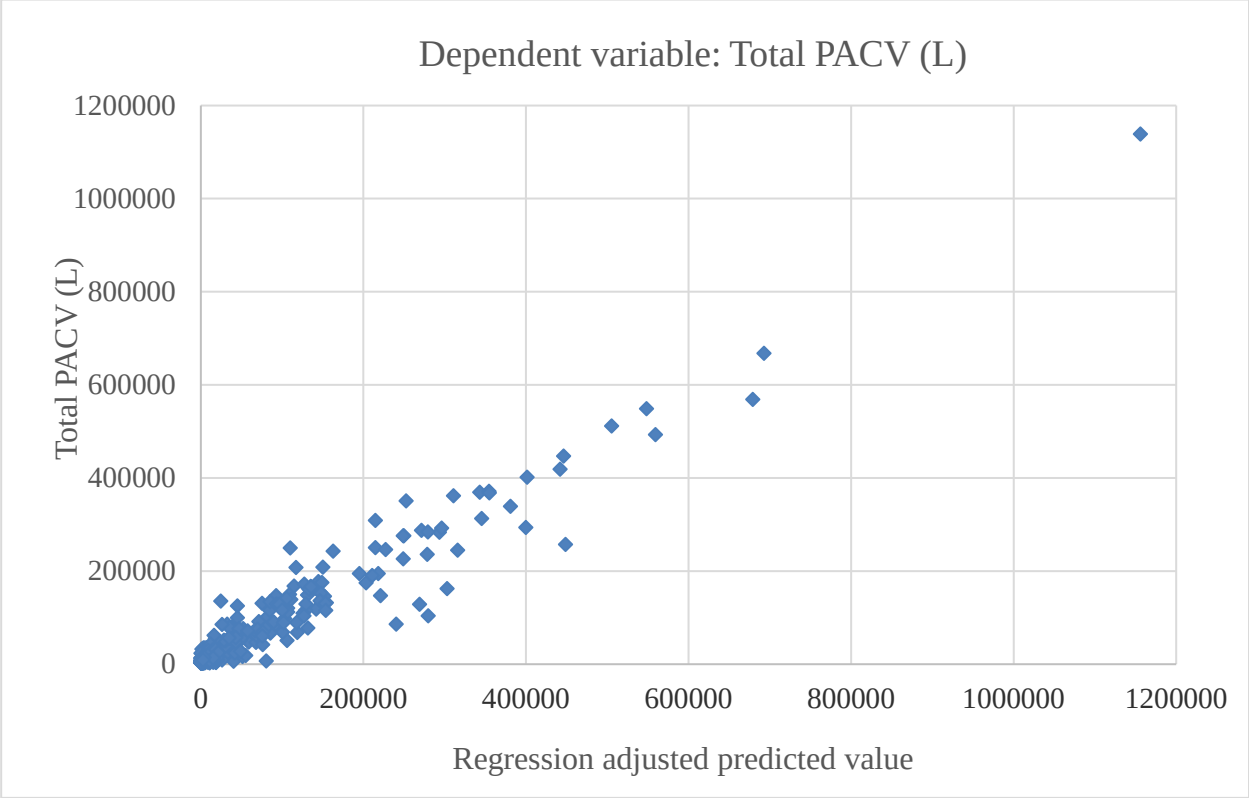


Figure 4. Relationship between total PACV per postcode and predicted total PACV



2.2 Size (Area) of Outlets

It was hypothesized that total land area comprised of alcohol outlets at a postcode level might predict volumes of alcohol sales made at a postcode level. An initial search of local council websites as well as liaison with the Department of Racing Gaming and Liquor determined that it was not practical to obtain area of outlets from electronic planning or submission information. Therefore, a manual search of building area measurement (m^2) using Google maps was proposed. To first establish feasibility, land area measurements were taken of a random sample of 68 of the 397 hotel or tavern licenced outlets operating in the metropolitan area that did not have a detached bottle shop. Only the area of the building's footprint (including beer garden) was measured via Google Maps i.e. licensed drinking areas across multiple stories were not able to be reliably included. See example of measurement in Figure 5.

Figure 5. Example of measurement of on-site outlet area using Google Maps

In a small number of cases, limitations were encountered when attempting to measure outlet size including: measuring size of outlets situated within a larger building, (e.g. shopping complex); and difficulty differentiating between area dedicated to accommodation and area dedicated to the sale of alcohol for some types of outlets (e.g. motels). Where this occurred approximations were made based on local knowledge. In addition, for some 5% of non-metropolitan outlets, it was difficult to determine whether outlets manually identified via Google maps were in fact the correct outlets. Once it was determined that land area estimates of the majority of hotels and taverns without bottle shops could be identified using this method, the remaining hotels and

taverns without detached bottle shops throughout the state were measured using the same method.

Once individual land area estimates for all (identifiable) hotels and taverns without a detached bottle shop were made, the relationship between total on-site outlet area and sales per postcode was analysed using ordered logistic regression. Ordered logistic regression models were run for each beverage type, i.e. beer, wine and spirits, with volume of sales as the outcome variable. Models controlled for licence type (i.e. hotel or tavern) and region (i.e. metro or non-metro). Feasibility analysis indicated, however, that land area of hotels/taverns was unlikely to be a suitable proxy for alcohol sales as the two variables were only very weakly correlated.

2.3 Other potential proxy measures considered

2.3.1 Physical characteristics of outlets required in licence submission

An online search for planning submissions made to local councils as well as discussions with the Department of Racing Gaming and Liquor did not find a practical or consistent way to identify venue characteristics such as floor space, refrigeration capacity, patron numbers, parking bays or staffing numbers. Although no suitable data sources could be found for WA, such information could potentially be investigated for application as a proxy for alcohol sales in jurisdictions where this information is consistently collected in a standardised manner and made available electronically.

2.3.2 Google data on popular times

Google quantifies level of patronage (by time of day and day of week) for businesses whose trading hours are listed on Google and which have adequate popularity data, using information derived from persons who store their mobile GPS location information on Google servers. Popular times are based on average popularity over the last several weeks. As this data may reflect volume of patronage and therefore alcohol sales, feasibility of its application as an alcohol sales data proxy was investigated. Unfortunately, it was evident that Google currently produces a temporal customer profile for only a minority of WA outlets and that the manner of deriving popular times negated comparisons across businesses. For the present, therefore, this approach proved problematic due to limitations in ability to compare across businesses. However, a similar approach based on web-generated data could be reconsidered in the future as systems improve and become more widespread.

2.3.3 Water waste tests

The use of wastewater tests, to estimate alcohol consumption in WA is gathering interest. Recent studies both internationally and within Australia have found the testing of raw wastewater for alcohol metabolites to be a viable means of determining catchment population alcohol consumption. While currently no system for testing wastewater in Western Australia exists, future application could both support and act as a check for currently collected sales data. However, wastewater sampling will likely be limited to where and when samples can be feasibly taken and may not enable the same level of geographic flexibility as other proxy measures. In jurisdictions where infrastructure to conduct wastewater tests are already in place, e.g. Victoria, alcohol metabolite calculations could be used to support other proxy measures.

3. RECOMMENDATIONS

Our investigation of potential proxy measures for alcohol sales demonstrated that off-site outlet brand names along with alcohol-related keywords in the trading names of outlets could serve as a proxy for alcohol sales in jurisdictions where alcohol sales data is not currently, consistently or reliably collected. In order to validate the generalisability of these results, replication of the analyses using data from other Australian jurisdictions that collect sales data is required. Nonetheless, this is an important finding considering that, presently, not all Australian jurisdiction have mandated the reporting of sales data by licensees to the responsible authority.

One of our primary considerations in identifying potential proxy measures for further testing was the degree to which underpinning data could be readily obtained. There is limited value in identifying proxy measures which are based on rare data or information which requires substantial resource investment to collect or access. Potential proxy data also needs to be reliable and routinely collected in a standardized format. The use of outlet trading names as a proxy for alcohol sales is therefore particularly appealing because of the ease of obtaining information on outlets, regardless of jurisdiction, and the relatively high level of accuracy that can be achieved with minimal resources.

Due to technological limitations, the use of data on popular times at on-site alcohol outlets currently collected by Google was not suitable for proxy analysis. Advances in technology, however, could allow utilization of such data and we recommend revisiting the use of popular time data in the future. Inability to access electronic data on physical attributes other than the outer perimeter of an outlet building proved an impediment to identifying alternative proxy measures such fridge space, patron capacity, car parking bays. More streamlined and consistent

collection of such information, as well as ensuring this information is publicly available (or at the least, able to be requested by research agencies) would allow further exploration of potential proxy measures for alcohol sales. Also worth consideration is the testing of wastewater for alcohol metabolites to determine population-level alcohol consumption. While this technology is relatively novel and not yet used in Western Australia for the purpose of monitoring alcohol consumption, future use may further enhance accuracy and generalisability in modelling alcohol-related harms.

We therefore recommend the following:

1. Advocate for the reliable and systematic collection of alcohol sales data in Australian jurisdictions where sales data collection is not currently undertaken.
2. Maintain reliable data collection practices that produce high quality data in Australian jurisdictions where alcohol sales data are currently collected.
3. Initiate the systematic collection of physical characteristics of licensed outlets by liquor licence regulators including, but not limited to, amount of floor space, amount of area dedicated to fridge space, patron capacity of on-site outlets, number of parking bays, presence of a drive-thru sales point.
4. Improve access to information on physical characteristics of outlets collected by departments regulating liquor licenses, e.g. by uploading plans and planning documents electronically.
5. Future investigation into the use of publicly available online information on business foot traffic (popularity) for the purpose of identification of reliable alcohol sales proxies.
6. Future investigation of wastewater testing for alcohol metabolites to improve estimates of alcohol consumption and identification of unrecorded consumption.

4. CONCLUSION

This report summarises the outcomes of Stage 2 of the project *Modelling the public health and safety impacts of liquor licensing changes on communities: enhancing evidence-based liquor licensing decisions*. The aim of Stage 2 was to identify proxy measures for alcohol sales which could be used in place of alcohol sales data in jurisdictions where reliable sales data are not available. Establishment of a reliable proxy will also enable estimation of the extent to which new outlets will influence total sales within a given region (e.g. postcode). A range of potential

measures were explored including brand names and alcohol keywords in trading names, web-based data on popular times of outlets, the physical area of buildings and other physical attributes which could potentially be obtained from planning documents and liquor licence applications. The analysis of both brand names and alcohol-related keywords, at postcode level, was found to be a good proxy accounting for the majority of variance in alcohol sales. We recommend that these analyses be replicated with data from other jurisdictions in order to confirm suitability as a proxy for sales in other regions of Australia. Other potential proxy measures may become viable in the mid to long term as technology and routine data collection processes improve.