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Department of Local
Government, Sport and Cultural
Industries

Banned Drinker Register: Interim report – Pilbara

Technology implementation and industry perspective

Towns/locations and licensed premises have been redacted to ensure anonymity is maintained.

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Executive Summary

Overview

Policy framework

The government of Western Australia is committed to policies and strategies that minimise the social harm associated with excessive alcohol consumption.

The Banned Drinkers Register (BDR) is a specific policy mechanism that the State Government is trialing, within an overall alcohol harm mitigation strategy. Anyone registered on the BDR is prohibited from purchasing takeaway packaged alcohol.

The BDR trial started in the Pilbara region on 1 January 2021.

The BDR process

People are placed on the BDR because they have: (i) voluntarily elected to place themselves on the BDR, or (ii) they are subject to either a Prohibition Order or (iii) a Barring Notice. A Prohibition Order will typically prohibit a person from being employed at and/or attend a specific licensed premises. A Barring Notice is issued when there is evidence of a person being: violent, disorderly, engaged in indecent conduct, or contravening a specific written law at or in the vicinity of a licensed premises.

BDR technology

BDR scanners alert licensed premise retail staff when someone is on the BDR and is not permitted to purchase packaged liquor. The system works by comparing information from scanned identification documents (e.g. driver licence) to data held on the BDR. Retail staff receive an immediate indication if a customer is on the BDR upon scanning an ID, and that information determines whether the sale can proceed.

Report perspective

Policy evaluations involve multiple perspectives. In this report the focus is on the perspective of the industry participants responsible for implementing the BDR. It is recognized that industry perspectives may be different to those of other stakeholders, and also a different perspective to government.

Report scope

The scope of this interim report is to consider the quality of the data collected from the BDR scanners; document the perspective of those operating the scanners on technology operation; identify potential issues the operation of the technology; present preliminary findings on impact; and identify any areas for potential improvement.

Industry perspective

Details on industry perspective were collected via an online survey. All participating stores were provided with an individual report with detailed data collected from the BDR scanners in their store, and provided with an opportunity to validate the data.

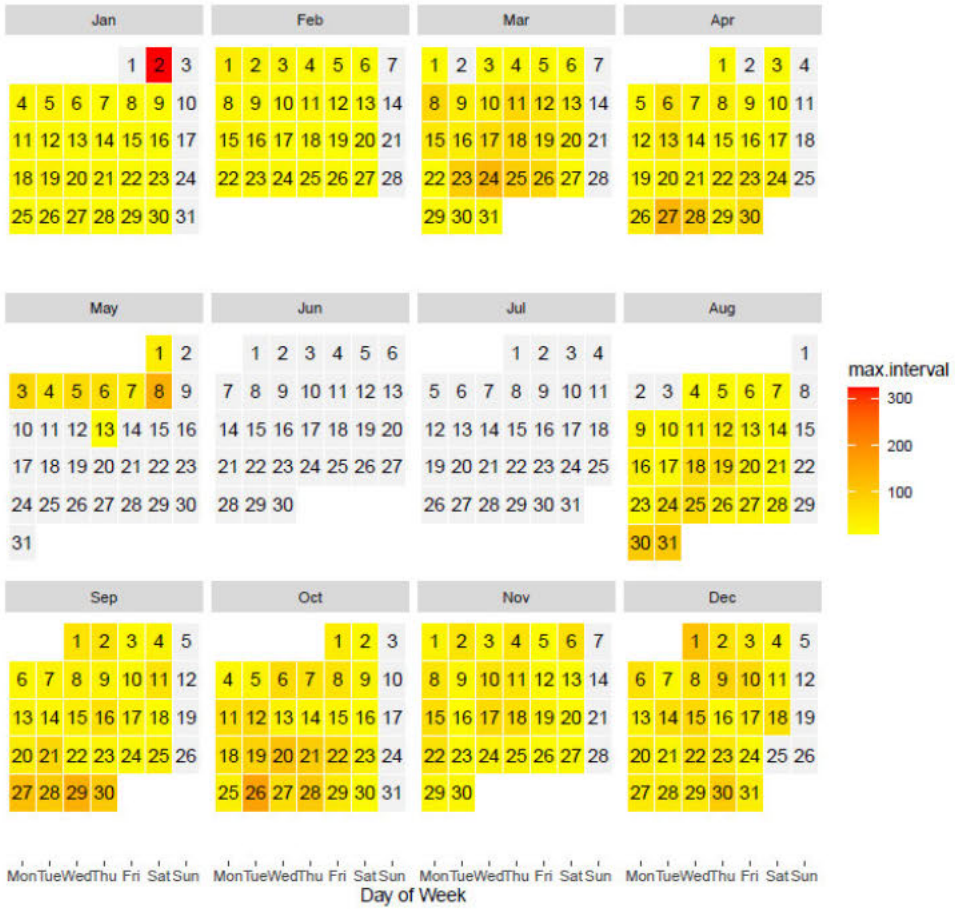
Key Findings

People on the BDR

Following six months of BDR operations in the Pilbara, the number of people on the BDR in the Pilbara has stabilised at a relatively low number. This is likely to reflect the maximum reach of the policy, as currently configured.

BDR technology is sometimes offline

Figure ES 2: Example of a specific store where the technology was offline



Note: Grey indicates days when the technology was offline

Table ES 2: Outcomes of scanning activity in the Pilbara: 2021

	Accept	Banned	Deny	Expired	Invalid	Not Acc.	Rescan	S115
No.	1,166,334	128	1,934	20,406	3,730	3,098	88,568	438
Percent	90.79	0.01	0.15	1.59	0.29	0.24	6.89	0.03

Industry perceptions

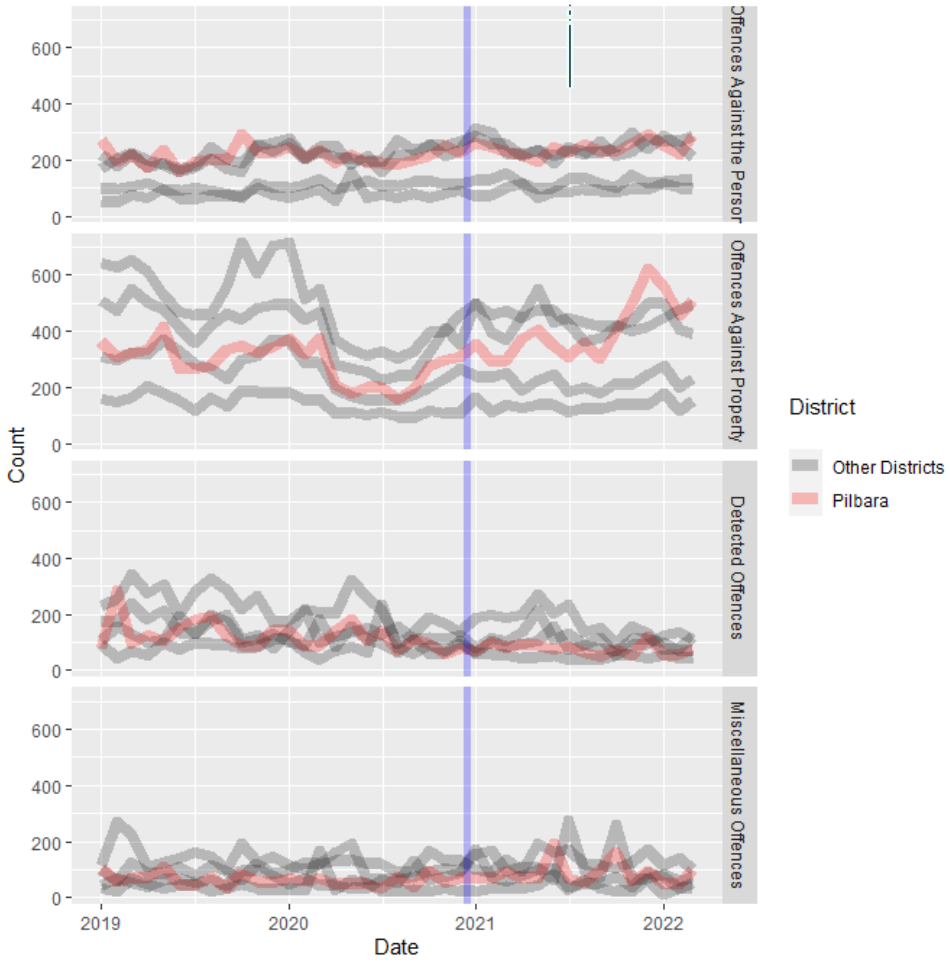
A wide variety of views were expressed by industry some key points include:

- The BDR has been implemented as expected
- Using the BDR scanners is an extra business cost (staff time), but it can be managed, in most locations
- Expected more people to be on the BDR
- The BDR would be successful if more people were on the BDR
- It could be more cost effective to target individuals directly for interventions
- There are some issues with tourists not understanding the system
- The BDR places an extra cost on the entire community, and the focus should be on relevant individuals only.

Measurable impact on crime

Alcohol consumption is only one of many factors associated with crime incidents. Following the introduction of the BDR, and controlling for other regional effects, there is no evidence of a reduction in crime for major crime categories of crime, in the Pilbara, relative to other regional locations in Western Australia that did not introduce a BDR. The sample period is relatively short.

Figure ES 3: Crime statistics in the Pilbara and comparison regions



Recommendations

Technology monitoring and maintenance

Current practice is to compile data at 12 months for an interim report and at 24 months for a final report. There is evidence that the scanner technology can be offline, at individual stores, for extended periods. A standardised store level reporting framework, that is largely automated could be established. If this report is run at regular intervals it would ensure problems with technology are identified and resolved in a timely manner. This is relevant to all trial jurisdictions.

New pathways to the BDR

The overall effectiveness of the BDR initiative is limited due to the low number of people registered on the BDR. The framework outlined in the Northern Territory *Alcohol Harm Reduction Bill 2017* provides a framework that could be used to expand the pathways to the BDR in WA. Within this framework there are

additional options for police and court related pathways to the BDR, and also an expansion of the range of people that can seek to place a person on the BDR.

Liquor restricted premises

Part 5B of the *Liquor Control Act 1988* provides for the creation of Liquor restricted premises. Increased engagement with such premises could be used to create an additional pathway to the BDR.

Service provider engagement

A harm minimisation approach requires involvement and engagement with support services. The link between support services and those placed on the BDR should be strengthened.

Potential store hopping

Analysis of time stamp data identified a small number of cases that may represent store hopping. Although the potential issue is minor, this is an area that could be further investigated with store owners.

Costs and benefits

Implementation and management of the BDR trial involves costs to society, via the direct cost of the technology, and via the Government staff time involved to manage and operate the BDR. There are also costs to store owners via the extra staff time required to make a sale. Finally, there are costs to some consumers, especially tourists, when they not have appropriate identification at the time of purchase. The potential benefits of the BDR include a reduction in social harm, and lower costs to government through lower policing and legal system costs. At the end of the 24-month trial period a full benefit-cost assessment of the BDR should be undertaken, where both direct and indirect costs are measured.

1 Introduction and overview

The Government of Western Australia is committed to policies that minimise the harms associated with excessive alcohol consumption.

The Banned Drinkers Register (BDR) is a specific policy mechanism that the Government is trialing, within an overall alcohol harm mitigation framework. The BDR approach is designed to assist licensees in addressing alcohol-related harm by enabling them to identify people prohibited from purchasing takeaway alcohol due to being listed on the BDR.

The BDR is a mechanism used to alert retail staff working in liquor sales when someone is on the BDR and is not permitted to be served packaged liquor. The system works by comparing information from scanned identification documents such as a driver license to data held on the BDR. Retail staff receive an immediate indication if a customer is on the BDR, and that information determines whether the sale can proceed.

People listed on the BDR are prohibited from purchasing takeaway alcohol because they have either voluntarily elected to be on the BDR, or they are subject to a current Prohibition Order[1] or a Barring Notice[2]. Voluntary applications require a person to contact the department directly, and there can be many reasons for a person electing to place themselves on the BDR.

This first interim report focuses on understanding the way the technology is working, and on documenting the perspective of those serving takeaway alcohol.

Industry participation in the program is voluntary, but industry sector engagement is essential if the BDR is to be successful. The technology and industry focus of this report is to allow the identification of potential improvements that can be made during the trial, that might also apply in other regions, and identify any issues with system use. It is explicitly acknowledged that the survey responses represent a specific interest group, and there are many other stakeholders.

The scope of this report addresses the following specific points: an evaluation of the BDR policy implementation, relative to industry expectations; analysis of crime activity trends before and after the introduction of the introduction of the BDT; the identification of operational issues; and advice on how to improve the operation of the BDR in practice, to ensure the policy better meets its purpose.

[1] Prohibition Order - issued by the Director of Liquor Licensing on application by the Commissioner of Police (Part 5A of the Liquor Control Act 1988.

[2] Barring Notice - issued by the Commissioner of Police (or Delegate) (s. 115AA or the Liquor Control Act 1988).

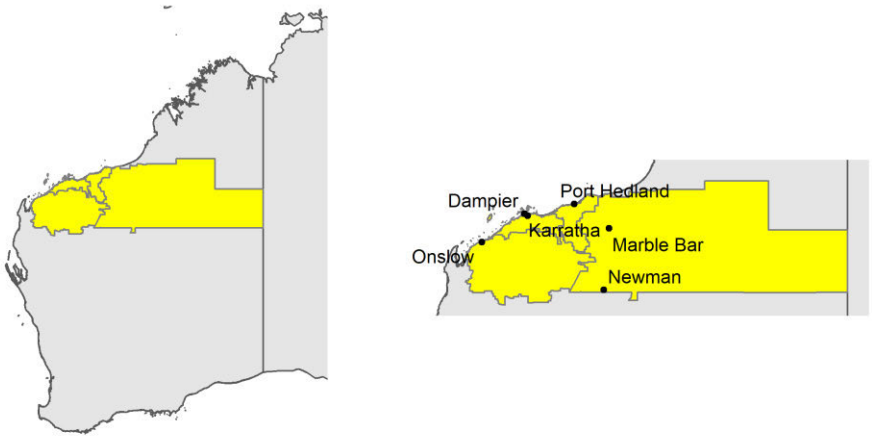
2 Background and context

This chapter provides background and context information on the Pilbara region; discusses the social cost of excessive alcohol consumption; reviews information on alcohol consumer responses to policy changes; discusses models of consumer behaviour in the alcohol market; and discusses pathways for the Banned Drinkers Register (BDR) to have an impact on social costs.

2.1 The Pilbara region

The Pilbara region is comprised of four local government areas in the North of Western Australia: Ashburton, East Pilbara, Port Hedland, and Karratha (see Figure 4). Accounting for approximately 80 percent of the economic output in the Pilbara, the mineral and energy sector is the largest contributor to economic value in the region. The region is highly productive, in an economic sense, with State Government estimates suggesting that although the region accounts for approximately five percent of employment in Western Australia, the region accounts for approximately 15 percent of output.[3] In addition to the local Pilbara population, there is a substantial fly-in-fly-out workforce that works in the iron ore and natural gas sectors.

Figure 4: The Pilbara region and major towns



2.2 Alcohol consumption

Today, alcohol consumption is widespread, and in a given year just over one half of all men, and just under one third of all women will have consumed alcohol (WHO 2011, p.14). In terms of the importance of alcohol to individual consumers, there is significant variation, both between and within countries, but Selvanathan and Selvanathan (2005, p. 209) report that on average, people allocate around 3 percent of their income to alcohol. Alcohol is therefore a significant consumption good.

[3] Department of Primary Industries and Regional Development data [accessed 22 May 2022]

Not all drinkers consume alcohol in a moderate fashion, and just over 16 percent of all male drinkers and just over four percent of all female drinkers engage in heavy weekly episodic consumption (WHO 2011, p.17)[4]. This is an important feature of the alcohol market, as high levels of alcohol consumption, and in particular, binge drinking, are associated with a range of negative health and social outcomes.

High levels of alcohol consumption, and in particular, binge drinking, also result in significant additional costs to government via the health, legal, and social security systems. For example, the World Health Organisation estimate that for developed countries the cost of excessive alcohol consumption is typically around 2.0 percent of GDP (WHO 2011). Some of these costs are private costs and some are public costs, but in a review of 15 alcohol damage cost studies for developed countries, Cnossen (2007 p. 716) found the mean lower bound externality cost estimate to be 0.8 percent of GDP.

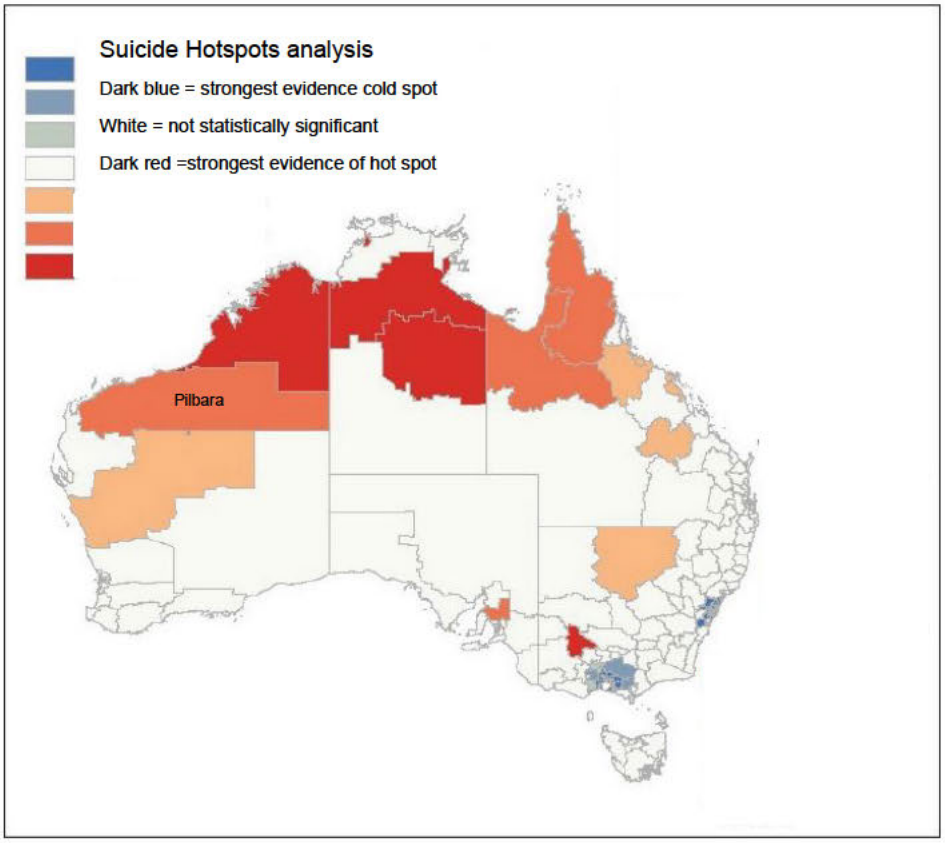
That there are large social costs due to excessive alcohol consumption means that there is a sound case for government intervention in the alcohol market. Intervention can be via alcohol specific taxes or other restrictions on alcohol purchases.

2.2.1 The Australian context

The most recent estimates for the cost of excessive alcohol consumption for Australia are for the financial year ending June 2018 and are compiled in Whetton et al. (2021). The central estimate for the annual tangible cost of excessive alcohol consumption is $18.2B and for intangible costs the estimate is $48.6B. The total tangible and intangible cost is therefore $66.8B. As a share of GDP (for 2018) this suggests that for Australia tangible costs are around 1.0 percent of GDP; intangible costs are around 2.6 percent of GDP; and total costs are around 3.6 percent of GDP. Premature mortality and morbidity account for the largest share of costs, and the Pilbara, along with most of the North of Australia, has been identified as an alcohol related suicide hotspot.

[4] As the definition of a standard drink varies across countries the WHO define heavy episodic drinking (HED) as consuming 60 grams of pure alcohol on at least one occasion in the past seven days. For beer that has an alcohol content of 5 percent, HED implies drinking around 1.6 liters in a single occasion; for wine with an alcohol content of 12.5 percent, HED implies drinking around 600 ml in a single sitting; and for spirits with an alcohol content of 37.5 percent, HED implies drinking around 200 ml in a single sitting.

Figure 5: Alcohol related suicide hot spot analysis



Source: Hurzeler et al. (2021)

2.3 Alcohol consumer behaviour

In practice, both price (tax) measures and other restrictions such as the BDR result in an increase to the full cost of alcohol, where cost (price) includes all activities required to source alcohol. For example, where restrictions on takeaway alcohol are in place, higher cost alcohol can still be purchased at licensed premises. Similarly, removing from availability four-litre cask wine (a non-price restriction) means that the effective price of a unit of alcohol increases. The cheapest product in terms of per unit of alcohol is not available, but the next cheapest product, in terms of per unit of alcohol content, still is available.

Where someone is restricted from purchasing alcohol, that person can invest time and effort to ensure someone else purchases alcohol for them. To the extent that time invested in extra activities is also a cost, this extra search/compel activity increases the effective price of alcohol.

As most policy mechanisms that seek to apply restrictions can be reframed as price increases, it is worth reviewing the literature on how alcohol consumers respond to price changes.

Table 3 provides a summary of the evidence on the way consumers respond to price changes, as measured by the own-price elasticity of demand (see Box 1 for a discussion of elasticity concepts). The evidence suggests that when prices

increase by around one percent, alcohol consumption falls by around half of one percent, on average. The consumption response is lowest for beer, and highest for spirits.

Table 3: Estimates of the price elasticity of alcoholic beverages

No.	Author(s) and Date	Beer	Wine	Spirits
1	Clements et al., (1997)	-0.18	-0.42	-0.77
2	Clements and Selvanathan (1991)	-0.15	-0.32	-0.61
		-0.43	-0.37	-0.83
3	Clements and Selvanathan (1987)	-0.12	-0.34	-0.52
4	Clements and Selvanathan (1988)	-0.09	-0.39	-0.41
5	Clements and Johnson (1983)	-0.09	-0.39	-0.41
		-0.36	-0.43	-0.74
6	Miller and Roberts (1972)	-	-1.80	-
7	Owen (1979)	-0.28	-	-
		-0.62	-	-
8	Penm (1988)	-0.45	-	-
9	Selvanathan and Selvanathan (2005)	-0.20	-0.43	-0.64
		-0.65	-0.61	-0.68
10	Selvanathan and Selvanathan (2004)	-0.16	-0.31	-0.62
		-0.33	-0.39	-1.30
11	Selvanathan (1991)	-0.15	-0.60	-0.61
12	Taplin and Ryan (1969)	-	-3.00	-

Note: More than one entry for a paper indicates that more than one estimate is presented in the paper.

Box 1: Price elasticity of demand concepts

The formal economic measure of the change in consumer behaviour following a price change is referred to as the own-price elasticity of demand for the good. The own-price elasticity of demand for alcohol is defined as the percentage change in the quantity of alcohol demanded as a result of a one percent change in the price of alcohol. Thus, if the own-price elasticity of demand for alcohol is minus 0.1, this means that if the (full effective) price of alcohol were to increase by one percent, the quantity demanded would decrease by 0.1 percent. The formal result for the own-price elasticity of demand for alcohol is shown directly below.

$$\frac{dQ_A}{dP_A} \times \frac{P_A}{Q_A} = \frac{dQ_A}{Q_A} \div \frac{dP_A}{P_A} = \text{Own Price Elasticity Alcohol}$$

The cross-price elasticity of a good measures the percentage change in the quantity of a good – say marijuana -- demanded as a result of a one percent change in the price of a different but related good, say the price of alcohol. If the cross-price elasticity of demand for alcohol and marijuana is 0.1, it implies that if the price of alcohol were to increase by one percent, the quantity of marijuana demanded would increase by 0.1 per cent. Where the cross-price elasticity is positive, the goods are referred to as substitutes, and where the cross-price elasticity is negative, the goods are referred to as complements. The formal result for the cross-price elasticity of demand between alcohol and marijuana concrete is shown directly below.

$$\frac{dQ_M}{dP_A} \times \frac{P_A}{Q_M} = \frac{dQ_M}{Q_M} \div \frac{dP_A}{P_A} = \text{Cross-Price Elasticity Alcohol}$$

The Demand homogeneity theorem implies that the fundamental determinants of the own-price elasticity of a good are:

(i) the number of substitutes, and

(ii) the extent to which products are substitutable.

2.3.1 Consumer heterogeneity and addition models

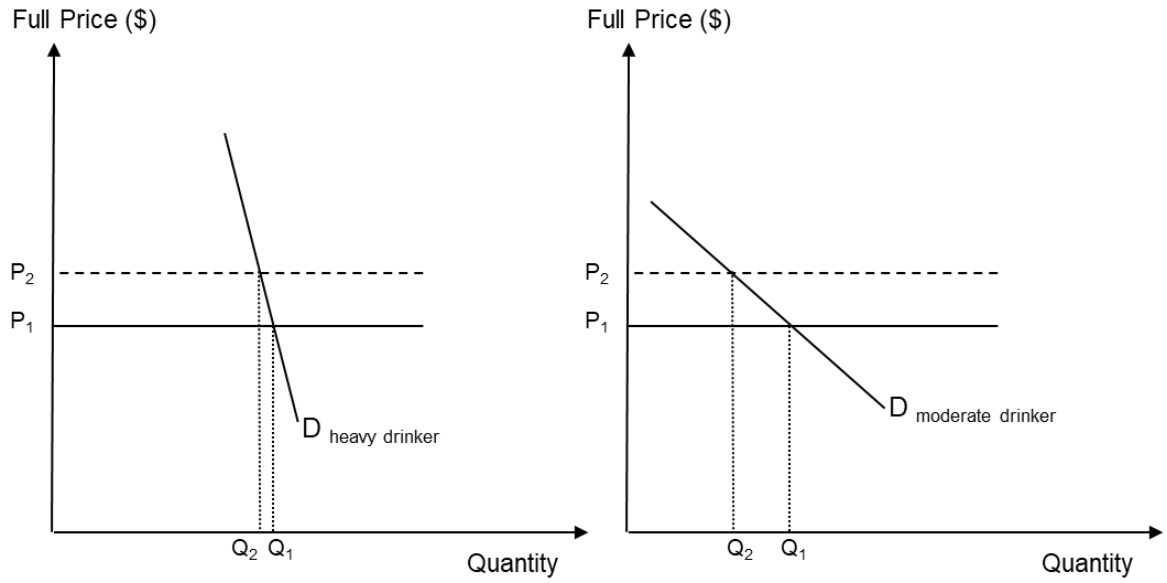
Although the population level evidence on the way consumers respond to changes in alcohol prices is quite consistent, the systematic discussion of the heavy drinking literature presented in Nelson (2013); Xuan et al. (2016); and Nelson (2016) provides strong evidence that heavy drinkers are unresponsive to price changes. Further, the direct evidence from studies such as Manning et al. (1995); An (2011); Ayyagari (2013); and Wen et al. (2019) that compare own-price elasticities when all consumers are pooled into a single group, to elasticity estimates for separate heavy- and moderate-drinking sub-groups or quantiles, shows that the population level price elasticity (as described in Table 3) is a combination of relatively elastic demand from moderate consumers (moderate consumers decrease consumption a lot following a price increase) and highly inelastic demand from heavy drinkers (heavy drinkers change consumption only marginally when faced with a price increase).

The core implication of consumer demand heterogeneity is that problem drinkers may not change the quantity of alcohol consumed when faced with an effective increase in the full cost of obtaining alcohol. The situation is illustrated in Figure 6, where the full price (direct price plus other effort costs) to purchase alcohol is

plotted on the vertical axis, and quantity consumed is plotted on the horizontal axis. In the figure, both consumer types are subject to the same policy change that has resulted in an increase in the full price of alcohol from P_1 to P_2. In response to the increase in the full price, both consumer types reduce their consumption from Q_1 to Q_2, but the actual change is very small for the heavy (problem) drinker group.

Both the strength and weakness of a policy approach such as the BDR that targets the heavy and or binge drinker cohort only is illustrated in Figure 6. The policy avoids placing a cost on moderate drinkers (strength), but it also very hard to shift the actual consumption of heavy drinkers with just a price increase (weakness).

Figure 6: Impact of change in the effective price of consumption



One reason that heavy drinkers may not change consumption is due to addiction. There are several addiction behaviour models, but here we focus on the Chicago School of Economics model (Becker and Murphy 1988). This is a model that can be used for all goods where consumption is influenced by experience, including additive goods, and so represents a general framework. Rather than focus on the maths that supports the model, here the focus is to illustrate that there can be additional complexity when considering the heavy drinker group in the alcohol market.

Addictive goods are characterised by: (i) *Reinforcement*, which implies past use raises the marginal satisfaction of current consumption; (ii) *Tolerance*, which implies that higher consumption in the past will lower the level of satisfaction gained from a given unit of consumption in the current period; and (iii) *Withdrawal*, which involves substantial temporary (but perhaps long lasting) negative effects for consumers that stop using the good.

The Chicago model of addiction captures all of these features. Additionally, the model allows for a negative effect on future income through lower wages as

addiction increases (as you become more addicted you are a less productive worker and have a lower income); that the reinforcement effect decreases over time when there is no use of the addictive good, and that costs and benefits through time can be aggregated by applying a discount factor to future effects (a future negative impact of say 100 units gets less weight than an immediate positive effect of 100).

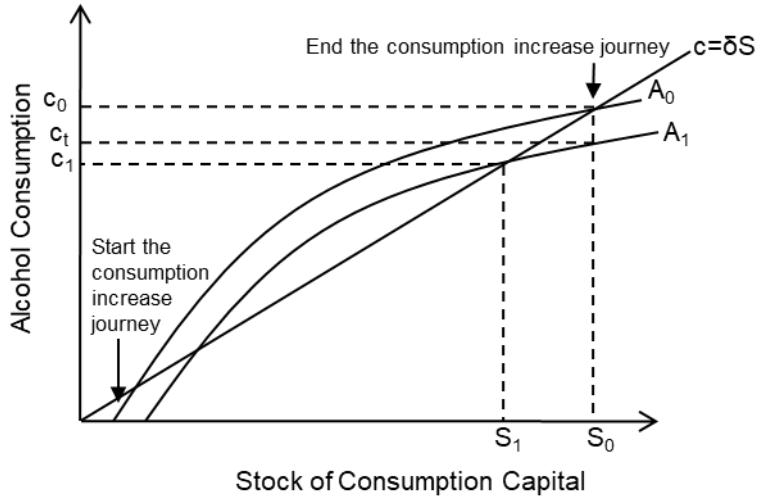
In the Chicago model the positive effect from an increase in consumption today must be greater than the negative effect of higher consumption in the future. As such, the value placed on future happiness (earnings) can play an important role in the consumption decision. If a person places a low value on future happiness (high discount rate), or has an income flow that is not negatively impacted by lower addiction related productive effects, the person is both more likely to become addicted and to stay addicted.

The basic model dynamics are illustrated in Figure 7, where the level of consumption at a given point in time is plotted on the vertical axis and the cumulative 'stock' of addictive capital is plotted on the horizontal axis. The stock of addictive capital generates the reinforcement effect. The A_i curves describe consumption paths through time, and points where the A_i curve intersect the $c = \delta S$ line represent potential long-run equilibrium points. In this model the impact of a full price change is represented by a shift in the curve to the right.

First, consider the A_0 curve. Where the A_0 curve intersects the horizontal axis represents the initial stock of addictive good capital, which varies by person and can vary through time, due to both positive and negative life experiences. A person then starts consuming alcohol, initially at a low level. Once alcohol consumption starts, the stock of consumption capital increases, and so alcohol consumption continues to increase through time. In each period the stock of consumption capital depreciates due to a natural decay process, but for the low levels of initial consumption the net effect is to continue to increase the level of alcohol consumption, and so consumption continues to increase.

Over time the person ends up at consumption level c_0. This is a high level of alcohol consumption, and so might be associated with the type of person targeted by the BDR. Now, let there be an increase in the full price of alcohol, such that A_1 is now the relevant consumption path curve. Consumption initially falls to c_t, but the benefits of this level of consumption are less than costs and over time consumption falls further to c_1. Under this scenario the outcome is essentially the same as that described for the heavy drinker in Figure 6. Following an increase in the full price of alcohol (via a non-price restriction), the addicted consumer remains consuming at a high level. The model does however suggest that the immediate response might not be the full consumption response. From a policy evaluation perspective it may take some time to see the full effect.

Figure 7: Potential effects with additive goods: example 1

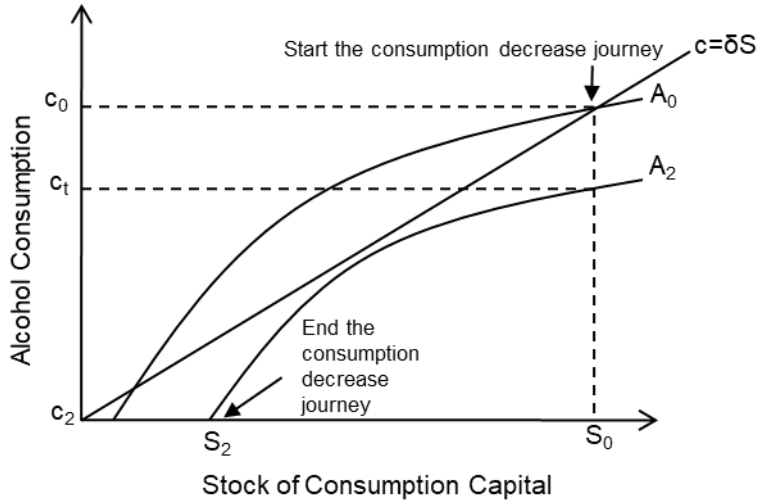


Now, consider the example scenario illustrated in Figure 8. For this example, let us start the discussion from the point where the person has reached the high level of consumption under the initial price conditions defined by c_0. Now let the increase in the full price of alcohol (which includes price and non-price restrictions) be such that the relevant consumption path is represented by A_2. Under this scenario the benefit of continuing to consume is no longer greater than the immediate cost of withdrawal symptoms, and consumption falls from a high level to zero. This might be described as the cold turkey scenario, with consumption falling from a high level to zero: heavy drinkers are more responsive than moderate drinkers, for this example.

Note that if steps can be taken to lower the cost of withdrawal by providing an appropriate support program, this change could be sufficient to also move an individual from a high initial consumption equilibrium to a new zero consumption equilibrium.

The overall implication of the Chicago model is that not only are responses to policy changes that increase the full price of alcohol consumption different between heavy drinkers and moderate drinkers, but that there can also be heterogeneity within the heavy drinker group. When faced with an increase in the full price of alcohol some heavy drinkers may switch from a high level of consumption to a zero level of consumption, even while the overall observed consumption change for heavy drinkers is small.

Figure 8: Potential effects with additive goods: example 2



2.4 The banned drinker register

The BDR identifies people who are banned from purchasing takeaway alcohol. The BDR was implemented in the Pilbara region in January 2021, as part of a two-year trial. The BDR program is one of the many tools available to the State Government to help minimise the harmful impact of alcohol consumption on communities and individuals. As part of the BDR program, individuals must present an eligible ID when purchasing takeaway alcohol. The BDR scanners alert retail staff when an individual is listed on the BDR, and the sale cannot proceed.

People registered on the BDR are prohibited from purchasing takeaway alcohol because they have either voluntarily elected to be on the BDR through self-referral, or they are subject to a current Prohibition Order or Barring Notice. Industry participation with the BDR is voluntary.

The BDR can influence behaviour in several ways. First, it raises the effective price of alcohol for those on the register. The extent of the increase in the effective full price depends on how well the system works. If the technology is largely not in place, or often not working, then the increase in the full price is low. The greater the system compliance the greater the increase in the effective price, for those on the register.

For both the traditional consumption model (Figure 9) and the addiction model (Figure 10) the impact of system effectiveness is illustrated as a difference in the change in the effective full price of alcohol. Note that for both models, the illustrated effect is modest, even with full compliance.

Figure 9: How big is the effective increase in the full price: standard model

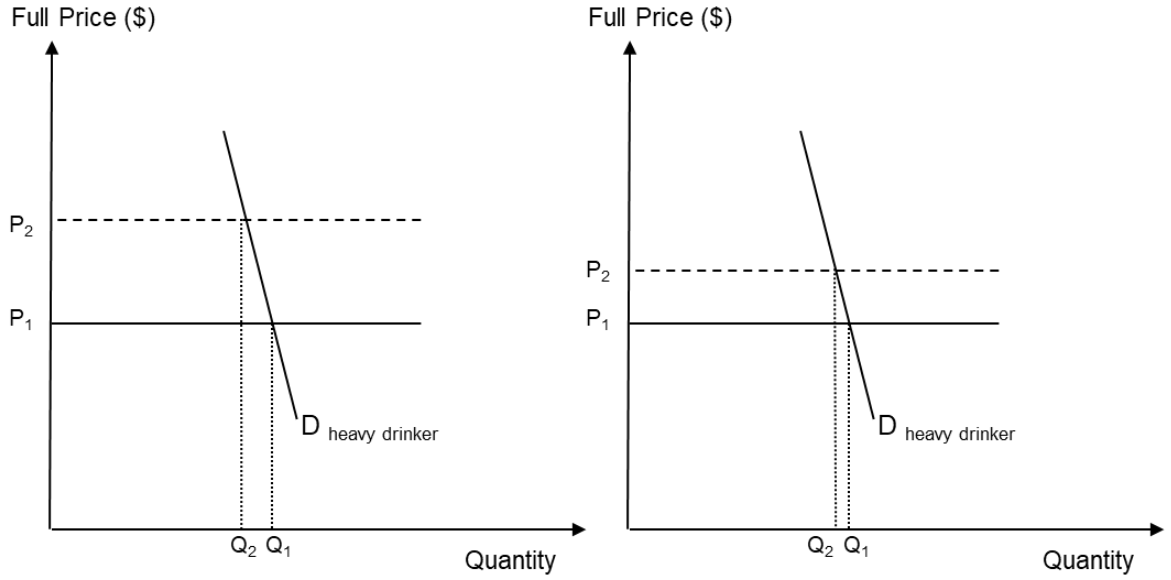
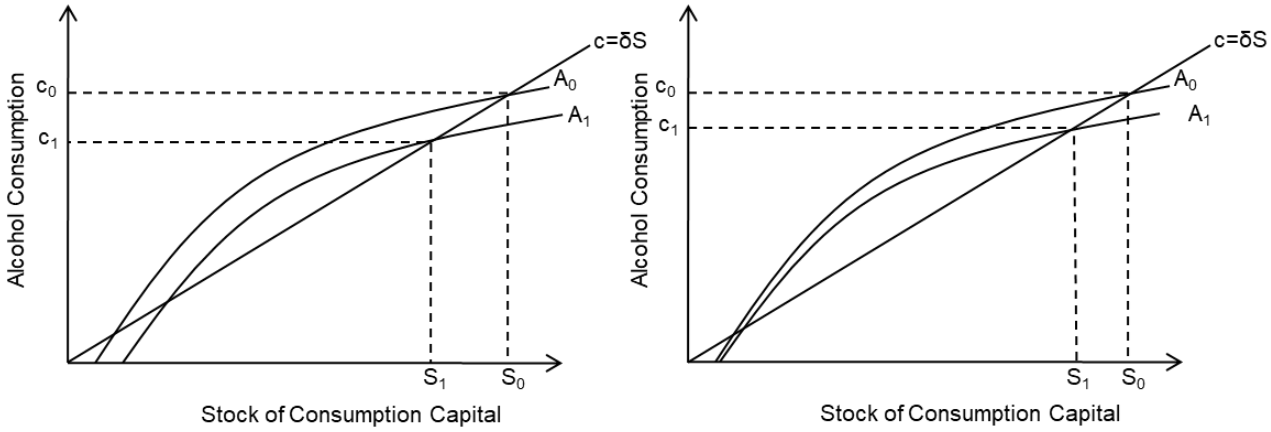
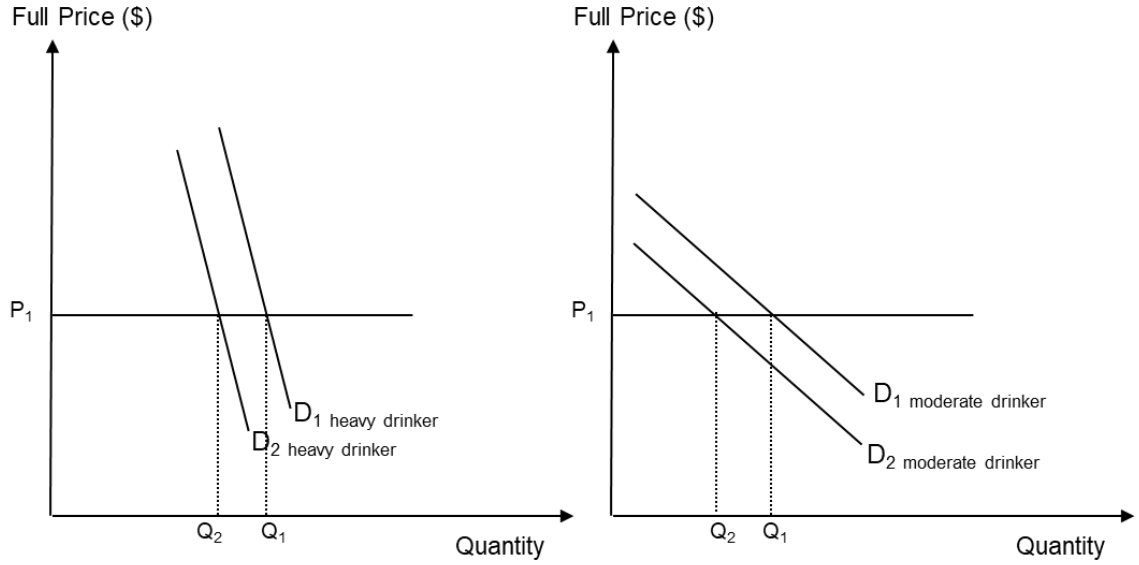


Figure 10: How big is the effective increase in the full price: addiction model



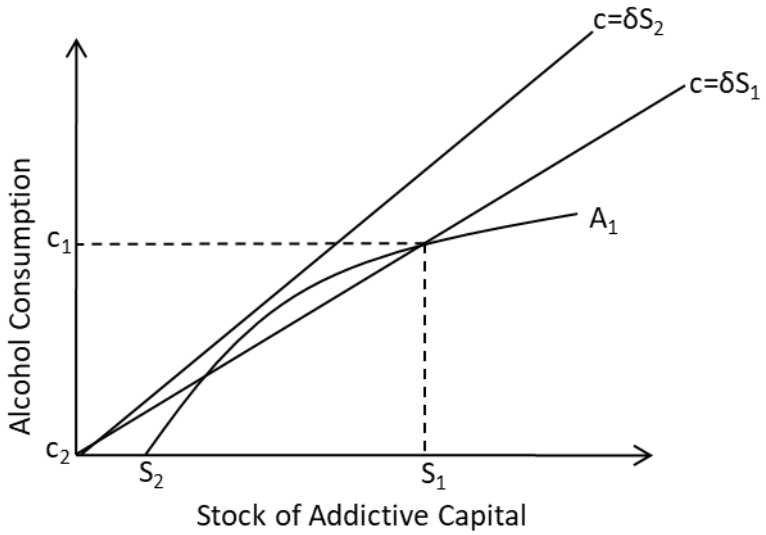
The second way that the BDR can have an impact on alcohol consumption is through influencing the community discussion about alcohol use. This pathway involves changing the discussion in the community by raising awareness of the potential costs of excessive alcohol consumption. This effect does not raise the effective price of alcohol but involves creating behaviour change. The process can impact both heavy drinkers and moderate drinker, and the change in behaviour effect can be substantial. As illustrated in Figure 11, the impact of this pathway is to change the level of alcohol consumption for any given price level.

Figure 11: The impact of policies that shift the demand curve



It is also possible to consider the potential impact of the BDR, where the BDR interacts with other support services. Within an addiction model (stylistically) interventions that lower the cost of withdrawal; raise the prospect of being employed in a high productivity industry in the future; or allow people to see the value of investing in future happiness, can all be represented as an increase in the rate of decay for the capital stock for the addictive good. In all cases this leads to lower consumption, but it can also lead to a person quitting, as illustrated in Figure 12.

Figure 12: Impact of policies that lower the cost of quitting



3 Operational data assessment

The chapter provides a review of the BDR scanner data at a high level and also at the sub-regional level. Potential issues with the operation of the technology are investigated and discussed. The extent of operational issues with the technology is relevant for the question of the extent of the barrier to consumption imposed via the BDR.

3.1 Pilbara level assessment

For the Pilbara, as a whole, Table 4 provides a summary of the recorded operator actions at stores with Scanners installed for the 2021 calendar year. As can be seen, in 91 percent of cases the record is Accept. Almost all other activity is then recorded as a rescan (7 percent). A rescan can be required for a number of reasons. The ID may not have been placed correctly on the machine or may have moved at the time of scanning; the ID presented may not be clear; or the ID may be of a type that the machine has trouble with, for example an ID where the age appears in a clear section of a driver licence, which is the case for some interstate driver licences.

Table 4: Pilbara data distribution for 2021 by operator action record

	Accept	Banned	Deny	Expired	Invalid	Not Acc.	Rescan	S115
No.	1,166,334	128	1,934	20,406	3,730	3,098	88,568	438
Percent	90.79	0.01	0.15	1.59	0.29	0.24	6.89	0.03

The number of people presenting at a store to purchase alcohol that are on the BDR is very small, approximately 0.01 percent of all transactions. This is not surprising as people on the BDR may try to purchase alcohol at a store at one point in time to see if the system works, or may try when their period on the BDR has nearly ended to check that they are still on the register. Regardless of how many people are on the register it is not expected that the number of BDR scans would be high. It is not expected that people that know they are on the BDR regularly try and purchase takeaway alcohol.

To validate the information recorded in Table 4, each store was provided with a summary of actions at their store. Table 5 provides a summary of the store feedback on recorded actions, and the store level feedback seems consistent with the data that has been processed. At any given store there might be several hundred transactions per day, and during the day, at many stores several rescans per day are required. This assessment could be interpreted as suggesting the machines are generally operating as expected, but that further operating improvements are possible.

Table 5: Survey data on need to rescan ID

Frequency of action	Percent
Many times per day	36.84
Several times per day	42.11
Once or twice per day	10.53
Once or twice per week	0.00
Once or twice per month	0.00
It is hardly ever necessary to rescan an ID	10.53

Table 6 provides information on store owner experience for processing unaccepted ID. These responses are broadly consistent with the data summarised in Table 4.

Table 6: Survey data on unacceptable ID

Frequency	Percent
Many times per day	15.79
Several times per day	26.32
Once or twice per day	15.79
Once or twice per week	15.79
Once or twice per month	0.00
Unacceptable ID is hardly ever presented	26.32

Overall 72 percent of survey respondents agreed that the data distribution of actions was accurate six percent disagreed, and 22 percent were unsure. In the open ended questions the issue of machines not working was raised by two respondents.

The number of people on the BDR, through time, is detailed in Table 7. As can be seen by reading down the columns, Prohibition Orders have become the most prominent pathway for an individual to added to the BDR, and the voluntary pathway has been used by relatively few people.

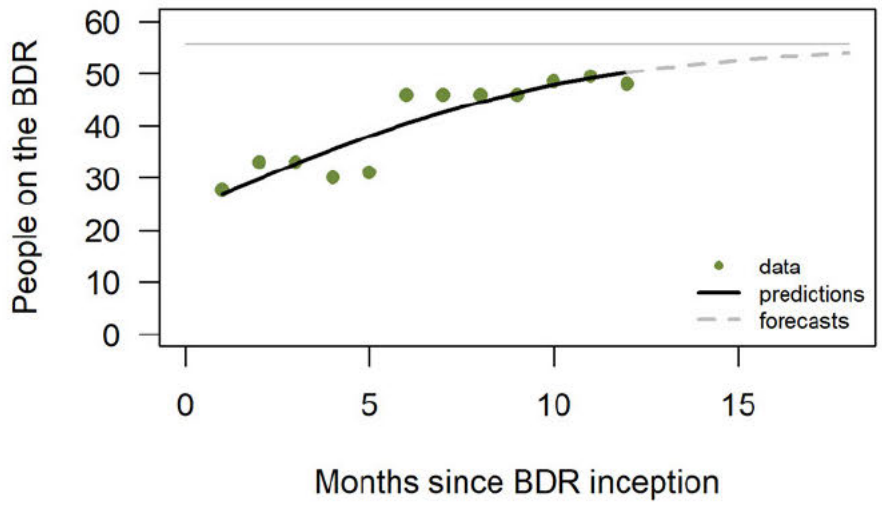
Table 7: People on the BDR by pathway

Month	Barring notice	Prohibition order	Voluntary	Total
January	18	8	1	28
February	20	8	5	33
March	18	8	7	33
April	13	9	8	30
May	12	9	10	31
June	14	22	10	46
July	12	26	8	46
August	11	26	9	46
September	10	27	9	46
October	13	28	9	49
November	11	30	9	50
December	10	29	9	48

Note: People can exit and enter the BDR at any point during the month and so the values reported represent an average over the month.

It is notable that the number of people on the BDR has been relatively stable in the second half of 2021. This pattern suggests that there is little prospect the number of people on the BDR will increase substantially going forward. Using the 2021 data to project forward suggests that with the current approach to listing people on the BDR the number of people on the BDR might increase a little, but a major change in the number of people on the BDR is unlikely. The data projection shown in Figure 13 is based on actual data only.

Figure 13: Projecting the future path of the BDR



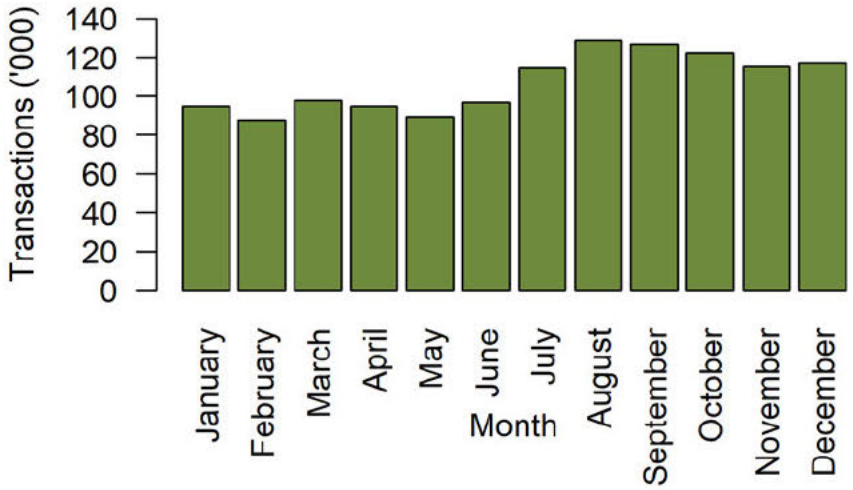
Note: The projection line is fitted via the method of nonlinear least squares.

Figure 14 and Figure 15 show the distribution of transactions across months, for the Pilbara as a whole. There are no striking anomalies in the data. A low for February is consistent with a short month, and July through October represents a relatively attractive time to visit the region, for tourism activities.

Table 8: Pilbara data distribution by Month: 2021

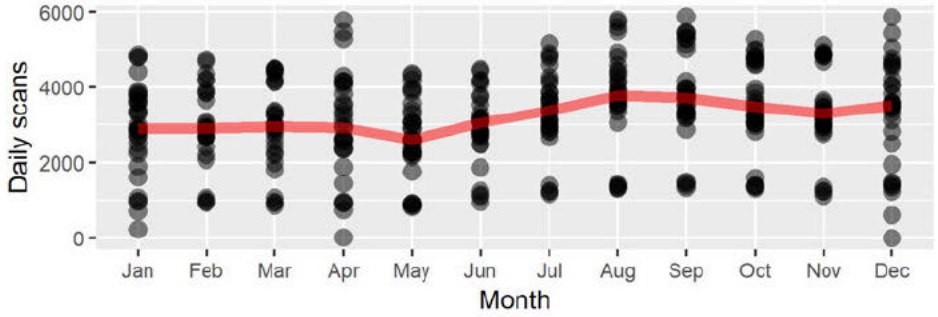
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No.	94,615	87,595	97,686	94,538	89,480	96,531	114,322	128,716	126,729	122,347	115,179	116,898
Percent	7.37	6.82	7.60	7.36	6.97	7.51	8.9	10.02	9.86	9.52	8.97	9.10

Figure 14: Pilbara data distribution by Month: 2021



The distribution of activity for the Pilbara over different time scales is illustrated in Figure 15 through Figure 17. Figure 15 plots the distribution of activity by month, with every dot representing a total activity record for the day. The systematic low points for sales represent days where trading is restricted in some locations, such as Sundays. The red line tracks the median level of activity, and the increase during the tourist season can be seen in the plot.

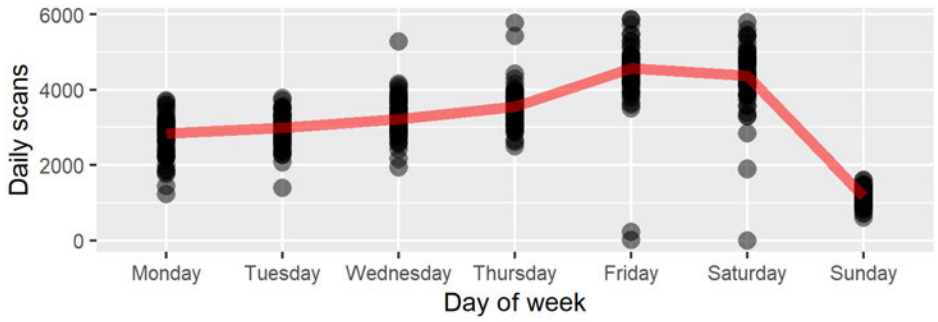
Figure 15: Distribution of accepted scans by month over 2021



Note: Median activity over the year shown by red line.

Figure 16 plots the distribution of activity on individual days of the week. Again, individual dots represent a specific data observation, and the red line tracks the median. The data shows the expected pattern. There is an increase in sales on Friday and Saturday, and less sales on Sunday, when trading restrictions are in place in some locations.

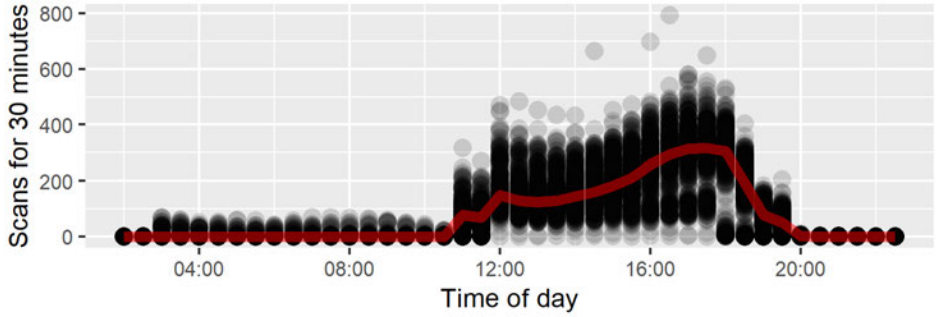
Figure 16: Distribution of accepted scans by day of the week over 2021



Note: Median activity over the day shown by red line.

Figure 17 plots the within day distribution. During non-operating hours there is various machine testing, but overall the peak in median sales occurs around 5:00pm through 6:00pm, each day.

Figure 17: Distribution of accepted scans within days over 2021

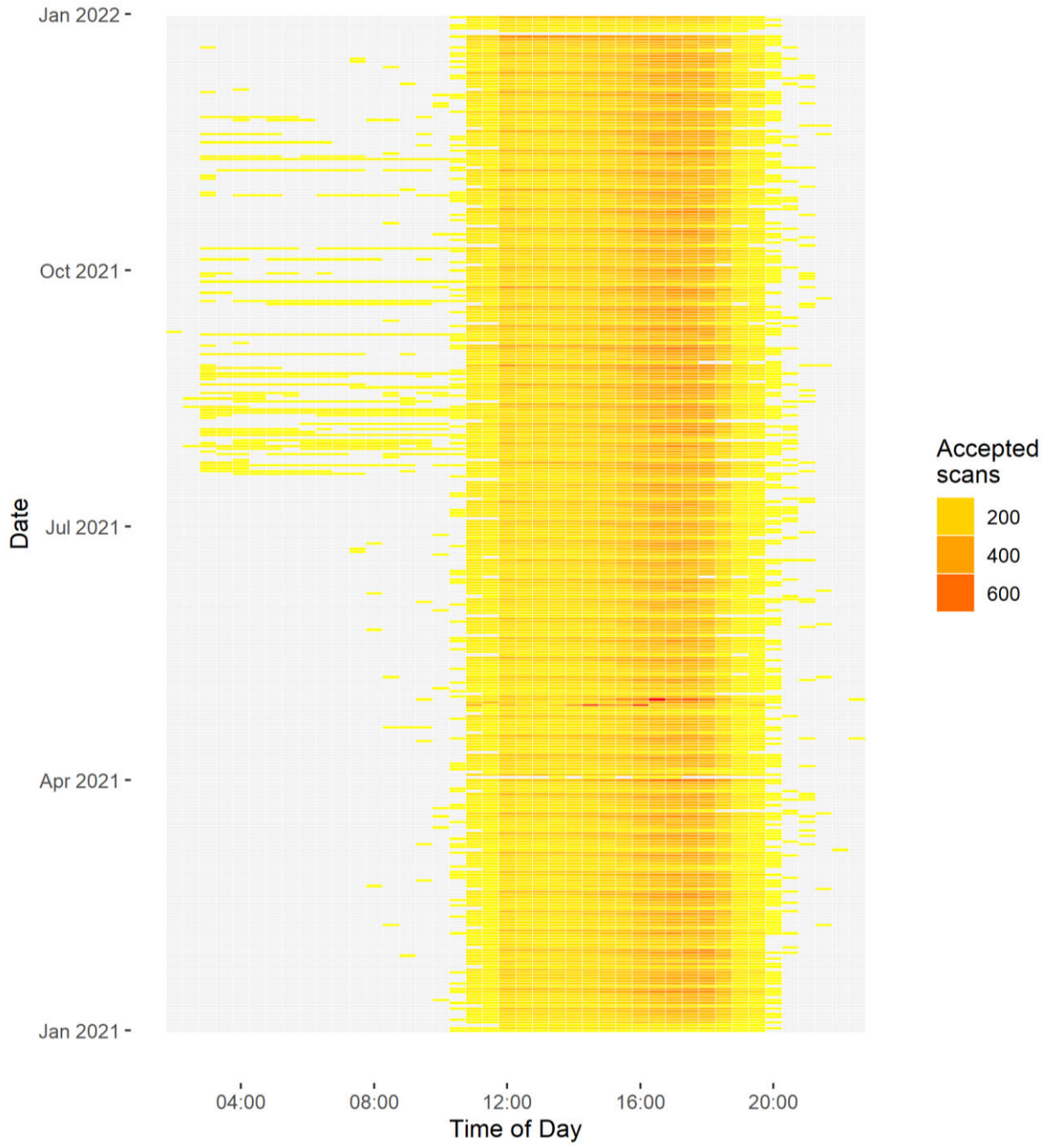


Note: Median activity within the day shown by red line.

For both the day during the week data and the time of transaction within the day data, each store in the Pilbara was provided with a unique store specific analysis of the data, and no store reported disagreeing with the transaction profile reported.

Figure 18 provides a high-level summary of scanner usage. The figure shows that although the general pattern of usage matches the expected pattern, there are scans outside the expected operating period for venues in the Pilbara. Although many of these transactions may be related to operational testing, it would be valuable to have processes that allowed individual items to be checked at short notice.

Figure 18: Number of accepted scans per 30 minute interval



3.2 Sub-regional information

As can be seen from Table 9, the majority of transactions are in the major city population centres: Karratha, South Hedland, Port Hedland and Tom Price. That the transaction data is broadly as would be expected based on the population data indicated no obvious structural issue with the data.

Table 9: Transaction records by major location

Regional location	Count	Percentage
[redacted]		

3.2.1 Transaction summary by store

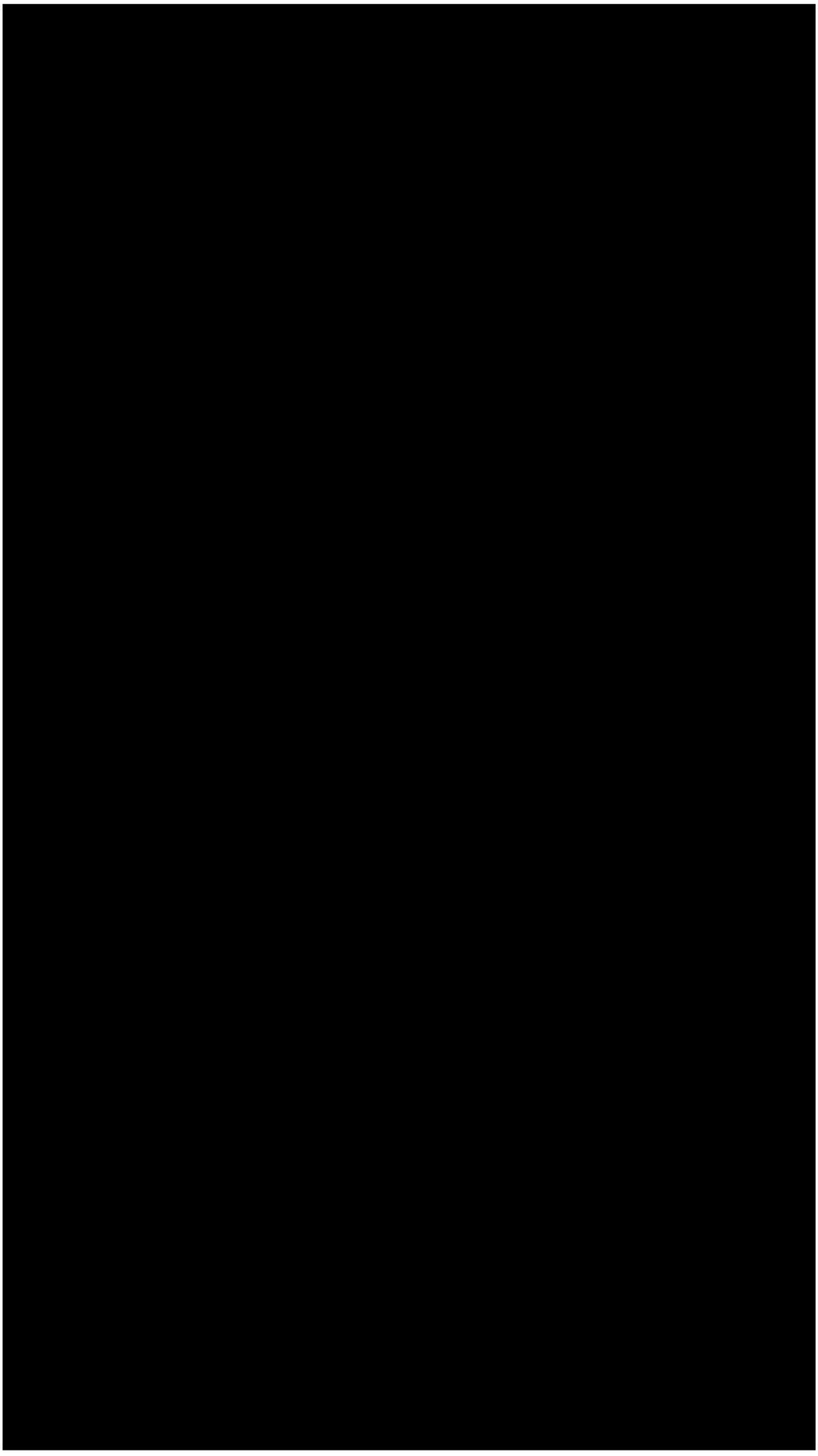
A summary of the transactions recorded for each venue in the Pilbara, by region is provided in the tables below. Although there are eight possible values given for the recorded *Operator Action* these values have been collapsed into three categories as follows:

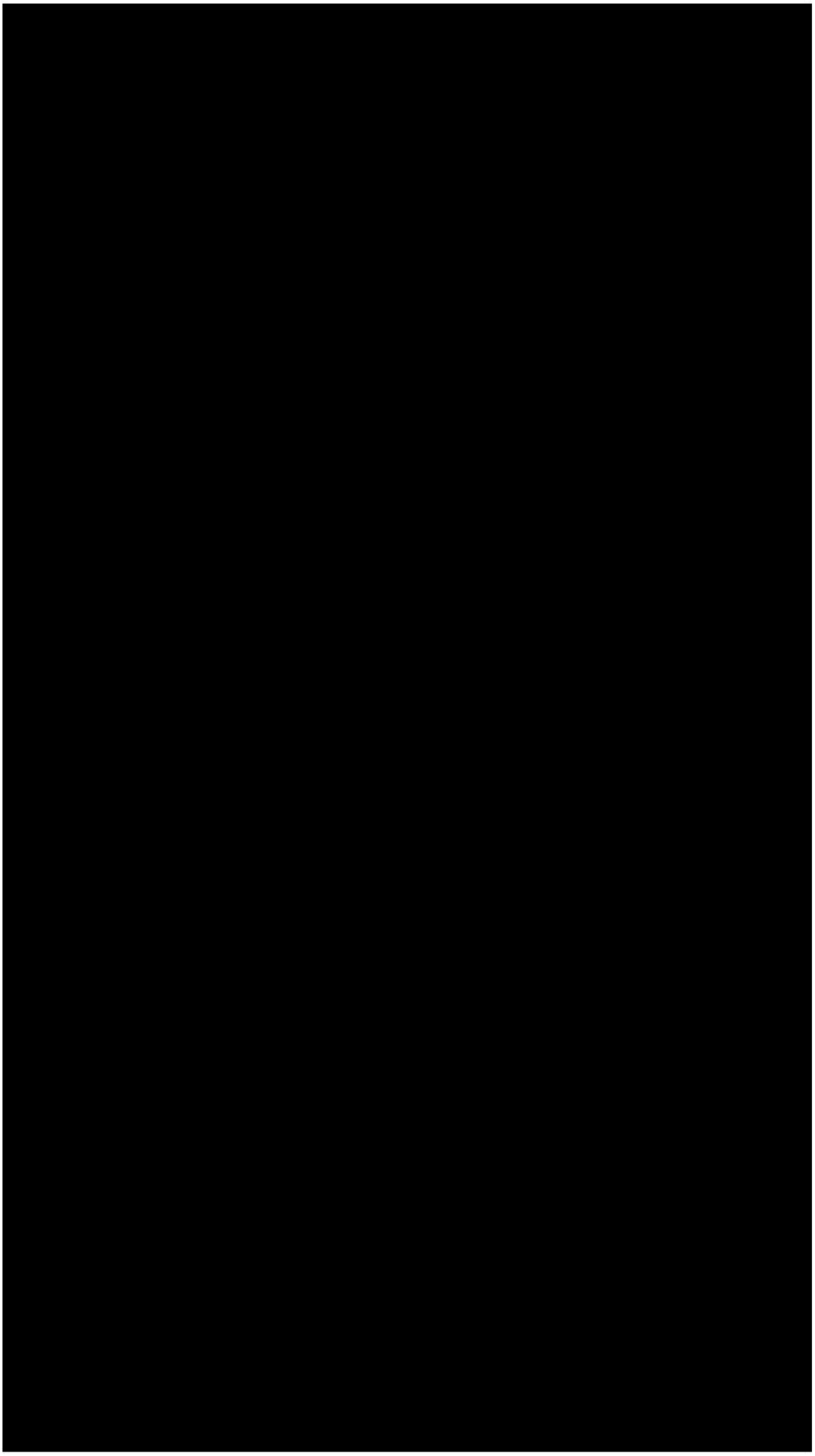
- **Accept** - when Operator Action is "ACCEPT"
- **Reject** - when Operator Action is one of "DENY", "EXPIRED", "INVALID", "NOT ACCEPTED", "RESCAN
- **Banned** - when Operator Action is either "BANNED", "S115 BANNED"

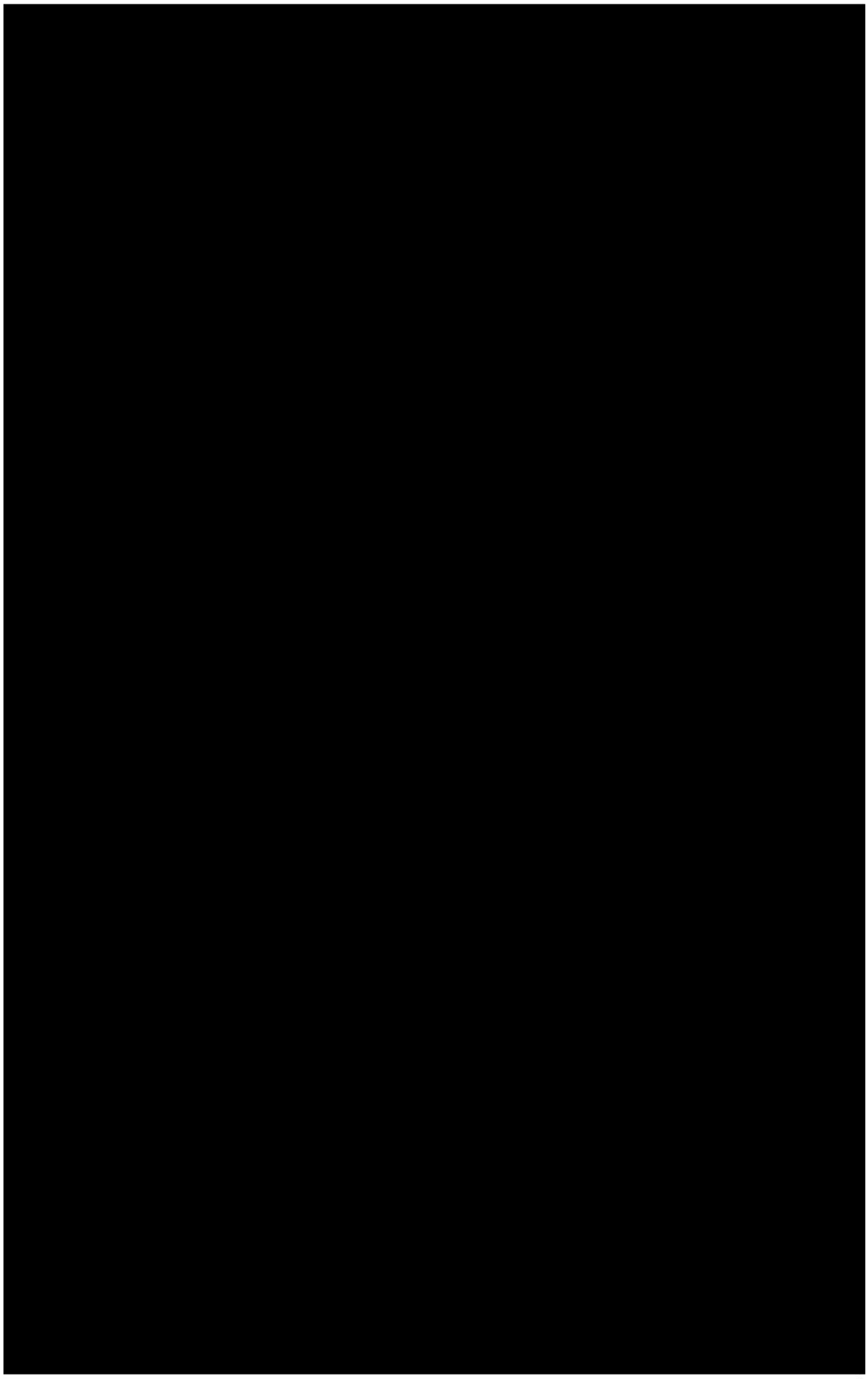
The store level tables have been aggregated to the regional level regional, and one notable observation is that although South Hedland accounts for 19 percent of total transactions it accounts for 67 of transactions in the combined banned category.

Each store was asked to validate the data

[redacted]



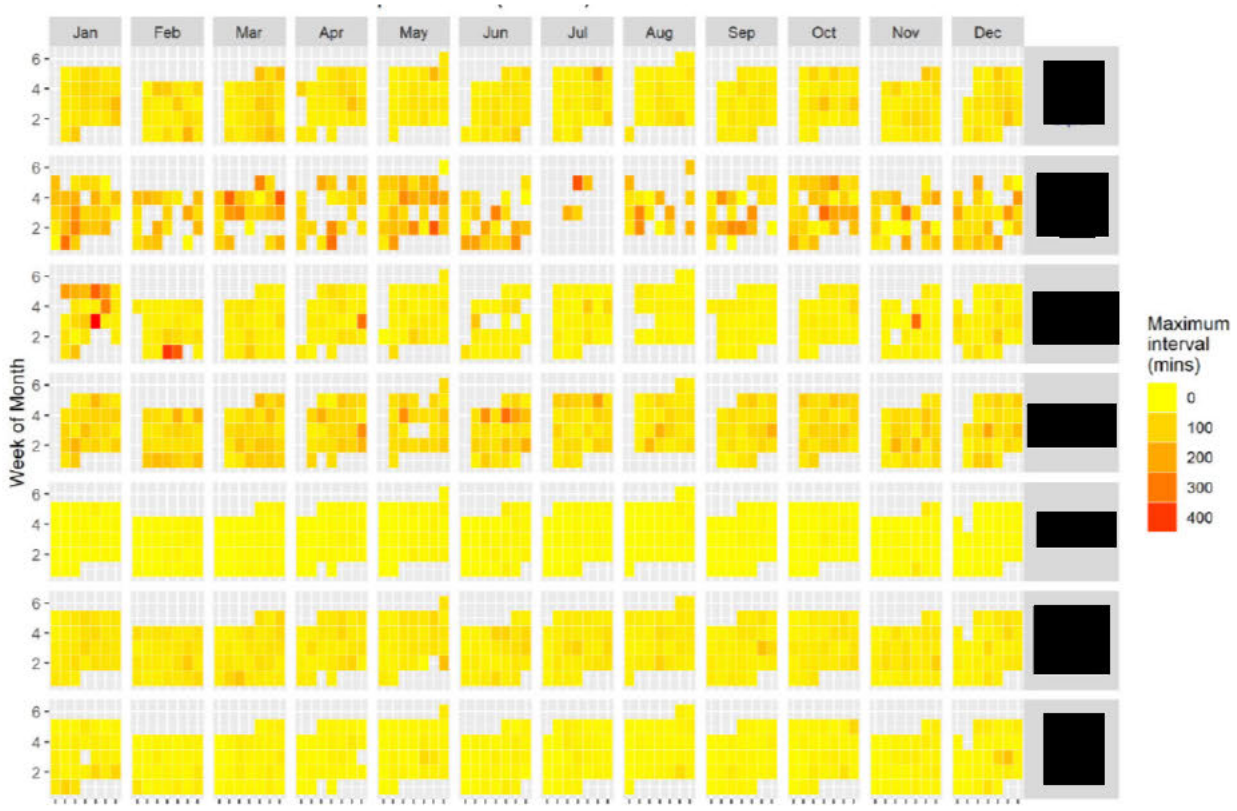




3.2.2 Activity summary by store

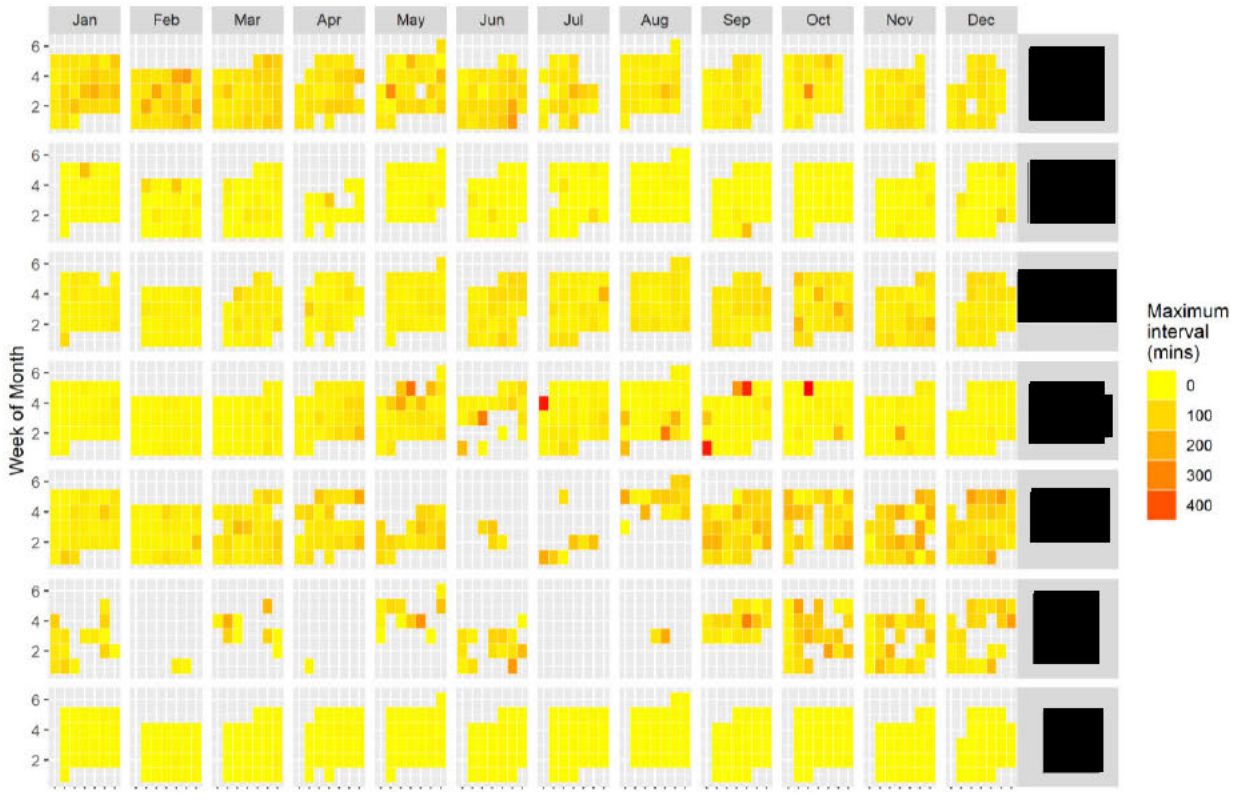
Figure 19 through Figure 23 provide information on the time interval between accepted scans at individual stores throughout the year. Grey indicates a day of no activity, and red indicates a long period between accepted scans. Although it is possible to look at the data in even finer detail, the message from the figures is clear. Across a wide range of venues, there are periods when the scanners are not active, and in some instances the non-active period is substantial.

Figure 19: Maximum intervals between accepted scans per day set 1 (mins)



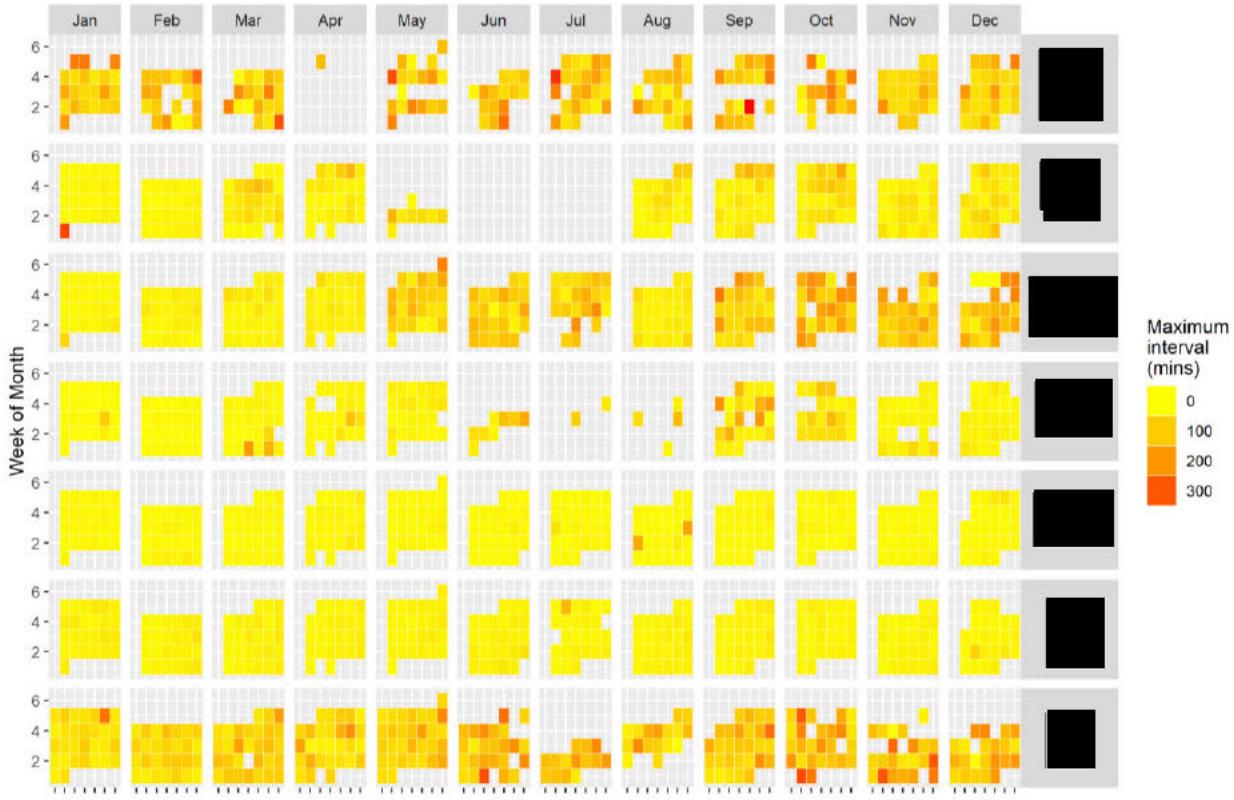
Note: Grey indicates that no scan took place on that day.

Figure 20: Maximum intervals between accepted scans per day set 2 (mins)



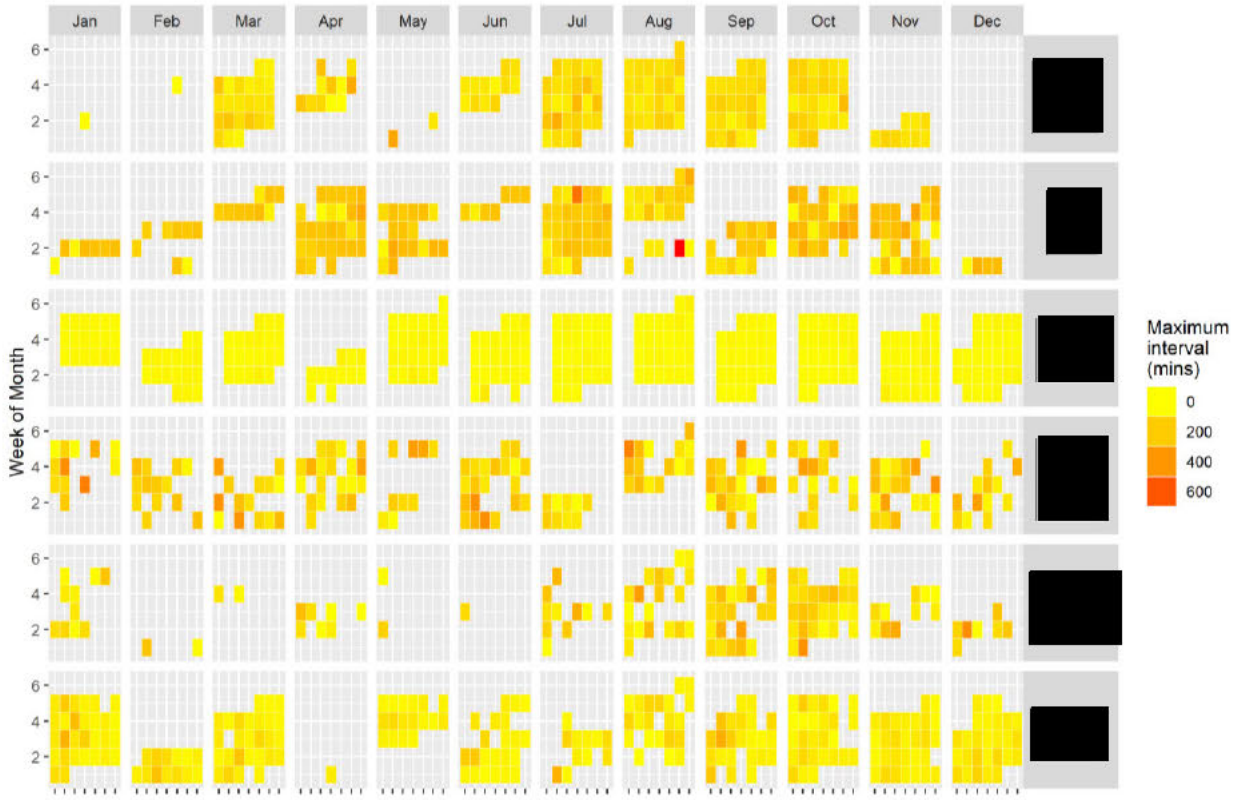
Note: Grey indicates that no scan took place on that day.

Figure 21: Maximum intervals between accepted scans per day set 3 (mins)



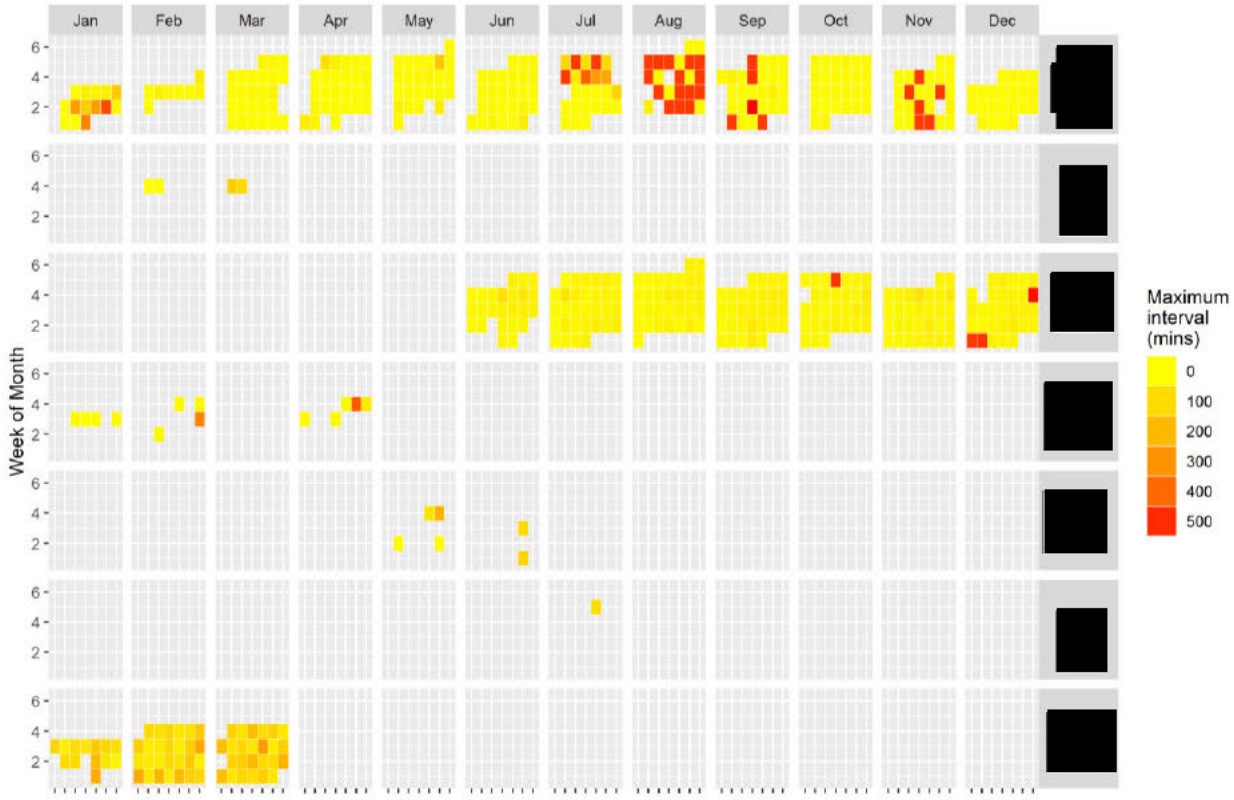
Note: Grey indicates that no scan took place on that day.

Figure 22: Maximum intervals between accepted scans per day set 4 (mins)



Note: Grey indicates that no scan took place on that day.

Figure 23: Maximum intervals between accepted scans per day set 5 (mins)

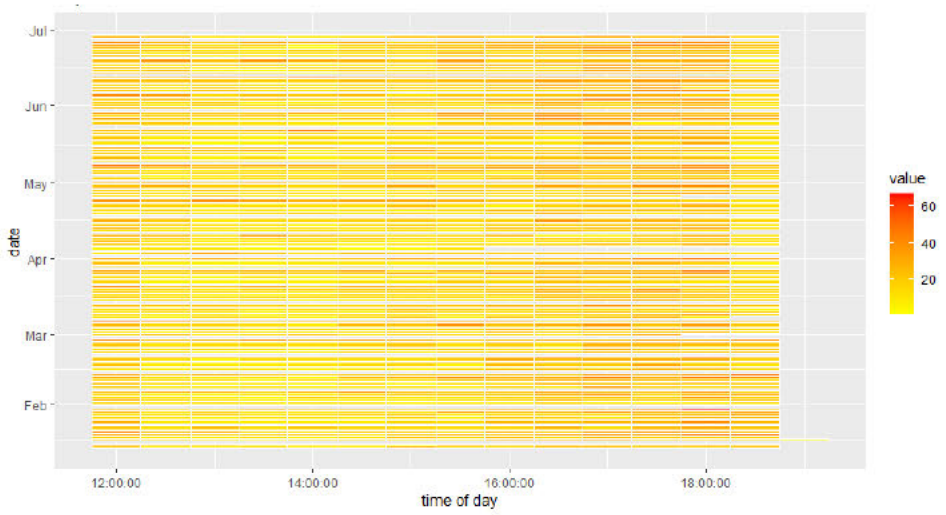


Note: Grey indicates that no scan took place on that day.

To evaluate the quality of the data representation summarised above, each store was provided with a detailed heat map for their store and this process validated the data picture. An example of the detailed store level heat map is illustrated in Figure 24. The feedback from stores on the data quality was that there are no obvious problems.

A total of 18 responses were received from stores and in only one case was the feedback that the scanner data did not reflect actual usage, as per the heat map. On further investigation the reason reported for the *No* was that the scanner was offline for large period of time, and this aspect was captured by the heat map.

Figure 24: Example detailed individual store heat map



3.3 Repeat purchase information

In this section we provide analysis of the scanner data to identify: (i) the extent of accepted transactions recorded against the same individual (or ID) at the same store within a given day; and (ii) the extent of accepted transactions to the same individual (or ID) in two or more locations on the same day.

3.3.1 Accepted scans: same venue, individual, day

The frequency of repeated accepted scans for the same individual, day, and venue are shown in Table 23. The summary shows that while there are 938,475 instances of an individual having only one accepted scan in a particular venue on a particular day, there are instances of up to 13 accepted scans for an individual ID on a single day at a single venue.

Table 23: Scans: same venue, person day

Number of accepted scans	Frequency
1	938,475
2	16,188
3	604
4	88
5	15
6	5
7	1
8	4
9	1
13	1

The tables below provide details for individuals, dates, and venues that had a high number of accepted scans. In the table a *Hash* is a unique identifier for a person.

Some of these scans are very close together in time and may be associated with machine testing or other maintenance activities. For simple repeat transactions it may be the case that individuals purchase some alcohol for immediate consumption and then purchase some additional alcohol later in the day. Information on quantity purchased is not recorded, as part of the BDR

The detail shown in Table 24 shows one accepted scan around noon, and then 12 subsequent transactions over a 12 minute period. In all but one of the remain examples, all the repeat accepted transactions are reported in very short periods of time. The exemption is at the [redacted] and this example has two periods in the day when there are repeat transactions very close together.

It would be valuable if cases of multiple scans during the day could be identified quickly, and investigated with store management, to confirm testing was taking place.

Table 24: Maximum repeat accepted scans: same venue, date, individual

Date and time	Hash	Venue Name	Location
2021-09-01 12:22:26	451be…	[redacted]	[redacted]
2021-09-01 18:17:24	451be…		
2021-09-01 18:17:31	451be…		
2021-09-01 18:18:31	451be…		
2021-09-01 18:18:37	451be…		
2021-09-01 18:21:26	451be…		
2021-09-01 18:22:18	451be…		
2021-09-01 18:22:25	451be…		
2021-09-01 18:23:04	451be…		
2021-09-01 18:23:11	451be…		
2021-09-01 18:24:06	451be…		
2021-09-01 18:28:30	451be…		
2021-09-01 18:29:37	451be…		

Table 25: Nine repeat accepted scans: same venue, date, individual

Date and time	Hash	Venue Name	Location
2021-08-28 14:10:11	d313e…	[redacted]	
2021-08-28 14:10:17	d313e…		
2021-08-28 14:11:16	d313e…		
2021-08-28 14:11:37	d313e…		
2021-08-28 14:11:44	d313e…		
2021-08-28 14:12:13	d313e…		
2021-08-28 14:14:03	d313e…		
2021-08-28 14:14:10	d313e…		
2021-08-28 14:14:51	d313e…		

Table 26: Eight repeat accepted scans: same venue, date, individual

Date and time	Hash	Venue Name	Location
2021-08-31 17:21:58	2b3db…	[redacted]	
2021-08-31 17:22:08	2b3db…		
2021-08-31 17:22:14	2b3db…		
2021-08-31 17:22:19	2b3db…		
2021-08-31 17:22:25	2b3db…		
2021-08-31 17:22:31	2b3db…		
2021-08-31 17:22:37	2b3db…		
2021-08-31 17:22:43	2b3db…		

Table 27: Eight repeat accepted scans: same venue, date, individual

Date and time	Hash	Venue Name	Location
2021-09-10 16:27:55	31e1d…	[redacted]	
2021-09-10 16:28:01	31e1d…		
2021-09-10 16:32:16	31e1d…		
2021-09-10 16:32:23	31e1d…		
2021-09-10 16:36:20	31e1d…		
2021-09-10 16:36:27	31e1d…		
2021-09-10 18:09:20	31e1d…		
2021-09-10 18:09:27	31e1d…		

Table 28: Eight repeat accepted scans: same venue, date, individual

Date and time	Hash	Venue Name	Location
2021-09-24 16:19:50	5ddc7…	[redacted]	
2021-09-24 16:19:57	5ddc7…		
2021-09-24 16:20:12	5ddc7…		
2021-09-24 16:20:23	5ddc7…		
2021-09-24 16:20:35	5ddc7…		
2021-09-24 16:20:42	5ddc7…		
2021-09-24 16:20:48	5ddc7…		
2021-09-24 16:20:58	5ddc7…		

Table 29: Eight repeat accepted scans: same venue, date, individual

Date and time	Hash	Venue Name	Location
2021-09-08 17:41:06	abfad…	[redacted]	
2021-09-08 17:41:13	abfad…		
2021-09-08 17:41:25	abfad…		
2021-09-08 17:41:31	abfad…		
2021-09-08 17:41:39	abfad…		
2021-09-08 17:41:52	abfad…		
2021-09-08 17:42:00	abfad…		
2021-09-08 17:42:12	abfad…		

3.3.2 Accepted scans: same individual and day, different venue

In this section we provide analysis of the scanner data to identify the extent of sales to the same individual (or ID) in two or more locations on the same day. Of the 937,605 individual × date combinations of accepted scans, there are 17,151 (1.83%) combinations that have accepted scans at multiple venues on the date.

The number of times that individuals have accepted scans at multiple venues on the same date is shown in Table 30. As can be seen, there are 16,569 instances of an individual having accepted scans at two venues and seven instances of an individual having accepted scans at five venues on the same date.

Table 30: Accepted scans recorded for same person and same day at more than one venue

Number of venues	Two	Three	Four	Five
Frequency	16,569	545	30	7

Details on some of the more extreme cases are shown below and it is possible that the behaviour identified represents store hopping to get around purchase restrictions. Take for example the pattern identified in Table 31. [redacted], and [redacted] are

all physically near to one another, and it appears transactions have been made at each store one after the other. Later in the day, it seems that there is a similar purchase pattern in [redacted] A similar purchase pattern is shown in Table 32.

Table 31: Possible store shopping example 1

Date and time	Hash	Venue Name	Location
2021-12-23 16:12:06	08b08…	[redacted]	
2021-12-23 16:21:17	08b08…		
2021-12-23 16:29:19	08b08…		
2021-12-23 16:49:24	08b08…		
2021-12-23 17:07:38	08b08…		

Table 32: Possible store shopping example 2

Date and time	Hash	Venue Name	Location
2021-05-14 12:38:05	7870b…	[redacted]	
2021-05-14 13:56:18	7870b…		
2021-05-14 14:07:25	7870b…		
2021-05-14 14:12:47	7870b…		
2021-05-14 14:40:15	7870b…		

The locations shown in Table 33 are different to the previous examples, but again the purchase pattern suggests the possibility of some sort of store shopping.

Table 33: Possible store shopping example 3

Date and time	Hash	Venue Name	Location
2021-11-06 13:24:11	8c6d4…	[redacted]	
2021-11-06 13:50:52	8c6d4…		
2021-11-06 19:22:45	8c6d4…		
2021-11-06 19:30:34	8c6d4…		
2021-11-06 19:35:59	8c6d4…		

4 Industry perspective on BDR

To obtain the perspective of industry on BDR operation, an online survey was developed. Questions were iteratively developed with input from the department, and several pilot iterations of the questionnaire were then tested.

Each store registered as participating in the BDR was then sent a store specific summary report, and a unique link to the survey to complete. Several rounds of follow-up correspondence were then sent to each store to encourage survey completion. The survey findings are summarised in this chapter.

4.1 Industry perceptions

4.1.1 BDR implementation

The majority of industry respondents (68 percent) indicated that the BDR has been implemented as they expected. Only 11 percent of industry respondents indicated that the BDR has not been implemented as expected, and 21 percent of respondents indicated they were unsure.

Comments from those responding *Yes* are:

- *So few are on the bdr system [it] slows each transaction down due to bad connectivity, therefore making customers frustrated and causes staff more issues with unhappy patrons*
- *I stopped selling takeaways as we needed to hire a full-time guard to stop the aggressive drunks who had been refused at other venues and wanted to fight our workers when refused. [We] Shouldn't have to hire a security guard to sell takeaways*
- *The use of the Scanner prevents people on the BDR from purchasing Alcohol*
- *I do not think it is required at* [redacted]
- *Since moving to the Pilbara I have seen the BDR system in use and it has worked exactly how I would have guessed*
- *In terms of the number of rescans of ID, this is largely due to customers presenting invalid ID or falsely presenting another person's ID.*
- *It would be helpful if there could be better education of tourists coming into the area so that they're aware of the BDR.*

Comments from those responding *No* are:

- *I was under the impression that Police would have the power, and use it by imposing 3 month bans on persons that are the cause of alcohol related incidents/ harm in our community. This is clearly not happening as it is very rare for my staff to refuse any customers service due to being on the BDR. Failure to have ID is the biggest cause for refusal of service.*
- *The implementation of the BDR was not good. The machines were installed on the DAY the BDR began. It wouldn't appear that feedback provided to the Scantek and the Dept was listened to.*

Comments from those responding *Unsure* are:

- *I am assuming yes, but have insufficient information to give a clear answer*
- *People complain about the BDR. [I] would recommend the state government put a press about the Pilbara having BDR*

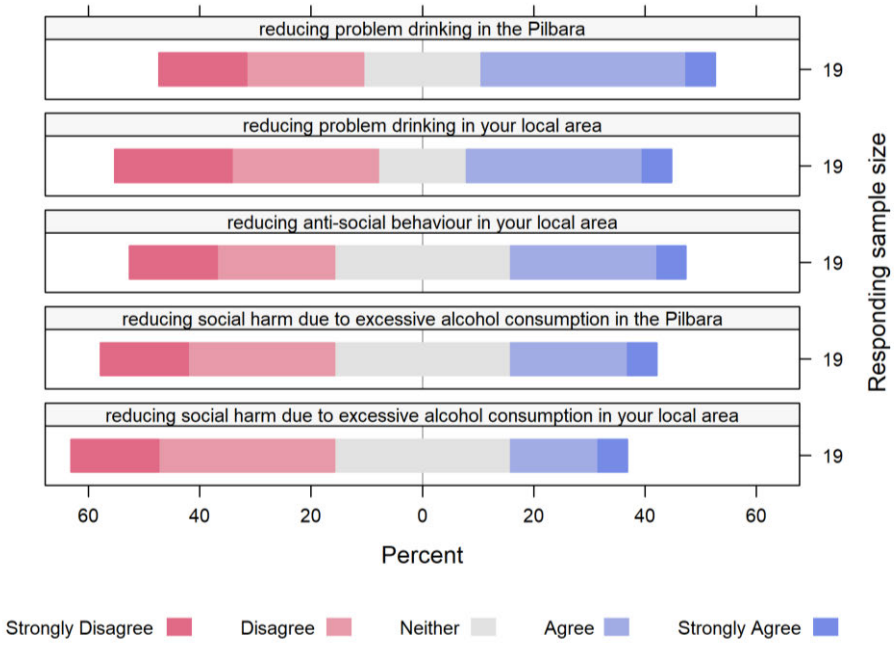
4.1.2 Impact on society

This question asked: In general, do you think the BDR has had an impact on:

- reducing problem drinking in your local area
- reducing problem drinking in the Pilbara
- reducing anti-social behaviour in your local area

- reducing social harm due to excessive alcohol consumption in your local area
- reducing social harm due to excessive alcohol consumption in the Pilbara.

Figure 25: Agreement on BDR impact on society



Open text responses that accompanied this question were:

- *The lack of a population on the BDR has limited its effectiveness in reducing the above area's. There is no lack of individuals causing the above issues and identifying them is simple. They how ever are not being put onto the BDR, therefor they will be served alcohol.*
- *As per the report we were sent, it has had next to no positive impact. We have not had to refuse anyone alcohol due to them being on the BDR.*
- *Problem people are getting other family and friends to purchase their products for them unfortunately they have found ways around bdr*
- *While I understand the intention of the program, I believe it has not had the intended impact. I have still witnessed behaviour unbecoming in my local area.*
- *Being on an island, the majority of our tourists travel from outside of the Pilbara area, so the impact of controlled drinking on the island is not really relevant. It is hard to make a comment on the entirety of the Pilbara area as we are so isolated here.*
- *Patrons use partners or friends with clear ID etc to get around the system*
- *We continue to fail to address the fundamental causes, striking instead at the symptoms.*
- *what is stopping someone that is not banned from coming into the store and buying for someone that is banned ?*
- *Can be more effect if we can get people on there quicker*
- *We dont have these issues in* [redacted]

- *Without the ability of the police being able to affectively put bans on the people that create the anti social behavior in the community the BDR is not very effective on stopping the issues.*
- [redacted]
- *While the BDR system has stopped the individual from being able to purchase alcohol, it does not seem to affect their ability to get it through friends and family.*
- *The key benefit of the BDR is that it targets the problem drinkers as opposed to extensive restrictions that impact all people. Our business fully supports the trial of the BDR and believes that this is the most targeted and potentially the most sustainable approach to the management of the misuse and abuse of alcohol in the Pilbara. However it will function most effectively if individuals are added to the BDR in a timely manner. For example, note the extensive policy adopted in the Northern Territory with routine processes providing local police with the ability to add people to the BDR with immediate effect. Also, broadening the reasons for someone to be placed on the BDR may also have a positive impact. Additional reasons to add people to the BDR could also include the unacceptable behaviour causing disruption to the community, including drug related incidents and other serious criminal offences; drink driving offences; to enforce bail conditions; etc. All of this being said, it has been quite some time since Police have requested that we implement temporary voluntary restrictions on products or trade due to a community issue in the South Hedland area.*
- *The key benefit of the BDR is that it targets the problem drinkers as opposed to extensive restrictions that impact all people. Our business fully supports the trial of the BDR and believes that this is the most targeted and potentially the most sustainable approach to the management of the misuse and abuse of alcohol in the Pilbara*

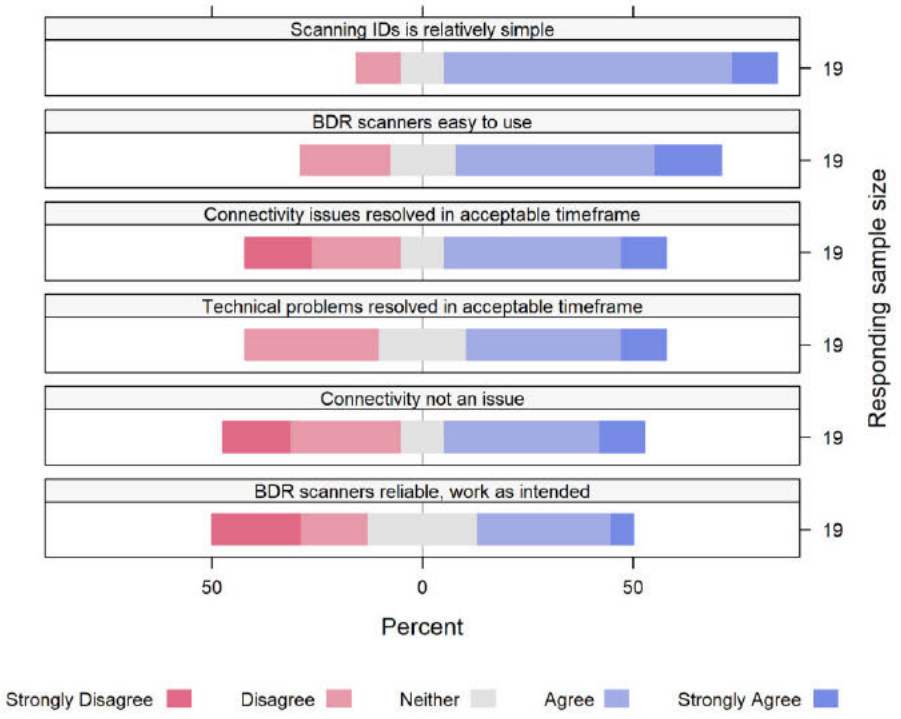
4.1.3 Efficiency and effectiveness of the BDR technology

This question asked:

Do you think the BDR technology works: (Please select the response that is most closely aligned to your view).

- The BDR scanners are easy to use
- The BDR scanners are reliable and work as intended
- Scanning IDs on the BDR scanners is relatively simple
- When there is a technical problem with a BDR scanner, it is resolved in an acceptable timeframe
- Connectivity to keep the system online is not an issue
- If there is an internet connectivity issue, it is resolved in an acceptable timeframe

Figure 26: Assessment of functionality of BDR scanner technology and support



Open text responses that accompanied this question were:

- *The scanners are an absolute nightmare. They increase the time spent at checkouts hugely, the connectivity is terrible*
- *Scanners freeze daily as poor internet connections in our community*
- *Being so remote, the internet is very temperamental and drops out multiple times per day.*
- *Interstate and international users are not on record - most of our clients*
- *internet is to slow and runs out of internet to fast*
- *the machine struggles with some state licensees*
- *Needs some work, regarding working under white lights. Faster connection to the cloud and being able to work on a range of phones. The mobile scanner is fantastic though. Would definitely speend things up. Did have some problems getting details downloaded correctly*
- *Not all state IDs work effectively on the BDR scanners and most need to be rescanned very slow during busy traded hours.*
- *Often the scanner will not pick up the data on the licence even when the licence is clear/ not marked and in good condition staff need to wait and re scan the identification holding up other customers; this affects our service and customer experience for other customers waiting to be served at both* [redacted] *and the* [redacted] *Sometimes the ID will always show as amber even when rescanned, should the staff be refusing service in this instance as the scanner has not confirmed they are banned nor has it confirmed they have not? If the staff proceed with the sale can we be held accountable for the sale if in fact the customer is banned from liquor sales even though the scanner has not identified them as being banned. Staff have*

identified that they have observed that at times the scanner will show a DOB which is manifestly incorrect.

- *The scanner is easy to use. However, we often experience connectivity issues requiring us to unplug the scanner units and re-plug them in to reset them. We do this on a daily basis to ensure the BDR scanners are ready for trade. However at times we need to do this multiple times a day. Over time it will be interesting to note how the scanner plate sustains long term use. For example, over time the scanner plates for the NT BDR units become scratched, leading to a higher number of re-scans or manual entries. It would be very helpful if the DLGSC provided short training videos that Licensees could use to teach new staff how to use the BDR and troubleshoot issues. In terms of the following question regarding ID re-scans, although there is a high instance of rescans required, this is largely due to customers presenting invalid ID/borrowed ID/expired ID etc.*
- *The store has experienced extensive BDR connectivity issues. This is evidenced by the data reflected in the report. The unit has to be unplugged and reset regularly so that it connects to wi-fi. It's not immediately obvious when the scanner is offline. Weather events also impact connectivity. From April had to have one of the BDR's replaced because it was non-functional. Also identified that no comms was on the modem. Took a week to get an answer from Scantek. Replacement scanner couldn't connect to wi-fi. Store self serviced fix to unit. Staff continue scanning even though there was a wifi connectivity issue, in expectation that the scans will process once the unit is back online.*

Table 34: Frequency of need to rescan ID

Frequency	count	percent
Many times per day	7	36.84
Several times per day	8	42.11
Once or twice per day	2	10.53
Once or twice per week	0	0.00
Once or twice per month	0	0.00
Unacceptable ID is hardly ever presented	2	10.53

5 Policy impact modelling

This chapter provides an overview of the formal modelling strategy employed to investigate the policy impact and presents the empirical findings. Further explanatory information relevant to the modelling is presented in the Appendix, but the information presented in this chapter can be understood without reference to the Appendix.

5.1 Methodology

In general the impact of a policy intervention cannot be measured by looking directly at trend changes in the target variable. This is because there can be many underlying contributing factors impacting trend variable changes. These trend impacts typically impact more than just the target region.

The policy impact of the BDR on crime can however be estimated using a difference-in-difference approach. The difference-in-difference approach considers changes to crime metrics in the Pilbara over the period of the introduction of the BDR, and compares these values to the change in crime metrics in other jurisdictions that either have no BDR or have had no operating BDR for the period of interest.

The idea is that by looking at the difference between the changes in crime statistics in the target region and changes in crime statistics in control regions that did not have a BDR it is possible to separate out the actual policy effect from underlying general trend changes impacting the State. Although the technical implementation is slightly more complex (see appendix) a simple numerical example can help explain the way the difference-in-difference method works.

Assume that at time period one the annual road traffic fatalities in the control region and the BDR target region are both 100. Now, let the BDR be implemented in the BDR target region but not in the control region. At time period two let the annual road traffic fatalities be 110 in the control region and 105 in the target BDR region. For this example the difference-in-difference approach attributes the increase of 10 fatalities to a common trend impacting all regions (due to say a reduced police enforcement effect) and so the effect attributed to the BDR is a reduction of five fatalities (110 to 105) not an increase of 5 fatalities (100 to 105). The intuition of the difference-in-difference approach is to control for overall data trends to isolate the actual policy impact.

The formal linear difference-in-difference regression model was implemented via the lm() function in the base stats package of R. This function uses a direct method to solve the linear least-squares problem to fit the model. To keep only those explanatory variables that were useful in explaining variation in reported crime, a step-wise variable selection based on the Akaike Information Criterion (AIC) was used.[5] This process was implemented using the stepAIC function from the MASS package. The variables that this procedure selected can be seen in the output in the Appendix.

5.2 WA Police data

Monthly crime data are available from the WA Police Force.[6] Data are available for the state of Western Australia, the two Regions (Metropolitan and Regional WA) and each individual police district from January 2007 onwards. Data are reported for the following categories:

- Total Selected Offences Against the Person
  - Homicide
  - Recent Sexual Offences
  - Historical Sexual Offences

[5] This procedure optimises a function balances the increase in model fit, following the addition of a variable, by including a penalty for model complexity. There are a range of different information criteria metrics. The AIC tends to favour parsimonious models

[6] https://www.police.wa.gov.au/crime/crimestatistics#/

  - Assault (Family)
  - Assault (Non-Family)
  - Threatening Behaviour (Family)
  - Threatening Behaviour (Non-Family)
  - Deprivation of Liberty
  - Robbery
- Total Selected Offences Against Property
  - Burglary
  - Stealing of Motor Vehicle
  - Stealing
  - Property Damage
  - Arson
- Total Detected Offences
  - Drug Offences
  - Receiving and Possession of Stolen Property
  - Regulated Weapons Offences
- Total Selected Miscellaneous Offences
  - Graffiti
  - Fraud & Related Offences
  - Breach of Violence Restraint Order

The regional police districts that are covered by the dataset are:

1) Goldfields-Esperance
2) Great Southern
3) Kimberley
4) Mid West-Gascoyne
5) Pilbara
6) South West
7) Wheatbelt

The focus of this analysis is the Pilbara district, in comparison to other districts that did not introduce a BDR during the same time period. The districts of the Kimberley and Goldfields-Esperance did commence a BDR trial during the analysis period (or will do so in the ultimate sample period) so we do not consider these districts to be free of a potential BDR effect and therefore these regions will not be used as comparison districts.

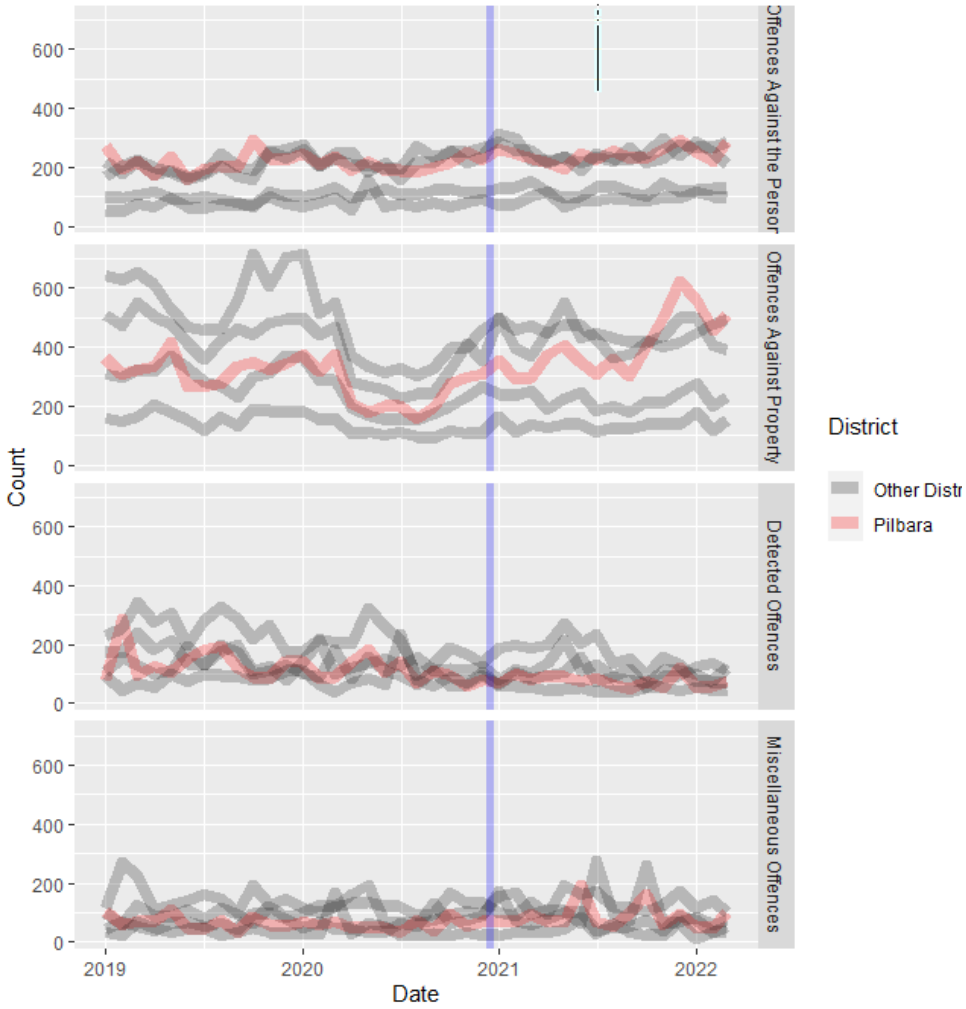
The time series plot of the five districts are shown below, with the Pilbara region highlighted in red. Figure 27 presents the monthly data in terms of actual counts of recorded offences. The partition between pre- and post-BDR introduction is shown as a vertical blue line.

Figure 28 plots the same data, normalised such that all region by crime series have an index value of 100 at the time of BDR introduction. The partition between pre- and post-BDR introduction is again shown as a vertical blue line.

In both Figure 27 and Figure 28 it can be seen that post BDR introduction there is a general increase in *Offences Against Property*. Looking at the Offences Against Property data in greater detail reveals that since 2007, when the data series starts, reported incidents for *Burglary (Non-Dwelling)* and *Stealing of Motor Vehicle* are highest in December 2021.

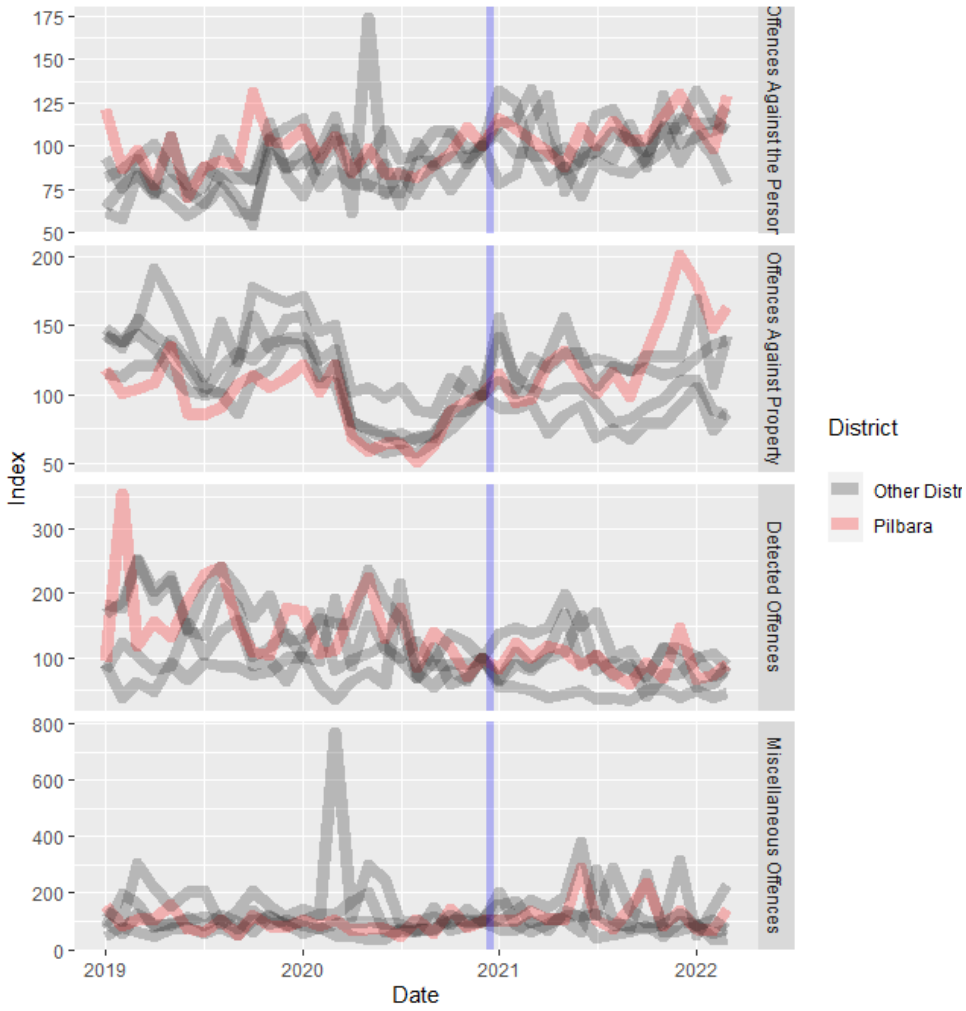
There does not appear to be a similar increase in the most recent months for the other districts to which the Pilbara is being compared. In the difference-in-difference modelling approach this will result in an estimated increase in *Offences Against Property* since the introduction of the BDR.

Figure 27: Monthly count data on reported crimes by type and region



Note: Blue line indicates the introduction of the BDR

Figure 28: Monthly crime data as an index by type and region



Note: Blue line indicates the introduction of the BDR

5.3 Difference-in-difference formal results

A panel data linear regression model was fitted separately to each of the four categories of crime described above. The parameter estimates for the key variable of interest are reported in Table 35. In the table it is the sign of the coefficient and whether it is statistically significant that are the two key aspects to consider.

The only statistically significant key parameter is the *Total Selected Offences Against Property* parameter and the parameter is positive. As discussed earlier, this is due to a large increase in the number of such offences since December 2021 in the Pilbara, particularly for *Burglary (Non-Dwelling)* and *Stealing of Motor Vehicle*. The interpretation of this result is that, controlling for other factors in the regions, in general, there has been an increase in Burglary and Motor Vehicle theft in the Pilbara since the start of the BDR, that has not been present in other regions. The model does not say that the BDR caused an increase in offences. There may be Pilbara-specific factors that are not captured in the model. Across all other offences, the model does not detect a statistically significant effect for the

introduction of the BDR. More detailed model summary information is provided in an Appendix.

Table 35: Model parameters for effect of introduction of BDR

Offence type	Estimate	Std. Error
Total Selected Offences Against the Person	-2.45	(4.94)
Total Selected Offences Against Property	42.88***	(11.82)
Total Detected Offences	-23.66	(14.80)
Total Selected Miscellaneous Offences	31.03	(20.89)

Note: * ** *** significant at the 10% 5% and 1% levels

A practical conclusion to draw is that there is no evidence that the introduction of the BDR has led to reduction in reported crime in the Pilbara, across all major crime categories. The sample time period is however relatively short.

6 Discussion and recommendations

Implementation

The evidence suggests that the BDR has been implemented as expected, by industry, but there is also evidence in the feedback from industry of an expectation that there would be a greater number of individuals on the BDR.

Pathways to the BDR

The number of people on the register is low because the pathways to being listed on the BDR are limited. The effectiveness of the BDR is related to the number of people on the BDR. The framework outlined in the *Alcohol Harm Reduction Bill 2017 (NT)* provides a framework that could be used to expand the pathways to the BDR. Within this framework there are additional options for police and court related pathways to the BDR, including offence types and also an expansion of the range of people that can seek to place a person on the BDR, subject to a review process.

Liquor restricted premises

The number of self-referrals to the BDR is low. Part 5B of the *Liquor Control Act 1988* provides for the creation of Liquor restricted premises. Increased engagement with residents of such premises could be used to create an additional pathway to the BDR, and engage with the community more generally regarding the BDR.

Support services

Heavy drinking is a complex problem, and management of heavy drinking requires a wholistic approach. It is possible to strengthen the link between support service providers and those placed on the BDR.

Policy impact

Across the major crime categories of: offences against persons; property crime; drug, stolen goods and weapons; other major crimes, there is no evidence that since the introduction of the BDR crime rates in the Pilbara have fallen. The sample period available to evaluate is however short.

Technology monitoring

Although the scanning technology generally works well, there have been extended periods when the technology has not been in operation at individual stores. A reporting protocol could be developed so that individual store level reports of scanner usage can be reviewed and issues detected quickly. If the protocol is largely automated then weekly or monthly level store reports could prepared and reviewed. Issues can then be resolved with individual stores.

Purchase restriction avoidance

Across the entire database, a very small number of cases of what might be store hopping were identified. The extent of the issue seems to be small, and because quantity purchased is not known it is not possible to reach a definite conclusion on the motivation for visiting more than one store to purchase alcohol. The extent of store hopping is an area that could be studied in further detail and discussed with relevant store owners. There is no evidence of a widespread problem.

Costs and benefits

Implementation and management of the BDR trial involves costs to society, via the direct cost of the trial, and via the Government staff time involved to manage and operate the BDR. There are also costs to store owners via the extra staff time required to make a sale. Finally, there are some costs to consumers, especially tourists, when they not have appropriate identification at the time of purchase.

The potential benefits of the BDR include a reduction in social harm, and lower costs to government through lower policing and legal system costs. At the end of the 24-month trial period a full benefit-cost assessment of the BDR should be undertaken, where both direct and indirect costs are measured.

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Appendix A

A.1 The theoretical framework

In general policy impacts cannot be measured by looking just at trend changes in the target variable. This is because there can be many underlying contributing factors to trend variable changes.

The law and order and health impacts of the BDR can however be identified, if present, using a difference-in-difference modelling approach.

The difference-in-difference approach considers changes to public health and law and order metrics in the Pilbara over the period of the introduction of the BDR, and compares these changes to changes in other jurisdictions that either have no BDR or have had the BDR operating for the period of interest.

The available data can be considered as A pooled cross-sectional data (or where identical items have been sampled multiple periods as panel data). In this setting the standard analytical approaches for panel data, of which difference-in-difference is one, can be applied (Wooldridge 2010).

The general form of the model with multiple is written as:

$$Y_{it} = \beta_0 + \beta_1 \mathrm{P}_i + \beta_2 BDR + \beta_3 \mathrm{P}_i \times \mathrm{BDR}_t + \boldsymbol{\gamma}\mathbf{X}_{it} + e_{it}$$

where:

Y_{it} is the health or law and order outcome for measure i at time t;

$\mathrm{P}_i = 1$ if the i^{th} value is within the Pilbara region, and 0 otherwise;

$\mathrm{BDR}_t = 1$ if time t is after the introduction of the BDR, and 0 otherwise;

$\mathbf{X}$ is a matrix of control variables of the i^{th} measurement at time t; and

e_{it} is a zero mean error term.

With this specification β_3 is the parameter of interest. It is a measure of the impact of the introduction of the BDR on Pilbara public health or law and order metric *Y*.

Metrics from multiple jurisdictions are modelled so that any effect that coincides in timing with the introduction of the BDR in the Pilbara but affects multiple jurisdictions does not 'confound' the estimate of the impact of the introduction of the BDR the Pilbara.

The least squares estimator for β_3 is: $\widehat{\beta_3} = \left(\bar{y}_{B,2} - \bar{y}_{B,1}\right) - \left(\bar{y}_{A,2} - \bar{y}_{A,1}\right)$

where $\left(\bar{y}_{B,2} - \bar{y}_{B,1}\right)$ is the change in the mean relevant metric from time 1 to time 2 in the Pilbara region and $\left(\bar{y}_{A,2} - \bar{y}_{A,1}\right)$ is the change in mean relevant metric from time 1 to time 2 in comparison jurisdictions: this is where the expression difference-indifferences comes from.

Other covariates can be included in the above model if needed. A practical extension to the methodology is semi-parametric modelling of a number of the continuously-valued predictors that can be included in the model (Abadie 2005).

Semi-parametric modelling relaxes some of the assumptions involved with least squares estimation.

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