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Improving the quality of reporting of Aboriginality in police data through record linkage

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AIM

The Aboriginality of people in contact with the NSW criminal justice system is recorded primarily by the NSW Police Force. However, this information has been inconsistently recorded over time and is frequently missing. This study compares approaches to improving the quality and completeness of Aboriginality information in NSW Police records for use in aggregated statistical reporting.

METHOD

42,887,648 NSW Police victim and person of interest records from January 1994 to February 2024 were extracted for 11,711,547 distinct individuals. To determine the likely Aboriginality of these individuals, several algorithms were applied to the records, including ever-identified, twice-identified, and percentage-based methods. Each algorithm was assessed by comparison to two "source of truth" datasets containing more complete Aboriginality data: the first was custodial data, and the second was NSW Police Force data after improvements to the recording of Aboriginality in 2022. Performance of these algorithms was compared based on: (i) similarity of counts of Aboriginal people to the comparison data (similarity); (ii) proportion of individuals whose Aboriginality was incorrectly assigned (classification error); and (iii) proportion of individuals identified as Aboriginal who were Aboriginal according to the comparison data (precision).

RESULTS

Ever-identified and twice-identified algorithms were found to substantially overestimate the number of Aboriginal people according to the comparison datasets. The algorithms with the lowest classification errors, closest similarity of counts, and higher precision were percentage-based algorithms. The performance of these varied between the two comparison datasets by age group and performance measure. It was found that algorithms that worked best for Aboriginal adults overcounted the number of Aboriginal young people. In response to this, a two-step method was devised: individuals with an adult record were considered likely to be Aboriginal if they were recorded as Aboriginal in at least 25% of their valid adult records; individuals who only had police records as a young person were considered likely to be Aboriginal if they were recorded as Aboriginal in at least 35% of their valid records. This method was found to generate similar counts to comparison datasets, for both Aboriginal adults and young people with the lowest classification error.

CONCLUSION

Algorithms applied to linked data are capable of substantially improving the completeness of NSW Police Aboriginality records and generating more accurate counts of Aboriginal people in contact with police. This in turn will improve our understanding of Aboriginal people's contact with the criminal justice system and inform efforts to reduce over-representation. For NSW victim and person of interest data, application of a two-step method whereby the presence of an adult record is used to determine which percentage method to apply for each individual was found to deliver the best results.

KEYWORDS

Aboriginal people

Administrative data

Time series

Police

Crime statistics

INTRODUCTION

Governments, researchers, and communities rely on administrative data to understand social issues, monitor system performance, measure outcomes, and make informed policy recommendations and decisions. In the justice system, administrative data is integral to evaluating whether the justice system is operating efficiently, effectively, and equitably. In Australia, a critical concern is the overrepresentation of Aboriginal and Torres Strait Islander people in the justice system and State and Federal Governments have commitments to address this through Closing the Gap socio-economic targets¹. To monitor progress towards these targets, and to identify areas for system improvements, reliable counts of Aboriginal and Torres Strait Islander people are needed across an array of government datasets (AIHW, 2012; Christensen et al., 2014; Gialamas et al. 2016; Hardman 2010).

Measuring the number of Aboriginal² people coming into contact with the justice system is not without its challenges. Issues with completeness (i.e. whether Aboriginality is recorded) and undercounting of Aboriginal people within administrative data (e.g. not all Aboriginal people identify as such to government officials) are well documented (AIHW, 2005, 2010; Briffa et al., 2010; Christensen et al., 2014; Hunter & Ayyer, 2011; Kennedy et al., 2009; Lawrence et al., 2012). Incomplete and inconsistent Aboriginality information may be the result of a range of factors, including the method of collection, staff practice and training, the circumstances at the point of interaction, a reluctance to identify or an individual's uncertainty of their ancestry (AIHW, 2005, 2012). Whilst much of the work in examining these complexities has focused on government health datasets, criminal justice system data is not immune to these issues. For example, between 1998 and 2006 the percentage of individuals recorded as being of unknown Aboriginality within the NSW Bureau of Crime Statistics and Research's (BOCSAR) Reoffending Database varied between 20% and 30% (Hunter & Ayyer, 2011).

The recording of Aboriginality in the NSW justice system

The Aboriginality of a person is potentially recorded each time they come into contact with police as either a person of interest (POI) or a victim of crime. If a person comes into contact with police multiple times their Aboriginality will be recorded separately at each contact.

NSW Police Force data is the only source of Aboriginality data for people coming into contact with police as victims of crime and the primary source of Aboriginality for alleged offenders. Aboriginality is not recorded at court, and while it is recorded when a person enters custody, most people in contact with the justice system do not have any experience of prison or youth detention. As such, gaps or inaccuracies in NSW Police Aboriginality data can heavily influence our understanding of the volume of Aboriginal people in the criminal justice system. The completeness of Aboriginality data recorded by NSW Police also has a direct impact on the ability to continuously monitor the performance of Target 13 under Closing the Gap in NSW, which aims to reduce the rate of family violence against Aboriginal women and children³.

As NSW Police records are the primary source of Aboriginality information for people in contact with the justice system, it is crucial that this data is reliable. However, the degree of reliability varies over time. One significant practice change occurred on 13 January 2022 when it became mandatory for police to ask all victims of crime, POIs, and persons subject to a police power, "Do you identify as Aboriginal and/or Torres Strait Islander?", with individuals asked having the right to refuse to answer⁴. This change significantly improved Aboriginality records. Police proceedings for traffic, marine and transport infringements were excluded from this change.

¹ <https://www.closingthegap.gov.au/national-agreement/targets>

² For the rest of this report, unless otherwise stated, the term 'Aboriginal' includes people identified as Aboriginal and/or Torres Strait Islanders due to the very small proportion of the population in NSW who are Torres Strait Islander origin only (ABS 2022).

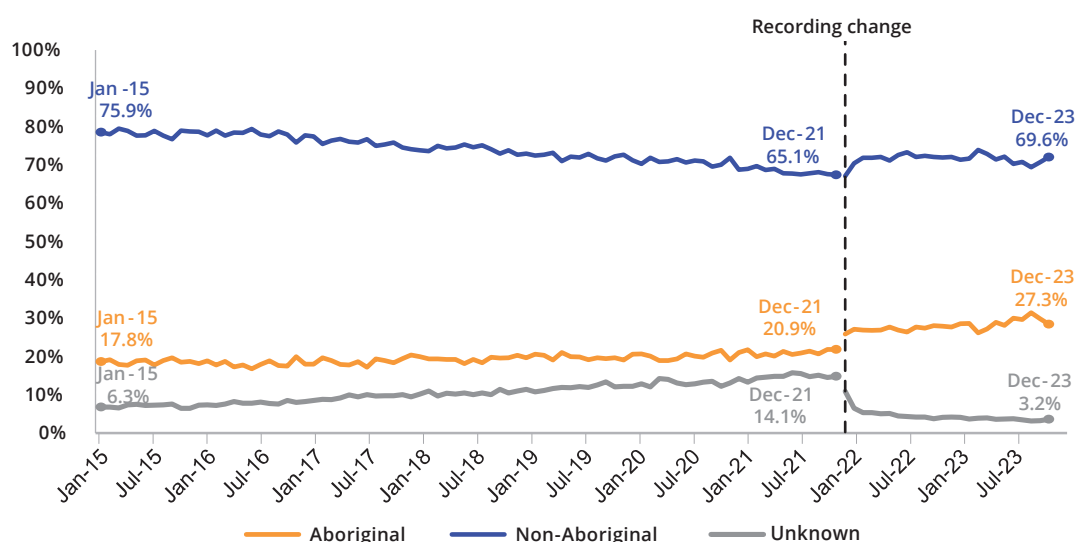
³ https://www.bocsar.nsw.gov.au/Pages/bocsar_pages/Closing-the-Gap.aspx

⁴ https://www.police.nsw.gov.au/safety_and_prevention/your_community/aboriginal_people_and_communities

The reliability of police data prior to and after this change is explored in Figure 1. This figure shows the proportion of POIs proceeded to court by police from 2015 to 2023, by Aboriginality as recorded at the time of contact. Between 2015 and 2021 the completeness of Aboriginality data recorded by police deteriorated with the proportion of POIs of unknown Aboriginality increasing over this time (Figure 1). In January 2015, 6.3% of POIs proceeded against to court had unknown Aboriginality, rising to 14.1% by December 2021. After the recording change in January 2022 there was a substantial reduction in the proportion of POIs of unknown Aboriginality, down to 3.2% by December 2023. Both the proportion of POIs recorded as non-Aboriginal and Aboriginal increased from 2022.

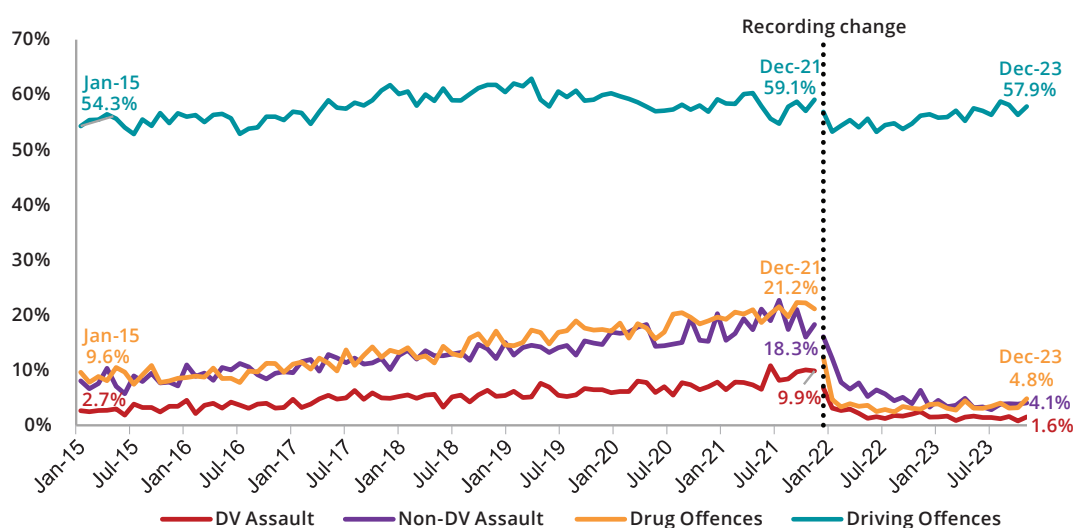
Figure 2 shows the percentage of POIs proceeded to court for domestic violence (DV) assault, non-DV assault, drug offences, and driving offences who were of unknown Aboriginality. This figure indicates that the percentage of POIs of unknown Aboriginality varies by offence with the percentage being particularly high for driving offences (59.1% in December 2021), followed by drug offences (21.2%), non-DV assault (18.3%) and DV assault (9.9%). For each offence the completeness of Aboriginality data deteriorated in the seven years to December 2021. For instance, the proportion of POIs proceeded to court for DV assault who were of unknown Aboriginality increased from 2.7% in January 2015 to 9.9% in December 2021. The percentage of POIs recorded as being of unknown Aboriginality decreased after January 2022 for DV assault (to 1.6% in December 2023), non-DV assault (to 4.1%), and drug offences (to 4.8%). Due to the exclusion of traffic offences from the recording change the percentage of POIs proceeded to court for these offences who were of unknown Aboriginality remained above 50%.

Figure 1. Recorded Aboriginality of POIs proceeded to court by NSW Police (%)⁵



⁵ Percentages in this data are not calculated from counts of unique individuals. If an individual was proceeded to court more than once in the time series then they will appear multiple times in the data, potentially with different Aboriginality recorded. Data excludes breaches of bail and driving offences.

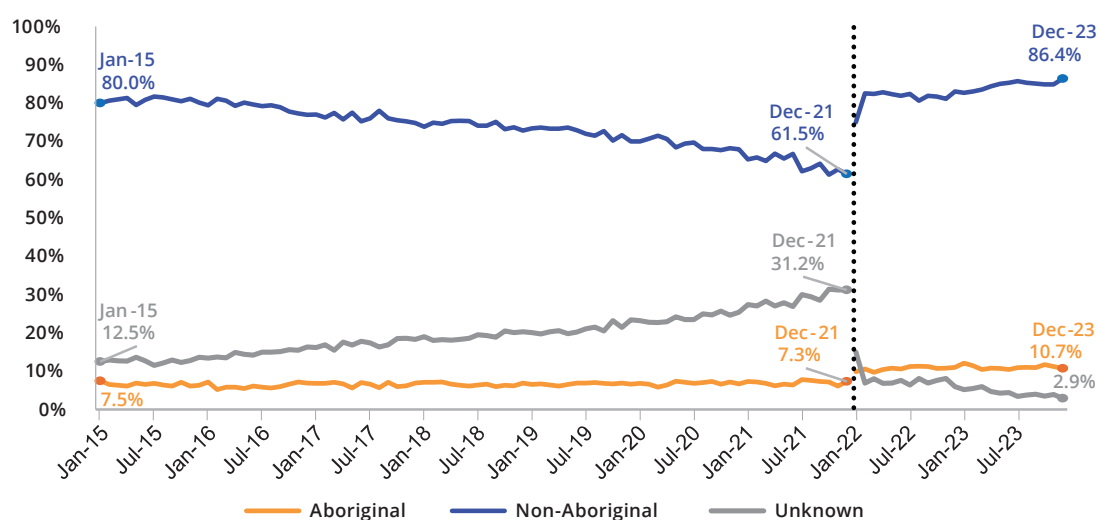
Figure 2. Missing/unknown Aboriginality among POIs proceeded to court by NSW Police, selected offences (%)⁵



The quality of Aboriginality data for victims also deteriorated up to December 2021. Figure 3 shows the Aboriginality of victims of violent offences recorded by police. The completeness of this data is low, with 31.2% of victims of violent offences recorded with unknown Aboriginality in December 2021, more than double the percentage in January 2015 (Figure 3). Here too data quality improved after January 2022 with the percentage of victims of unknown Aboriginality decreasing significantly, down to 2.9% by December 2023.

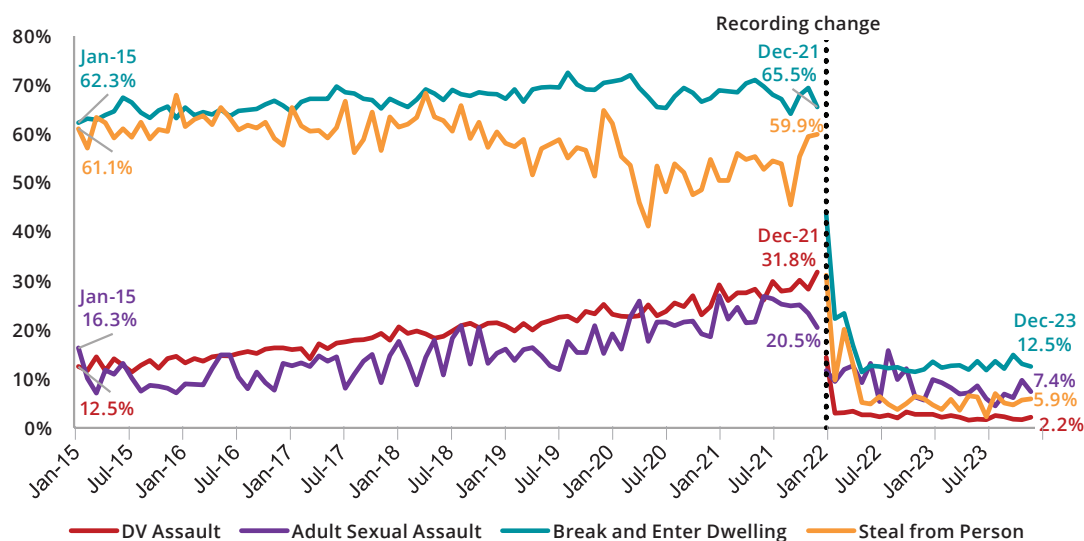
Figure 4 shows the proportion of victims of DV assault, adult sexual assault, break and enter dwelling, and steal from person whose Aboriginality was unknown. For DV assault the proportion of victims who were of unknown Aboriginality more than doubled from 12.5% in January 2015 to 31.8% by December 2021. There was also an increase over time in the proportion of adult sexual assault victims recorded as being of unknown Aboriginality from 16.3% in January 2015 to 20.5% in December 2021. For break and enter dwelling and steal from person the majority of victims had unknown Aboriginality consistently across the whole period from 2015 to 2021. For all four offences the proportion of victims recorded as being of unknown Aboriginality decreased substantially after the recording change in 2022.

Figure 3. Recorded Aboriginality for victims of violent crime recorded by NSW Police (%)⁵



Note. Violent offences include murder, attempted murder, manslaughter, domestic violence related, non-domestic violence related, assault police, robbery without a weapon, robbery with a firearm, robbery with a weapon not a firearm, sexual assault and sexual touching, sexual act and other sexual offences.

Figure 4. Missing/unknown Aboriginality for crime victims recorded by NSW Police, selected offences (%)⁵



The high proportion of unknowns prior to 2022 increases the uncertainty of estimates of the actual incidence of Aboriginal persons in contact with the justice system before 2022. Using this data; the number of Aboriginal people would be significantly undercounted by varying degrees depending on the proportion of the unknown component that is made up of Aboriginal and non-Aboriginal persons (a problem previously identified by Hunter & Ayyer, 2011). This in turn impacts estimates of the rate of overrepresentation of Aboriginal people in the criminal justice system. Furthermore, a high proportion of records with unknown Aboriginality suggests poor overall data quality and calls into question the reliability of recorded Aboriginality data. These issues undermine confidence in the data available to policy makers.

The recording change by NSW Police improved the completeness of Aboriginality data after January 2022, however it also introduced a break in the time series for Aboriginal identification among persons coming into contact with the justice system as either victims or offenders. As such, unadjusted counts of Aboriginal and non-Aboriginal individuals in police data after 13 January 2022 cannot be compared to counts prior to this date due to the differing recording practices. This is problematic for tracking long term trends in offending and victimisation, and for monitoring progress to Target 13 of Closing the Gap as the baseline year for the target is the 2018-19 financial year.

Therefore, the problems in counting the number of Aboriginal people in the NSW criminal justice system are two-fold. Firstly, there is an unacceptably high proportion of persons of unknown Aboriginality prior to 2022 and associated concerns with data quality. Secondly, there is a discontinuity in the data due to the improvement in Aboriginality recording since 2022 which means that counts of Aboriginal and non-Aboriginal people pre- and post-change cannot be directly compared.

Methods for improving administrative data

The issues outlined above demonstrate that raw unadjusted Aboriginality data for the NSW justice system is not adequate for reporting and monitoring the number of Aboriginal people coming into contact with the justice system.

An established way to improve the consistency and completeness of Aboriginality data in large administrative datasets is to apply a simple algorithm to linked data records belonging to each individual to derive the person's likely Aboriginality (AIHW, 2012). That status is then applied across all records for a person for the purposes of statistical counting. These methods can be applied to linked records from a

single dataset or linked records across multiple datasets (AIHW, 2012; Christensen et al. 2014; Tervonen et al., 2019; Thompson et al., 2012). Examples include⁶:

- **Ever-identified:** A person is counted as Aboriginal if they have been recorded as Aboriginal at least once (i.e. on at least one administrative record) (e.g. Badgery-Parker, 2012; Centre for Epidemiology & Health NSW, 2012; Draper et al., 2009; Gialamas et al. 2016; Randall et al., 2013; Taylor et al., 2012; Tervonen et al., 2019);
- **Twice-identified⁷:** A person is counted as Aboriginal if they were recorded as Aboriginal on at least two administrative records (where the person has at least three independent records). People with only one or two independent administrative records are considered Aboriginal if they were recorded as Aboriginal at least once (e.g. Centre for Epidemiology & Health NSW, 2012; Gialamas et al., 2016; Nelson et al., 2020; Taylor et al., 2012);
- **Most recent record:** A person is counted as Aboriginal if they were recorded as such on their most recent administrative record (e.g. Randall et al., 2013; Tervonen et al., 2019);
- **Index record:** A person is counted as Aboriginal if they were recorded as such on their first administrative record (e.g. Badgery-Parker, 2012; Briffa et al., 2010);
- **Percentage based methods:** A person is counted as Aboriginal if they were recorded as Aboriginal in a set proportion of their administrative records. A common threshold is 50%; i.e. a person is counted as Aboriginal if they are recorded as Aboriginal in at least half their administrative records (e.g., Badgery-Parker, 2012; Briffa et al., 2010; Draper et al., 2009; Neville et al., 2011; Randall et al., 2013).

Several studies have investigated how Aboriginality counts differ based on the algorithm applied and how this in turn impacts the reported outcomes (Briffa et al., 2010; Centre for Epidemiology & Health NSW, 2012; Gialamas et al., 2016; Randall et al., 2013; Taylor et al., 2012; Tervonen et al., 2019). For example, Gialamas et al. (2016) found in a 2008-2012 cohort of South Australian Year 3 students, that the proportion of children who were identified as Aboriginal varied from 2.6% to 4.7%, depending on the counting method applied to linked birth, perinatal, and education data. These differences in the number of children identified as Aboriginal resulted in a 12 percentage point difference (43% to 55%) in the estimated proportion of Aboriginal children attaining the national minimum standard in Year 3 reading in 2012 (Gialamas et al., 2016). Clearly, the particular method adopted affects the number of Aboriginal people counted in the data and subsequent reporting of rates, potentially impacting the allocation of resources and supports. It is important, therefore, that the method chosen provides Aboriginality counts that are as reliable as possible.

One way to test for the most appropriate counting method for a particular dataset is to compare the derived Aboriginality of individuals from different algorithms with Aboriginality data of those individuals from an independent and reliable external data source linked to the dataset of interest. This external “source of truth” must hold data on a subset of individuals recorded in the dataset of interest, but with independently collected Aboriginality information. Possible sources of truth for use as comparison datasets include linked survey data (Nelson et al., 2020) or other administrative data collections containing more accurate Aboriginality data (Badgery-Parker, 2012).

The various methods can then be compared by how often the derived Aboriginality for individuals matches their Aboriginality recorded in the source of truth comparison dataset (AIHW, 2012; Badgery-Parker, 2012; Nelson et al., 2020). This approach offers a defined target (the number of Aboriginal people in the comparison file) and clear quantitative criteria for measuring algorithm performance.

⁶ More complex algorithms than those listed here (e.g. multi-stage median) can also be used to improve the accuracy of linked datasets. These assign Aboriginality by applying a counting method to the recorded history of each individual for each linked dataset, then applying the same or a different method across the datasets to generate an overall identifier for the linked datasets (AIHW, 2012; Christensen et al., 2014; Gibberd et al., 2017; Nelson et al., 2020). Such methods can be applied to multiple independent linked datasets from a variety of agencies (e.g., Christensen et al., 2014; Gibberd et al., 2017; Nelson et al., 2020; Ringland et al., 2022; Boiteux & Poynton, 2023). For simplicity, and as the Aboriginality data used to count Aboriginal POIs and victims comes from the same agency (NSW Police), these methods were not considered in this study.

⁷ Variations of this method have also been referred to as a “weight of evidence” algorithm (Randall et al., 2013; Tervonen et al., 2019) or “Enhanced Reporting of Aboriginality” (Centre for Epidemiology & Health NSW, 2012).

It is important to note that no algorithm can define an individual as Aboriginal. The purpose of these methods is to generate a statistical construct that reasonably estimates the actual number of Aboriginal people in contact with police. This in turn allows the provision of reliable and complete aggregate data which can be used by government and community to monitor trends, inform strategic planning, guide policy development and track outcomes. The approach considered here is not appropriate for the purpose of determining an individual's eligibility for a service or program nor should it be used as an alternative to self-identification at the point of service contact.

The current study

The purpose of this work is to identify a method that can be applied to POI and victim records from the NSW Police Force to improve the quality of Aboriginality data for research and analysis. The preferred method should improve Aboriginality classification by both reducing the proportion of records with unknown Aboriginality while also delivering more accurate counts of Aboriginal people.

Our approach to developing and testing an appropriate method is to:

1. Apply various algorithms to a test dataset consisting of NSW Police data to generate counts of individuals by their derived Aboriginality; and
2. Test the quality of derived Aboriginality counts by comparing them with Aboriginality counts from two independent sources:
 - i. Custody data from Corrective Services NSW and Youth Justice NSW;
 - ii. NSW Police data collected post-recording change (from 13 January 2022).

This will allow us to determine the most appropriate method to apply to the data source into the future.

METHOD

Data sources

Test dataset: NSW Police data

Victim and POI details for 42,887,648 unique police recorded events⁸ from 1 January 1994 to 10 February 2024 were extracted from the NSW Police Computerised Operational Policing System (COPS). This includes Aboriginality information gathered directly by police officers at each police contact. Individuals are assigned a Central Name Index (CNI) by NSW Police; this is a unique reference number that connects their records over time. The whole dataset contained records of 11,711,547 unique CNIs/people; 8,199,413 CNIs were recorded as victims in an event, and 7,020,010 were recorded as POIs, with 471,727 recorded as both a victim and a POI in the same event.

Each recorded contact with police (either as a victim or alleged offender) includes information on whether the person identified as Aboriginal or non-Aboriginal to NSW Police or were of unknown⁹ Aboriginality at the contact. All records belonging to each individual (from 1994 to 10 February 2024) were linked by CNI. For each individual person, we could then observe and count the number of records where they were identified as Aboriginal, non-Aboriginal, or were of unknown Aboriginality. Counts of the number of recorded events with a known Aboriginality (i.e. recorded as either Aboriginal or non-Aboriginal) for each CNI were also calculated. For the purposes of analysis each unique CNI is treated as a distinct individual.

⁸ An event is a set of one or more related criminal incidents reported to or detected by police and recorded on the NSW Police Force's COPS database.

⁹ As part of the recording changes on 13 January 2022 the 'unknown' option for police recording of response was replaced with 'unable to ask' with a choice of the following four options for indicating the reason for this: Person Not Present, Intoxicated, Incapacitated, Deceased. In addition, police may record that an individual 'refused to answer' whether they identify as Aboriginal and/or Torres Strait Islander. In this report the 'unable to ask' category is combined with 'refused to answer' and the resultant output referred to as 'unknown' for consistency with pre-2022 data.

For analysis of algorithm performance, four smaller test datasets comprised of CNIs appearing in the data between January 2017 and December 2021 were selected from the larger extract. These were:

1. Adult POIs proceeded to court, excluding those proceeded against for driving and transport regulatory offences (226,591 individuals);
2. Adult victims of DV related assault¹⁰ (106,242 individuals);
3. Under 18 POIs proceeded against by NSW Police¹¹, excluding those proceeded against for driving and transport offences (40,306 individuals);
4. Under 18 victims of DV related assault¹⁰ (11,663 individuals).

These datasets are not mutually exclusive as individuals may appear as a POI in one event and a victim in another, or in separate events as a young person and later as an adult. These cohorts were chosen as they reflect cohorts of interest in BOCSAR's reporting about Aboriginal peoples' contact with the justice system.¹²

Comparison dataset: Custody data

The first source of truth dataset consists of data from adults discharged from Corrective Services NSW (CSNSW) gazetted correctional centres and young people discharged from Youth Justice NSW (YJNSW) centres between 1 January 2012 and 31 January 2024.

Adult and youth data were extracted from CSNSW Offender Integrated Management System (OIMS) and the YJNSW Client Information Management System (CIMS) respectively. Detailed information is collected by CSNSW and YJNSW when a person is admitted into custody, including the individual's Aboriginality. Critical for this study, the collection of Aboriginality data in CSNSW and YJNSW custody data is both independently recorded and considered more reliable than Aboriginality data recorded by NSW Police due to its higher completeness and the information recording process during reception into custody¹³. For example, in December 2023 only 0.2% of adults and no young people were of unknown Aboriginality.¹⁴

Data from individuals in the custody dataset was joined to the complete COPS extract using CNI. This linked dataset contained 93,102 unique individuals with both a custody episode and a recorded contact with the NSW Police Force (as a victim of crime or a POI). Of these individuals 2,077 (2.2%) had custody episodes with conflicting Aboriginality. That is at least one custody record indicated the person was Aboriginal and another custody record indicated the person was non-Aboriginal. For the purposes of this analysis a CNI with at least one custody record indicating they were Aboriginal was treated as Aboriginal in this source of truth. Of the individuals with both a custody episode and a recorded contact with NSW Police, 65,318 were proceeded to court between 2017 and 2021.

Table 1 shows the total number of police events and custody episodes in the full recorded histories of individuals who were proceeded to court by NSW Police between 2017 and 2021 and who had a custody episode between January 2012 and January 2024. Table 1 also shows the proportion of these police events and custody episodes by Aboriginality recorded at that event/episode. Aboriginality was recorded as unknown in 26.2% of police events between January 1994 and February 2024. This figure was substantially lower for custody episodes involving this cohort, with 1.8% of custody episodes where Aboriginality was unknown.

¹⁰ Assault offences which the NSW Police Force choose to flag as 'domestic violence related' based on the definition of domestic violence from the *Crimes (Domestic and Personal Violence) Act, 2007*

¹¹ Includes young people proceeded to court and youth justice conferences, cautions and warnings under the *Young Offenders Act, 1997*

¹² <https://bocsar.nsw.gov.au/topic-areas/aboriginal-over-representation.html>

¹³ <https://correctiveservices.dcj.nsw.gov.au/content/dam/dcj/corrective-services-nsw/documents/copp/01-reception/01.01-reception-procedures.pdf>

¹⁴ <https://bocsar.nsw.gov.au/statistics-dashboards/custody/custody-dashboard.html>

Table 1. Aboriginality recorded on police events and custody episodes for individuals with both a court proceeding between 2017 and 2021 and a custody episode between January 2012 and January 2024 (CNIs= 65,318)

Recorded Aboriginality	Police events recorded between 1 Jan 1994 and 10 Feb 2024		Custody episodes occurring between 1 Jan 2012 and 31 Jan 2024	
	Number of police events	% of police events	Number of custody episodes	% of custody episodes
Aboriginal	868,464	16.7%	75,211	36.2%
Non-Aboriginal	2,971,236	57.1%	129,046	62.1%
Unknown	1,363,764	26.2%	3,652	1.8%
Total records	5,203,464	100.0%	207,909	100.0%

Of the 65,318 unique individuals proceeded to court between 2017 and 2021 who had a custody episode, 1,830 (2.8%) had no recorded Aboriginality in the custody data (i.e. were of unknown Aboriginality in all of their custody episodes). For the analysis of algorithm performance, persons with unknown Aboriginality in the comparison dataset were excluded.

Comparison dataset: NSW Police data post-recording change

The second source of truth dataset is NSW Police Force data for victims of crime and POIs with events occurring between 13 January 2022 and 10 February 2024. As demonstrated in Figures 1 – 4, there was a significant improvement in the quality of police recorded Aboriginality from January 2022 after it became mandatory for police to ask victims and POIs whether they identify as an Aboriginal or Torres Strait Islander person. As such, Aboriginality data recorded by police after this change can be regarded as having greater reliability than the data recorded prior.

There were, however, some police events that did not benefit from the police practice change. These events were omitted from the comparison dataset and included the following:

- Events where the most serious proceeding type was an infringement notice (fine);
- Events where the most serious offence was a driving offence;¹⁵ and
- Events where the most serious offence was 'Transport regulatory offences'¹⁶ which includes offences on the rail network such as travelling without a valid ticket, smoking, drinking, or using offensive language.

This dataset contained 815,131 unique CNIs; 551,772 CNIs were recorded as victims in an event, and 323,716 were recorded as POIs, with 25,644 recorded as both a victim and a POI during the period. There were 35,571 individuals (4.4%) who had at least two police events with conflicting recorded Aboriginality data between 13 January 2022 and 10 February 2024. Whilst the quality of police data improved after the recording change, it remains less complete than the custody data. Due to this concern, CNIs with conflicting records of Aboriginality in the comparison dataset were excluded from the study, leaving 779,560 unique CNIs in the dataset. Of these individuals, 84,996 were also proceeded to court by NSW Police between 2017 and 2021. CNIs with at least one record in which they were recorded as Aboriginal were treated as Aboriginal in the comparison dataset.

Table 2 shows police recorded Aboriginality for events involving individuals with both a court proceeding between 2017 and 2021 and at least one record in the police post-recording change comparison data. The two leftmost columns show the total number and percentages of all events for these individuals

¹⁵ Specifically, events in which the most serious charge was for the following Australian and New Zealand Standard Offence Classifications (ANZSOC) were excluded (ABS, 2011): 0132-Driving causing death; 0411-Drive under the influence of alcohol or other substance; 0412-Dangerous or negligent operation (driving) of a vehicle; Division 14-Traffic and vehicle regulatory offences.

¹⁶ <https://www.bocsar.nsw.gov.au/Documents/RCS-Annual/Recorded%20Crime%20Report%20Appendix%204.pdf>

occurring between January 1994 and February 2024, by recorded Aboriginality. Aboriginality was unknown in 30.4% of these events. The two columns to the right show the number and percentage of events occurring in the comparison dataset, Aboriginality was unknown in 6.9% of these events.

Table 2. Aboriginality recorded on events in the full police dataset (1994 to 2024) and post recording-change, for individuals proceeded to court between 2017 and 2021 and with a record in the comparison dataset (CNIs=84,996)

Recorded Aboriginality	Police events recorded between 1 Jan 1994 and 10 Feb 2024		Police events recorded between 13 Jan 2022 and 10 Feb 2024 ¹⁷	
	Number of police events	% of police events	Number of police events	% of police events
Aboriginal	509,715	11.6%	39,176	12.5%
Non-Aboriginal	2,558,195	58.0%	251,860	80.6%
Unknown	1,342,263	30.4%	21,486	6.9%
Total	4,410,173	100.0%	312,522	100.0%

Of the 84,996 individuals proceeded to court between 2017 and 2021 who also had a police event post-recording change, 2,738 (3.2%) had no recorded Aboriginality in the police comparison dataset (i.e. were of unknown Aboriginality in all of their records in this dataset). These persons were excluded from analysis of algorithm performance.

Table 3 shows police recorded Aboriginality on all events involving victims of a DV assault between 2017 and 2021 who also have a police record post-recording change. The two leftmost columns show all events for these individuals occurring between January 1994 and February 2024, by recorded Aboriginality. Aboriginality was unknown in 38.4% of these events. The remaining columns show events in the comparison dataset; Aboriginality was unknown in 11.7% of these events.

Table 3. Aboriginality recorded on events in the full police dataset (1994 to 2024) and post recording-change, for individuals recorded as a victim of DV assault between 2017 and 2021 and with a record in the comparison dataset (CNIs=37,537)

Recorded Aboriginality	Police events recorded between 1 Jan 1994 and 10 Feb 2024		Police events recorded between 13 Jan 2022 and 10 Feb 2024 ¹⁷	
	Number of police events	% of police events	Number of police events	% of police events
Aboriginal	227,065	14.3%	18,948	17.1%
Non-Aboriginal	753,690	47.3%	78,593	71.1%
Unknown	611,177	38.4%	12,975	11.7%
Total	1,591,932	100.0%	110,516	100.0%

Of the 37,537 victims of DV assault between 2017 and 2021 who also had a police event post-recording change, 2,072 (5.5%) had no recorded Aboriginality in the police comparison dataset (i.e. were of unknown Aboriginality according to the comparison data). For the analysis of algorithm performance these persons were excluded.

¹⁷ Excludes events where the most serious proceeding was an infringement notice and events where the most serious offence was a driving or transport offence.

Counting methods applied to the data

The performance of three algorithmic methods were tested. Each method was applied to the linked NSW Police victim and POI records to generate an adjusted Aboriginality for each CNL:

1. Ever-identified

- If at least one police event indicated the person to be Aboriginal, then the person is counted as Aboriginal. Persons with at least one record indicating them to be non-Aboriginal, and with no records indicating them to be Aboriginal, are counted as non-Aboriginal.
- If all an individual's records had Aboriginality recorded as unknown then the person's Aboriginality is counted as unknown.

2. Twice-identified

- If a person has more than two police events with Aboriginality recorded (i.e. not unknown), and at least two of those recorded the person as Aboriginal, then the person is counted as Aboriginal.
- Or else, if a person has two or fewer police events with Aboriginality recorded, and at least one of those indicates the person is Aboriginal, then the person is counted as Aboriginal.
- If all an individual's records have Aboriginality recorded as unknown then the person's Aboriginality is counted as unknown.
- All other people, who do not meet any of the criteria above, are counted as non-Aboriginal.

3. Percentage methods

- If a set percentage of an individual's police events with Aboriginality recorded indicate that the person is Aboriginal, then they are counted as Aboriginal. Police events with Aboriginality recorded as unknown were excluded when calculating the percentage.
- If the percentage threshold is not met and the individual has at least one record reporting them as non-Aboriginal, then they are counted as non-Aboriginal.
- If all an individual's records had Aboriginality recorded as unknown then the person's Aboriginality is counted as unknown.
- Nine separate percentage thresholds were applied with percentages ranging between 10% and 50% in increments of 5 percentage points (p.p.).

Each method uses all the events in an individual's recorded history. In the case of under 18s this includes any adult records that may have occurred after they turned 18. This is to reflect the way in which these algorithms would operate if fully implemented by BOCSAR.

How performance was measured

Three metrics were used to evaluate the performance of the various methods.

The first was the similarity of counts of Aboriginal people relative to the source of truth comparison datasets. This is presented in equation 1 as

$$\text{similarity} = ((CA + IA) / N_{\text{Aboriginal}}) \times 100 \quad (1)$$

Where CA is the number of CNIs correctly identified as Aboriginal and IA is the number of CNIs incorrectly identified as Aboriginal, and the sum of these is divided by the total number (N) of Aboriginal people according to the linked comparison dataset. Similarity is expressed here as a percentage where 100% indicates that the algorithm identified the same number of Aboriginal people as the comparison dataset. Values below and above 100% indicate undercounting and overcounting respectively. For example, a similarity value of 110% would indicate a 10% overcount of Aboriginal people compared to the

comparison dataset. Similarity simply indicates how close the algorithm’s count of Aboriginal individuals is to the number in the comparison dataset, regardless of whether they were the same individuals in both datasets.

The second metric, classification error (CE), is defined in Equation 2 as

$$CE = ((IA + IN + IU) / (CA + IA + CN + IN + IU)) \times 100 \tag{2}$$

Where IN is the number of CNIs incorrectly identified as non-Aboriginal, IU is the number of CNIs incorrectly identified as having unknown Aboriginality, and CN is the number of CNIs correctly identified as non-Aboriginal. CE indicates the proportion of total assignments that were incorrect according to the comparison dataset.

Lastly, precision (also known as the positive predictor value) of Aboriginal classification was calculated as

$$Precision_{Aboriginal} = (CA / (CA + IA)) \times 100 \tag{3}$$

This indicates the proportion of people identified as Aboriginal by each method who were correctly identified as Aboriginal according to the comparison dataset.

RESULTS

Comparison dataset: Custody data

Adults proceeded to court (2017 to 2021) cohort

There were 226,591 unique individuals/CNIs proceeded to court as an adult between 2017 and 2021, of these 59,932 (26.4%) also appeared in the source of truth custody comparison dataset with recorded Aboriginality information. Table 4 shows the median number of events with a recorded Aboriginality for the total number of individuals proceeded to court and for the subset who also appeared in the custody comparison dataset. Individuals with a record in both datasets had a median number of 45 police events, either as a POI or a victim (with a recorded Aboriginality), over the period 1994 to 2024, with a median of five events as a victim and 37 events as a POI. The median number of events as a POI for the custody cohort is substantially higher than that of the total proceeded to court group indicating that, as would be expected, the subgroup appearing in the custody data is a high-offending group.

Table 4. Median number of events with a recorded Aboriginality for adults proceeded to court between 2017 and 2021, and for the subset of individuals that also appear in the custody comparison dataset

	Adults proceeded to court, 2017 and 2021	Also appear in custody comparison dataset
Number of CNIs	226,591	59,932
Median number of police events (interquartile range)	13 (4 – 34)	45 (21 – 81)
Median number of police events as a POI (interquartile range)	8 (3 – 25)	37 (16 – 70)
Median number of police events as a victim (interquartile range)	3 (1 – 7)	5 (2 – 10)

Table 5 shows the number of individuals counted as Aboriginal and non-Aboriginal using the counting methods outlined in the Method section and whether these counts were correct according to the custody comparison dataset. To indicate the performance of each method we show CE, precision, and the similarity for each algorithm using the custody dataset as the comparison.

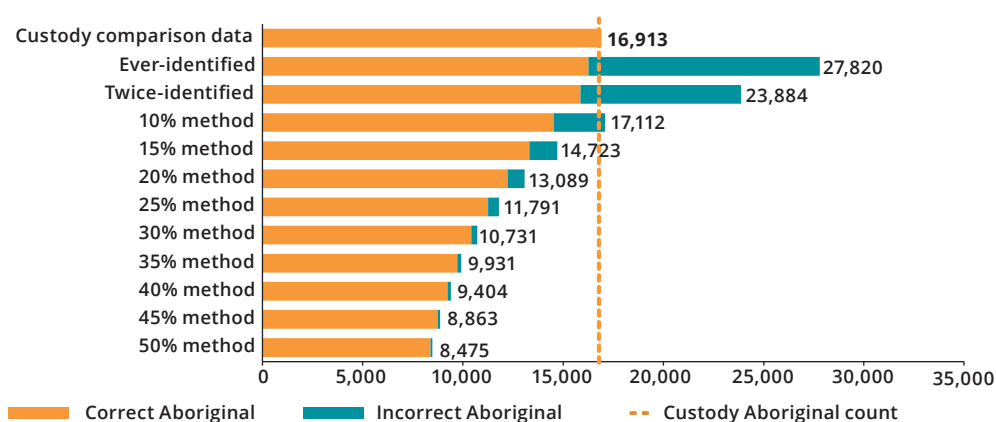
The number of individuals identified as Aboriginal by each algorithm are illustrated in Figure 5, split between those that are correct according to the custody comparison data and those that are incorrect. The chart also indicates the number of Aboriginal people according to the custody comparison dataset.

The results in Table 5 and Figure 5 show that according to the custody comparison data 16,913 of the 59,932 individuals are Aboriginal (28.2%). Both the ever-identified and twice-identified algorithms substantially overcounted the number of Aboriginal individuals. The estimated number of Aboriginal people exceeded the number in the custody comparison data by 64.5% and 41.2%, respectively. This is due to a high number of non-Aboriginal people incorrectly identified as Aboriginal, which is reflected in the low precision of both methods (under 70%), and which is the primary cause for the relatively high CE (Table 5). However, the ever-identified and twice-identified methods also had the highest number of correct Aboriginal classifications according to the comparison data; correctly identifying over 90% of Aboriginal individuals in the custody comparison dataset.

The 10% method had the lowest CE (8.3%) and closest similarity of Aboriginal counts (101.2%) to the custody data (Table 5). Whilst there were over 2,500 people incorrectly identified as Aboriginal; this was offset by a similar number of people incorrectly counted as non-Aboriginal. Precision for the 10% method was also high at 84.9%. The number of people incorrectly identified as Aboriginal decreased with higher percentage cut-offs. However, the number of individuals incorrectly identified as non-Aboriginal increased at an ever-greater rate resulting in higher CEs (Table 5). Whilst the declining number of incorrect Aboriginal classifications resulted in higher precision as the percentage threshold increased, the number of correct Aboriginal classifications also decreased resulting in lower overall counts of Aboriginal individuals and reduced similarity with the custody comparison data Aboriginal count.

Across all algorithms, the number of individuals counted as unknown is low, 24 or 0.04%. Classification as unknown requires there to be no records with a reported Aboriginality for the individual. This is uncommon given the high median number of police records (45) among this cohort.

Figure 5. Number of adults identified as Aboriginal who were proceeded to court between 2017 to 2021 who also had a custody episode between January 2012 to January 2024, by counting method



The results for adult DV assault victims between 2017 and 2021 who had ever had a custody episode were similar to the proceeded to court cohort. These are shown in Appendix Table A1. Both the ever-identified and twice-identified methods significantly overestimated the number of Aboriginal individuals according to the custody comparison dataset, whilst the 10% method produced the most similar count of Aboriginal individuals and had the second lowest CE.

Table 5. Aboriginality assignments from various algorithms for adults proceeded to court between 2017 and 2021 who also had a custody episode between January 2012 and January 2024 (n=59,932), and algorithm performance measures¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Custody comparison data	16,913	-	43,019	-	-	16,913	28.2%	-	-	-
Ever-identified	16,268	11,552	31,445	643	24	27,820	46.4%	20.4%	58.5%	164.5%
Twice-identified	15,864	8,020	34,977	1,047	24	23,884	39.9%	15.2%	66.4%	141.2%
10% method	14,532	2,580	40,417	2,379	24	17,112	28.6%	8.3%	84.9%	101.2%
15% method	13,327	1,396	41,601	3,584	24	14,723	24.6%	8.3%	90.5%	87.1%
20% method	12,226	863	42,134	4,685	24	13,089	21.8%	9.3%	93.4%	77.4%
25% method	11,263	528	42,469	5,648	24	11,791	19.7%	10.3%	95.5%	69.7%
30% method	10,410	321	42,676	6,501	24	10,731	17.9%	11.4%	97.0%	63.4%
35% method	9,721	210	42,787	7,190	24	9,931	16.6%	12.4%	97.9%	58.7%
40% method	9,238	166	42,831	7,673	24	9,404	15.7%	13.1%	98.2%	55.6%
45% method	8,751	112	42,885	8,160	24	8,863	14.8%	13.8%	98.7%	52.4%
50% method	8,385	90	42,907	8,526	24	8,475	14.1%	14.4%	98.9%	50.1%

¹⁸ Lowest classification error, highest precision, and closest similarity highlighted in green.

Under 18 persons of interest (2017 to 2021) cohort

There were 40,306 unique individuals/ CNIs who were proceeded against by NSW police between 2017 and 2021 and who were aged under 18 at the time of the offence. Of these, 7,085 (17.6%) had a custody episode with Aboriginality recorded in their history. Table 6 shows that the median number of police events (with a recorded Aboriginality) for the custody cohort was 38, including both events that occurred before and after they turned 18. The median number of recorded events with a reported Aboriginality where the individual was listed as a POI was 32 and the median number of events where the individual was listed as a victim was three. As with adults proceeded to court, the median number of POI events for those individuals appearing in the custody comparison data is significantly higher than for the total group.

Table 6. Median number of events with a recorded Aboriginality for under 18 POIs proceeded against between 2017 and 2021 and for those individuals that also appear in the custody comparison dataset

	Under 18 POIs, 2017 to 2021	Also appear in custody comparison dataset
Number of CNIs	40,306	7,085
Median number of police events (interquartile range)	6 (2 – 17)	38 (20 – 65)
Median number of police events as a POI (interquartile range)	4 (2 – 13)	32 (16 – 59)
Median number of police events as a victim (interquartile range)	1 (0 – 3)	3 (1 – 7)

Table 7 shows the number of individuals in this cohort by their Aboriginality as indicated in the custody comparison dataset and as classified by each algorithm. According to the custody data, 44.8% of the young persons in this cohort were Aboriginal. The 15% method produced the count of Aboriginal young persons that was the most similar to the custody data (3,147 compared to 3,173). The ever-identified method produced the highest estimate of Aboriginal persons and the 50% algorithm the lowest.

The CE, precision, and similarity for this cohort are also shown in Table 7. The ever-identified and 50% methods had the highest CE, both exceeding 18%. In the case of the ever-identified method, the high CE was due to the high number of non-Aboriginal persons being counted as Aboriginal. This resulted in a 37.4% overcount of Aboriginal individuals. For the 50% method the high CE was the result of a high number of Aboriginal individuals incorrectly identified as non-Aboriginal (Table 7, Figure 6). Of the algorithms tested, the 15% method had the lowest CE (7.9%) as well as the closest similarity of Aboriginal counts (99.2%) to the custody comparison data (Table 7).

Figure 6. Number of under 18s who were proceeded against by NSW Police between 2017 and 2021 who also had a custody episode between January 2012 to January 2024, by counting method

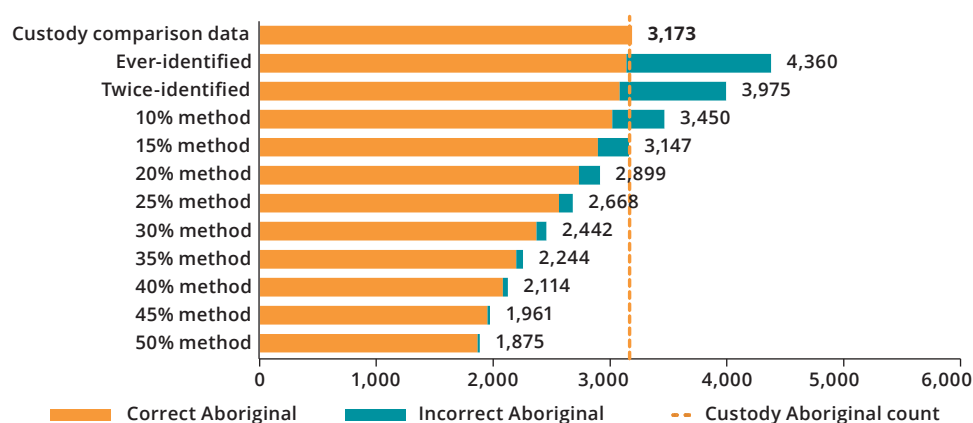


Table 7. Aboriginality assignments from various algorithms for persons aged under 18 who were proceeded against by NSW Police between 2017 and 2021 who also had a custody episode between January 2012 and January 2024 (n=7,085), and algorithm performance measures¹⁸

	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Custody comparison data	3,173	-	3,912	-	-	3,173	44.8%	-	-	-
Ever-identified	3,123	1,237	2,674	49	2	4,360	46.4%	18.2%	71.6%	137.4%
Twice-identified	3,068	907	3,004	104	2	3,975	39.9%	14.3%	77.2%	125.3%
10% method	3,004	446	3,465	168	2	3,450	28.6%	8.7%	87.1%	108.7%
15% method	2,880	267	3,644	292	2	3,147	24.6%	7.9%	91.5%	99.2%
20% method	2,720	179	3,732	452	2	2,899	21.8%	8.9%	93.8%	91.4%
25% method	2,550	118	3,793	622	2	2,668	19.7%	10.5%	95.6%	84.1%
30% method	2,358	84	3,827	814	2	2,442	17.9%	12.7%	96.6%	77.0%
35% method	2,187	57	3,854	985	2	2,244	16.6%	14.7%	97.5%	70.7%
40% method	2,072	42	3,869	1,100	2	2,114	15.7%	16.1%	98.0%	66.6%
45% method	1,939	22	3,889	1,233	2	1,961	14.8%	17.7%	98.9%	61.8%
50% method	1,856	19	3,892	1,316	2	1,875	14.1%	18.9%	99.0%	59.1%

The results for persons aged under 18 who were a DV assault victim between 2017 and 2021 and who had a custody episode were similar to the under 18 POI cohort (Appendix Table A2). The 15% method had the lowest CE and produced the most similar count of Aboriginal individuals. Percentage methods ranging from 35% to 50% had CEs exceeding 20%, due to high numbers of Aboriginal individuals incorrectly identified as non-Aboriginal (Appendix Table A2). The ever-identified method also performed poorly with a CE of 18.9%. Almost all the erroneous assignments by this method were non-Aboriginal individuals being counted as Aboriginal.

Comparison dataset: NSW Police data post 2022 recording change

Adults proceeded to court (2017 to 2021) cohort

Of the 226,591 unique individuals/CNIs who were proceeded to court as an adult between 2017 and 2021 there were 77,910 (34.4%) who were also recorded in a police event in the NSW Police post-recording change comparison dataset. This cohort had a median number of 23 police recorded events (either as a POI or a victim) where Aboriginality was recorded (Table 8). The median number of POI events with a recorded Aboriginality was 16 and the median number of victim events was four. Whilst the median number of events for those who also appeared in the comparison dataset was higher than for the total group, the difference is substantially smaller than the difference between the total group and those appearing in the custody data. This indicates that the police post-recording change comparison dataset is more representative of police data overall than the custody dataset.

Table 8. Median number of events with a recorded Aboriginality for adults proceeded to court between 2017 and 2021, and for those individuals who were also recorded in a police event after the 2022 recording change

	Adults proceeded to court, 2017 to 2021	Also recorded in an event post-recording change
Number of CNIs	226,591	77,910
Median number of police events (interquartile range)	13 (4 – 34)	23 (11 – 48)
Median number of police events as a POI (interquartile range)	8 (3 – 25)	16 (7 – 38)
Median number of police events as a victim (interquartile range)	3 (1 – 7)	4 (2 – 9)

According to the source of truth comparison data 12.7% of the cohort is Aboriginal and 87.3% non-Aboriginal (Table 9). The ever-identified method generated the highest count of Aboriginal individuals (19,403 or 24.9%) whilst the 50% method generated the lowest count of Aboriginal people (7,442 or 9.6%).

Both the ever-identified and twice-identified methods substantially overcounted the number of Aboriginal people, with the ever-identified method generating a count of Aboriginal individuals nearly double that of the post-recording change dataset; the twice-identified method overcounted by 49.9% (Figure 7, Table 9). The high number of individuals incorrectly counted as Aboriginal (as indicated by the comparison data) meant that both these methods also had the highest CE and lowest precision of all the methods tested (Table 9).

Of the percentage methods, the 20% method had the most similar count of Aboriginal individuals to the comparison data, with a similarity of 100.5%. Whilst higher percentage thresholds yielded lower CEs, the variation between methods with thresholds of 20% and above was low; at less than 0.3 p.p.. This was due

to the decline in incorrect assignments of individuals as Aboriginal being commensurate with an increase in the number of individuals incorrectly counted as non-Aboriginal by these methods. Similarity decreased as the percentage thresholds became higher because the number of individuals incorrectly counted as non-Aboriginal increased, and fewer individuals were correctly counted as Aboriginal by each algorithm (Figure 7, Table 9). The precision of counts of Aboriginal people increased with higher percentage methods as whilst fewer people were counted as Aboriginal by these methods, a smaller proportion of these were counted incorrectly according to the comparison data.

Figure 7. Number of adults identified as Aboriginal who were proceeded to court between 2017 and 2021 and recorded in a police event after the 2022 recording change, by counting method

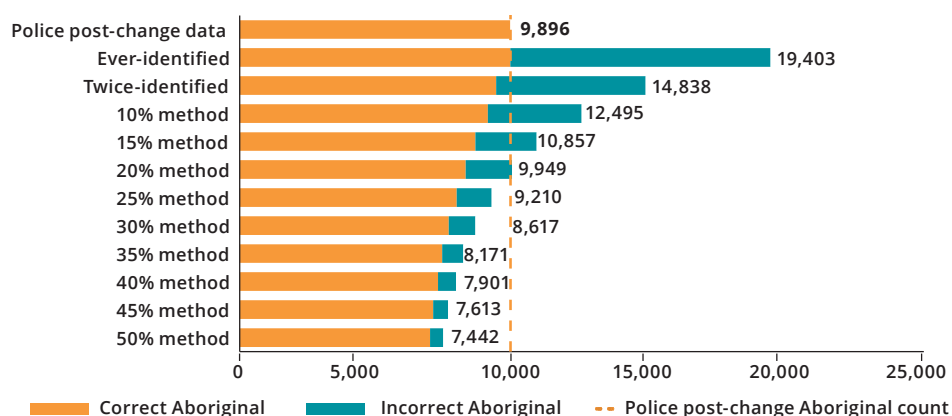


Table 9. Aboriginality assignments from various algorithms for adults who had a court proceeding between 2017 and 2021 who were also recorded in a police event after the 2022 recording change (n=77,910), and algorithm performance measures¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	9,896	-	68,014	-	-	9,896	12.7%	-	-	-
Ever-identified	9,896	9,507	58,507	0	0	19,403	24.9%	12.2%	51.0%	196.1%
Twice-identified	9,374	5,464	62,550	522	0	14,838	19.0%	7.7%	63.2%	149.9%
10% method	9,068	3,427	64,587	828	0	12,495	16.0%	5.5%	72.6%	126.3%
15% method	8,609	2,248	65,766	1,287	0	10,857	13.9%	4.5%	79.3%	109.7%
20% method	8,264	1,685	66,329	1,632	0	9,949	12.8%	4.3%	83.1%	100.5%
25% method	7,935	1,275	66,739	1,961	0	9,210	11.8%	4.2%	86.2%	93.1%
30% method	7,638	979	67,035	2,258	0	8,617	11.1%	4.2%	88.6%	87.1%
35% method	7,399	772	67,242	2,497	0	8,171	10.5%	4.2%	90.6%	82.6%
40% method	7,243	658	67,356	2,653	0	7,901	10.1%	4.2%	91.7%	79.8%
45% method	7,071	542	67,472	2,825	0	7,613	9.8%	4.3%	92.9%	76.9%
50% method	6,954	488	67,526	2,942	0	7,442	9.6%	4.4%	93.4%	75.2%

Adult victims of DV assault (2017 to 2021) cohort

There were 106,242 unique individuals/CNIs who were reported as an adult victim of DV assault between 2017 and 2021. Of these, 31,306 (29.5%) individuals appeared in the NSW Police post-recording change comparison data. The median number of police events with a recorded Aboriginality (either as victim or POI) for this subset of victims was 17 (Table 10). The median number of POI events with a recorded Aboriginality was six and the median number of victim events was nine.

Table 10. Median number of events with a recorded Aboriginality for adults recorded as a DV assault victim between 2017 and 2021 and for those individuals who were also recorded in a police event after the 2022 recording change

	Adult DV assault victims, 2017 to 2021	Also recorded in an event post-recording change
Number of CNIs	106,242	31,306
Median number of police events (interquartile range)	8 (3 – 21)	17 (8 – 36)
Median number of police events as a POI (interquartile range)	2 (0 – 8)	6 (2 – 18)
Median number of police events as a victim (interquartile range)	5 (2 – 10)	9 (4 – 16)

In the comparison data, 5,065 (16.2%) individuals were recorded as Aboriginal (Table 11). The ever-identified method produced the highest count of Aboriginal people (8,719). The percentage methods generated lower counts of Aboriginal individuals than both the ever-identified and twice-identified methods, with the lowest calculated by the 50% method (3,965).

Figure 8. Number of adults identified as Aboriginal who were recorded as a DV assault victim (2017 to 2021) and recorded in a police event after the 2022 recording change, by counting method

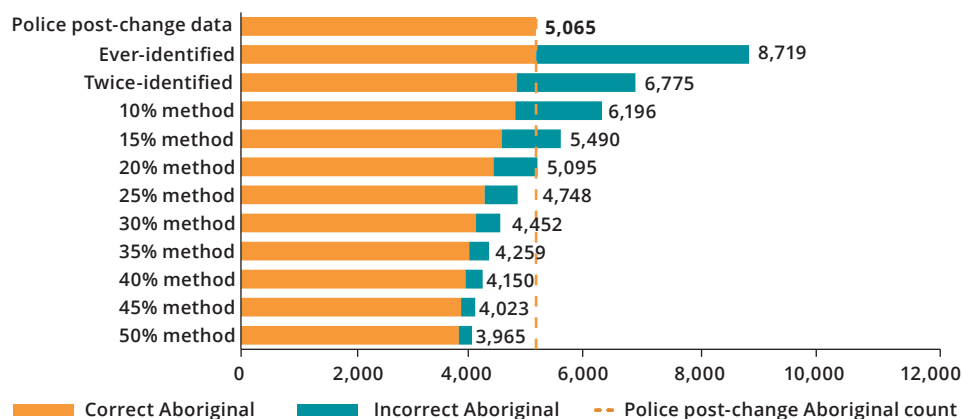


Table 11 also shows, for each method, the proportion of assignments that were correct according to the comparison data, as well as CE, precision, and similarity for this cohort. The number of people counted as Aboriginal by each method and in the comparison dataset are shown graphically in Figure 8. As with the proceeded to court cohort, the ever-identified and twice-identified methods incorrectly counted a high number of individuals as Aboriginal according to the comparison data, resulting in substantial overestimation of the number of Aboriginal individuals, relatively high CE and low precision (Figure 8, Table 11). The 25% method had the lowest CE whilst the 20% method generated the most similar count of Aboriginal individuals compared to the post-recording change comparison dataset. Precision increased and similarity decreased with higher percentage methods, while the number of individuals incorrectly counted as non-Aboriginal increased.

Table 11. Aboriginality assignments from various algorithms for adults recorded as DV assault victims between 2017 and 2021 who were also recorded in a police event after the 2022 recording change (n=31,306), and algorithm performance measures¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	5,065	-	26,241	-	-	5,065	16.2%	-	-	-
Ever-identified	5,065	3,654	22,587	0	0	8,719	27.9%	11.7%	58.1%	172.1%
Twice-identified	4,733	2,042	24,199	332	0	6,775	21.6%	7.6%	69.9%	133.8%
10% method	4,707	1,489	24,752	358	0	6,196	19.8%	5.9%	76.0%	122.3%
15% method	4,476	1,014	25,227	589	0	5,490	17.5%	5.1%	81.5%	108.4%
20% method	4,335	760	25,481	730	0	5,095	16.3%	4.8%	85.1%	100.6%
25% method	4,184	564	25,677	881	0	4,748	15.2%	4.6%	88.1%	93.7%
30% method	4,028	424	25,817	1,037	0	4,452	14.2%	4.7%	90.5%	87.9%
35% method	3,919	340	25,901	1,146	0	4,259	13.6%	4.7%	92.0%	84.1%
40% method	3,854	296	25,945	1,211	0	4,150	13.3%	4.8%	92.9%	81.9%
45% method	3,777	246	25,995	1,288	0	4,023	12.9%	4.9%	93.9%	79.4%
50% method	3,739	226	26,015	1,326	0	3,965	12.7%	5.0%	94.3%	78.3%

Under 18 persons of interest (2017 to 2021) cohort

Of the 40,306 unique individuals/CNIs who were recorded as a POI by NSW police between 2017 and 2021 and who were aged under 18 at the time of the event, 15,445 (38.3%) also appeared in the police post-recording change comparison dataset. The median number of police events with a recorded Aboriginality for this cohort was 11. The median number of events with a recorded Aboriginality where the individual was listed as a POI was eight and the median number where the individual was listed as a victim was two.

Table 12. Median number of events with a recorded Aboriginality for under 18 POIs proceeded against between 2017 and 2021 and for those individuals who were also recorded in a police event after the 2022 recording change

	Under 18 POIs, 2017 to 2021	Also recorded in an event post-recording change
Number of CNIs	40,306	15,445
Median number of police events (interquartile range)	6 (2 – 17)	11 (5 – 23)
Median number of police events as a POI (interquartile range)	4 (2 – 13)	8 (4 – 18)
Median number of police events as a victim (interquartile range)	1 (0 – 3)	2 (1 – 4)

Table 13 shows the number of individuals in this cohort who were identified as Aboriginal in the police post-recording change comparison data and by each algorithm. According to the post-recording change comparison data, 2,708 (17.5%) of the young persons in this cohort were Aboriginal. The ever-identified method produced the highest estimated number of Aboriginal young persons (4,382) and the 50% method the lowest (2,352). The closest estimate to the count of Aboriginal individuals in the comparison dataset was produced by the 30% method (2,728).

Table 13 shows the counts of Aboriginal and non-Aboriginal people generated by each algorithm and whether these were correct according to the comparison data, as well as the CE, precision, and similarity for each counting method tested. Figure 9 also illustrates the number of correct and incorrect assignments of individuals as Aboriginal. The ever-identified method had a CE of 10.8%, the highest of the tested algorithms, and substantially overcounted the number of Aboriginal individuals (Table 13, Figure 11). Of the algorithms tested, the 30% method had the closest similarity of Aboriginal counts (100.7%) to the post-recording change comparison data (Table 13, Figure 11). Similarity decreased with higher percentage thresholds, while precision increased. There was little variation in the CEs of percentage methods between the 25% and 50% thresholds with the number of people incorrectly identified as Aboriginal decreasing at a similar rate to the increases in the number of people incorrectly identified as non-Aboriginal.

Figure 9. Number of under 18s identified as Aboriginal who were proceeded against by NSW Police between 2017 and 2021 and recorded in a police event after the 2022 recording change, by counting method

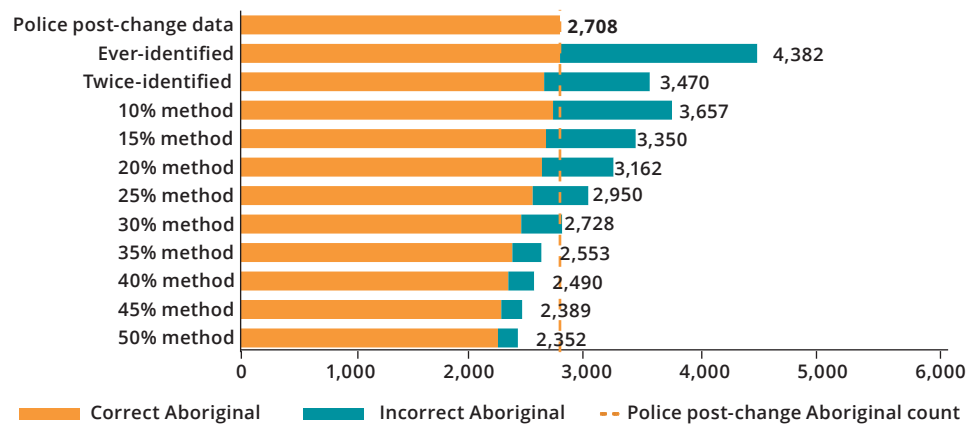


Table 13. Aboriginality assignments from various algorithms for under 18s who were proceeded against by NSW Police between 2017 and 2021 who were also recorded in a police event after the 2022 recording change (n=15,445), and algorithm performance measures¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	2,708	-	12,737	-	-	2,708	17.5%	-	-	-
Ever-identified	2,708	1,674	11,063	0	0	4,382	28.4%	10.8%	61.8%	161.8%
Twice-identified	2,573	897	11,840	135	0	3,470	22.5%	6.7%	74.1%	128.1%
10% method	2,648	1,009	11,728	60	0	3,657	23.7%	6.9%	72.4%	135.0%
15% method	2,590	760	11,977	118	0	3,350	21.7%	5.7%	77.3%	123.7%
20% method	2,555	607	12,130	153	0	3,162	20.5%	4.9%	80.8%	116.8%
25% method	2,476	474	12,263	232	0	2,950	19.1%	4.6%	83.9%	108.9%
30% method	2,381	347	12,390	327	0	2,728	17.7%	4.4%	87.3%	100.7%
35% method	2,304	249	12,488	404	0	2,553	16.5%	4.2%	90.2%	94.3%
40% method	2,271	219	12,518	437	0	2,490	16.1%	4.2%	91.2%	91.9%
45% method	2,211	178	12,559	497	0	2,389	15.5%	4.4%	92.5%	88.2%
50% method	2,183	169	12,568	525	0	2,352	15.2%	4.5%	92.8%	86.9%

Under 18 victims of DV assault (2017 to 2021) cohort

Of the 11,663 unique individuals/CNIs who were reported as a victim of DV assault between 2017 and 2021 and who were under the age of 18 at the time of the event, 3,867 (33.2%) also had a record in the police post-recording change comparison dataset. The median number of police events with a recorded Aboriginality for this cohort was nine (Table 14). The median number of police events with a recorded Aboriginality where the individual was a POI was four and the median number of police events where the individual was listed as a victim was also four.

Table 14. Median number of events with a recorded Aboriginality for under 18s recorded as a DV assault victim between 2017 and 2021 and for those individuals who were also recorded in a police event after the 2022 recording change

	Under 18 DV assault victim, 2017 to 2021	Also recorded in an event post-recording change
Number of CNIs	11,663	3,867
Median number of police events (interquartile range)	5 (2 – 13)	9 (5 – 19)
Median number of police events as a POI (interquartile range)	1 (0 – 7)	4 (1 – 11)
Median number of police events as a victim (interquartile range)	3 (1 – 6)	4 (2 – 8)

The Aboriginality split for this cohort according to the post-recording change comparison dataset and the algorithms are shown in Table 15. According to the comparison data, 19.1% (739) of this cohort were Aboriginal. The ever-identified method estimated that 31.1% (1,201) of the cohort were Aboriginal, which was the highest count generated by any algorithm. The remaining methods generated lower counts of Aboriginal individuals with the lowest calculated by the 50% method (Table 15).

Figure 10. Number of under 18s identified as Aboriginal who were recorded as a DV assault victim between 2017 and 2021 and recorded in a police event after the 2022 recording change, by counting method

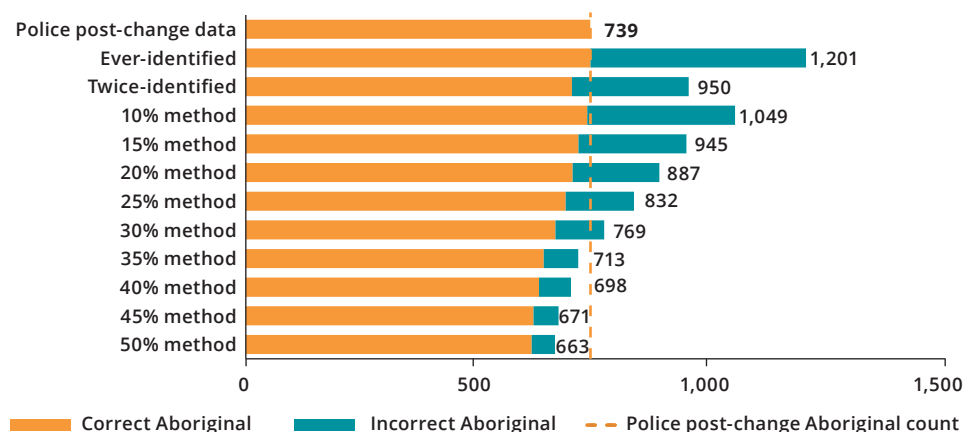


Table 15. Aboriginality assignments from various algorithms for under 18s who were recorded as DV assault victims between 2017 and 2021 who were also recorded in a police event after the 2022 recording change (n=3,867), and algorithm performance measures¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	739	-	3,128	-	-	739	19.1%	-	-	-
Ever-identified	739	462	2,666	0	0	1,201	31.1%	11.9%	61.5%	162.5%
Twice-identified	699	251	2,877	40	0	950	24.6%	7.5%	73.6%	128.6%
10% method	732	317	2,811	7	0	1,049	27.1%	8.4%	69.8%	141.9%
15% method	713	232	2,896	26	0	945	24.4%	6.7%	75.4%	127.9%
20% method	701	186	2,942	38	0	887	22.9%	5.8%	79.0%	120.0%
25% method	686	146	2,982	53	0	832	21.5%	5.1%	82.5%	112.6%
30% method	664	105	3,023	75	0	769	19.9%	4.7%	86.3%	104.1%
35% method	639	74	3,054	100	0	713	18.4%	4.5%	89.6%	96.5%
40% method	629	69	3,059	110	0	698	18.1%	4.6%	90.1%	94.5%
45% method	617	54	3,074	122	0	671	17.4%	4.6%	92.0%	90.8%
50% method	613	50	3,078	126	0	663	17.1%	4.6%	92.5%	89.7%

The number of individuals counted as Aboriginal or non-Aboriginal by each method and whether these individuals were correctly counted are also shown in Table 15, along with the CE, precision, and similarity for each method. The number of individuals correctly and incorrectly identified as Aboriginal according to the comparison data are shown graphically in Figure 10. The algorithm with the highest CE was the ever-identified method with a CE of 11.9%. This method also had the highest number of individuals incorrectly identified as Aboriginal (Table 15, Figure 10).

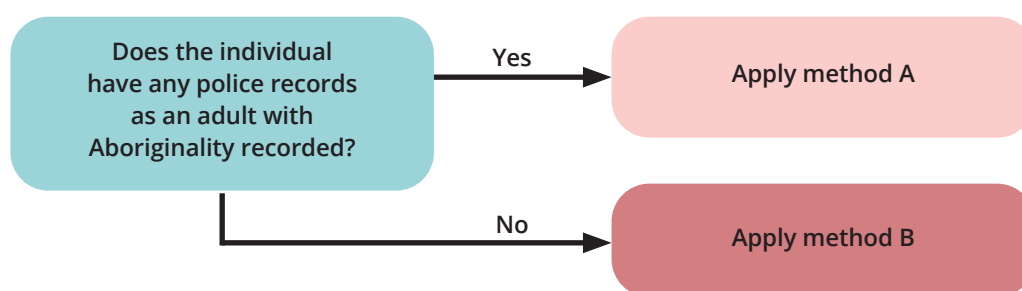
The 35% method generated the most similar count of Aboriginal individuals (96.5%) to the post-recording change comparison data, with the 30% method generating the second closest count (104.1%) (Table 15, Figure 10). Similarity decreased and precision increased with higher percentage thresholds, as fewer individuals were identified as Aboriginal but a higher proportion of those individuals were correctly identified according to the comparison data.

Two-step method

Given the results presented, which is the optimal method for improving the accuracy of Aboriginality data in NSW Police data? The results from both the custody and police post-recording change source of truth datasets indicate that different percentage thresholds perform better depending on the age group of the individuals. Due to the custody comparison data being highly skewed towards individuals with a high number of police events in their history and related concerns over whether this group is representative, from here we focus on analyses that used the police post-recording change comparison dataset. Using the police post-recording change comparison data, the 20% method generated the most similar counts for the adult cohorts,¹⁹ while the 30% and 35% methods produced more similar counts for the under 18 cohorts. For under 18s, the 20% method overcounted the number of Aboriginal people by up to 20% (Tables 13 and 15). On the other hand, the 30% algorithm undercounted the number of Aboriginal adults proceeded to court or recorded as a victim of DV assault by approximately 13% (Tables 9 and 11).

Due to the different results between age cohorts, an additional set of methods were trialled to test the performance of an algorithm able to generate accurate results for both under 18s and adults (relative to the comparison datasets). A two-step methodology was devised whereby different percentage methods were applied depending on whether or not an individual had any adult police records. This process is summarised in Figure 11.

Figure 11. Process for applying two-step method to infer Aboriginality from police records



Using the process outlined in Figure 11, the Aboriginality of individuals with both under 18 and adult records, or with only adult records, will be inferred using **method A**, whereas those with only youth records will have Aboriginality inferred using **method B**. This approach avoids double counting individuals with both under 18 and adult records, as a person with an adult record will only have **method A** applied to their event history.

¹⁹ The 20% method performed optimally for adults when applied to all records in an individual's history.

As we saw above, the 20% method works best for adults when applied to all the person's police records (adult and youth). This makes the 20% method a possible candidate for **method A**. An alternative, however, is to apply **method A** to the individual's adult records only. To test whether this delivers better performance, the analyses for the adult cohorts were repeated with percentage methods applied to only events occurring when the individual is an adult. The three algorithms that performed best against the police comparison dataset are shown in Table 16 (full results in Appendix Table A3).

When applied to just adult records, the 25% method returned the most similar number of Aboriginal adults compared to the comparison data (99.2%). The 25% method identified 9,812 individuals as Aboriginal with a precision of 84.6%. CE varied by just 0.3 p.p. between the 20%, 25%, and 30% methods, as the number of erroneous classifications was similar between these algorithms. Similar results were found when these methods were applied to adult DV victims recorded between 2017 and 2021 (Appendix Table A4). As such a 25% threshold applied to adult records is also a potential candidate for **method A**.

Table 16. Aboriginality assignments from algorithms applied to only adult records, for adults who were proceeded to court by NSW Police between 2017 and 2021 and who were recorded in a police event after the 2022 recording change (n=77,910)¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	9,896	-	68,014	-	-	-	-	-
20% method	8,572	1,939	66,072	1,324	3	4.2%	81.6%	106.2%
25% method	8,299	1,513	66,498	1,597	3	4.0%	84.6%	99.2%
30% method	7,991	1,151	66,860	1,905	3	3.9%	87.4%	92.4%

In the initial analyses for the under 18 cohorts, events across their entire history (including any adult records within the studied time frames) were utilised by the applied algorithms. However, **method B** differs as it is only applied to those young people with no adult record (Figure 11). As such, to find a suitable candidate for **method B**, the performance of methods for inferring the Aboriginality of young people with no subsequent adult record needs to be tested. Table 17 shows the performance measures for the three methods that performed the best when applied to under 18 POIs recorded between 2017 and 2021 who had no adult records, using the police post-recording change dataset for validation. The 35% method generated the most similar count of Aboriginal individuals aged under 18 to the comparison dataset, with 840 individuals inferred to be Aboriginal using this method compared to 858 individuals in the police post-recording change dataset. The 30%, 35%, and 40% methods all had near identical CEs with similar numbers of errors in assignment. Full results for all algorithms can be seen in Appendix Table A5. Similar results were also produced for under 18 victims of DV assault (2017 to 2021) with no adult record (Appendix Table A6). As such the best candidate for **method B**, to be applied to under 18s with no adult record, is the 35% method.

Table 17. Aboriginality assignments for under 18s who were proceeded against by NSW Police between 2017 and 2021 and recorded in a police event after the 2022 recording change; only those with no adult record (n=4,304)¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	858	-	3,446	-	-	-	-	-
30% algorithm	793	111	3,335	65	0	4.1%	87.7%	105.4%
35% algorithm	760	80	3,366	98	0	4.1%	90.5%	97.9%
40% algorithm	755	73	3,373	103	0	4.1%	91.2%	96.5%

Based on these results the following candidate two-step methods were applied:

Two-step option 1: For persons **with an adult record apply a 20% method to all of their records (youth and adult, *method A*)**, for those **with no adult record apply 35% method to their youth records (*method B*)**

Two-step option 2: For persons **with an adult record apply a 25% method to their adult records (*method A*)**, for those **with no adult record apply 35% method to their youth records (*method B*)**

These were then applied to the full under 18 POI and DV victim cohorts. Table 18 shows the classification categories, CE, precision, and similarity of the counts for these methods. Of the two versions of the two-step method, **two-step option 2** produced the most similar count of Aboriginal under 18s to the post-recoding change comparison data (Table 18). The CE for this method was also substantially lower for counts of both cohorts (2.8% compared to over 4.6%). Performance of **two-step option 1** for under 18s was comparable to the original 25% method (Tables 13 and 15). Both versions of the two-step method apply the same counting method (35%) to under 18s with no adult record. As such the differences in counts of young people between **two-step option 1** and **two-step option 2** are due to the application of a different ***method A*** to young people recorded between 2017 and 2021 who also have an adult record.

Note that due to the process outlined in Figure 11 the performance measures of the two-step methods for the adult cohorts are identical to the 20% method in Tables 9 and 11 for **two-step option 1**, and the 25% method in Table 16 and Appendix Table A4 for **two-step option 2**. Counts of Aboriginal adults by these methods differed by less than 1% compared to the numbers in the post-recording change comparison data.

Based on these results, **two-step option 2** is the preferred method due to its ability to derive accurate counts of both Aboriginal adults and Aboriginal young people.

Table 18. Aboriginality assignments by two-step methods for all under 18 POIs and victims of DV assault (2017-2021) who were also recorded in a police event after the 2022 recording change¹⁸

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Classification error (CE)	Precision (Aboriginal)	Similarity
Under 18 POIs (n=15,445)								
Police post-recording change comparison data	2,708	-	12,737	-	-	-	-	-
Two-step option 1	2,474	494	12,243	234	0	4.7%	83.4%	109.6%
Two-step option 2	2,564	286	12,451	144	0	2.8%	90.0%	105.2%
Under 18 DV assault victims (n=3,867)								
Police post-recording change comparison data	739	-	3,128	-	-	-	-	-
Two-step option 1	675	143	2,985	64	0	5.4%	82.5%	110.7%
Two-step option 2	700	68	3,060	39	0	2.8%	91.1%	103.9%

Impact of applying two-step option 2 to BOCSAR's time series data

As well as the incompleteness and accuracy of raw police Aboriginality data another issue is the discontinuity in the time series caused by the changes in recording practice in 2022. The following section shows examples of two-step option 2 being applied to time series of event-level police data to examine the impact on event counts across the time series break.

Figure 12 shows the monthly percentage of adults proceeded to court by NSW Police who were counted as Aboriginal using Aboriginality as recorded by police and using two-step option 2²⁰. The unadjusted data suggested that 18.6% of adults proceeded to court in 2021 were Aboriginal; this increased to 23.8% in 2022 and 25.4% in 2023 after NSW Police implemented changes to improve recording of Aboriginality. When two-step option 2 was applied, the proportion of adults counted as Aboriginal rose from 20.3% in 2021 to 22.0% in 2022 and 23.6% in 2023; a smaller shift following the practice change. The Two-step series shows a continuous (but increasing) trend in the percentage of adult POIs counted as Aboriginal, with no obvious interruption at the time of the recording change in January 2022. This suggests that, for adults proceeded to court, the two-step method has removed the discontinuity in the time series.

The equivalent time series for adult victims of DV assault is shown in figure 13. The proportion of adult victims that were identified as Aboriginal in the unadjusted data shows an increase after the recording changes, with 9.3% of victims recorded as Aboriginal in 2021 increasing to 14.9% in 2022. There was little change in the proportion of adults counted as Aboriginal between 2021 and 2022 under the two-step method, from 14.9% to 16.0% (Figure 13). The absence of a distinct shift in the percentage of adult victims identified as Aboriginal in the two-step series across the recording change suggests that the new method offers a continuous time series on victim Aboriginality through the recording change.

²⁰ As in Figures 1 to 4, these do not show counts of unique individuals and as such these counts differ from the tables in the results section.

Figure 12. Monthly percentage⁵ of adults proceeded against to court by NSW Police counted as Aboriginal as recorded at the time of each event and under the two-step option 2 method

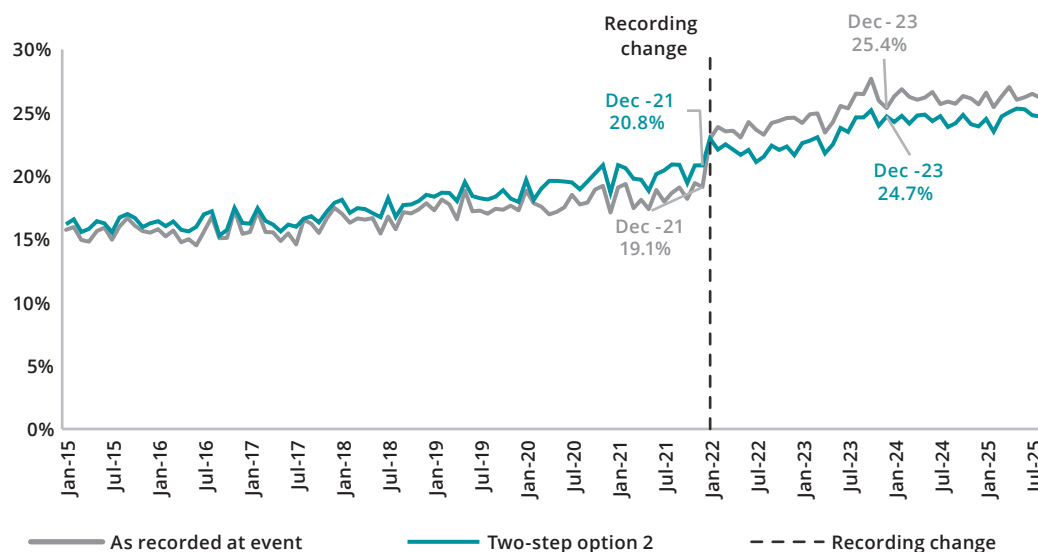


Figure 13. Monthly percentage⁵ of NSW Police recorded adult victims of DV assault counted as Aboriginal as recorded at the time of each event and under the two-step option 2 method

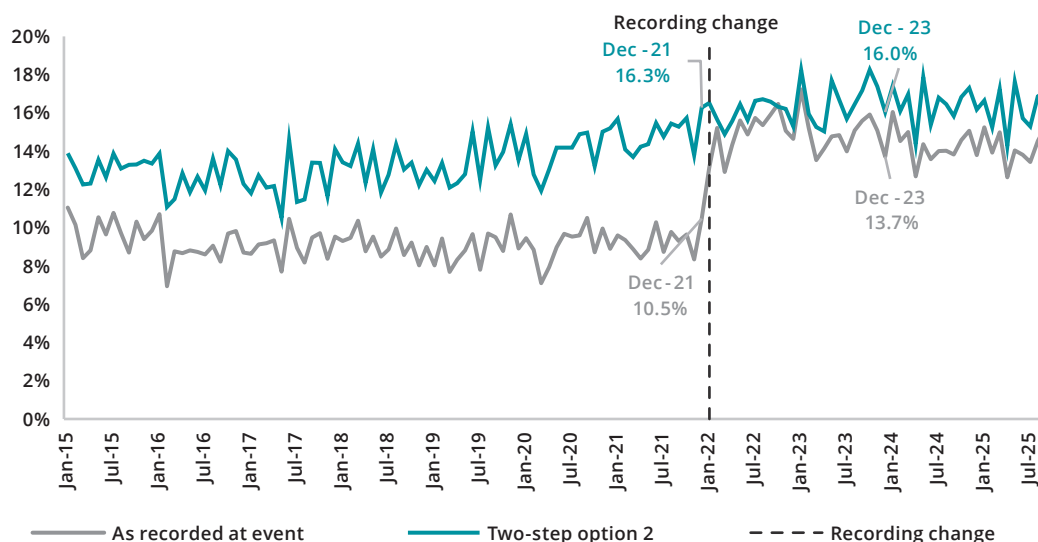


Figure 14 presents data on young persons of interest (POIs) proceeded against by NSW Police. The unadjusted figures show a notable increase in young POIs identified as Aboriginal: from 23.5% in 2021 in the 12 months prior to the recording change in January 2022 to 35.0% in 2022. Adjusted counts using the two-step method reduce but do not remove this increase, with the proportion moving from 33.4% in 2021 to 39.0% in 2022. This could suggest that the new adjusted time series is still affected by the recording change. However, further analysis indicates that this discontinuity is linked to an actual rise in court proceedings against young people for property crimes in early 2022 (see Appendix B). Therefore, we consider that the two-step method supports consistent measurement of Aboriginal young POIs across the recording change.

The time series for under 18 victims of DV assault in figure 15 shows the unadjusted percentage of victims recorded as Aboriginal increased from 12.2% in 2021 to 17.0% in 2022. There was little in change in the proportion of under 18 victims counted as Aboriginal using the chosen two-step method, with 20.9% counted as Aboriginal in 2021 and 21.0% in 2022 suggesting that the two-step series is unaffected by the change in recording of Aboriginality by NSW Police.

Figure 14. Monthly percentage⁵ of under 18 POIs counted as Aboriginal as recorded at the time of each event and under the two-step option 2 method

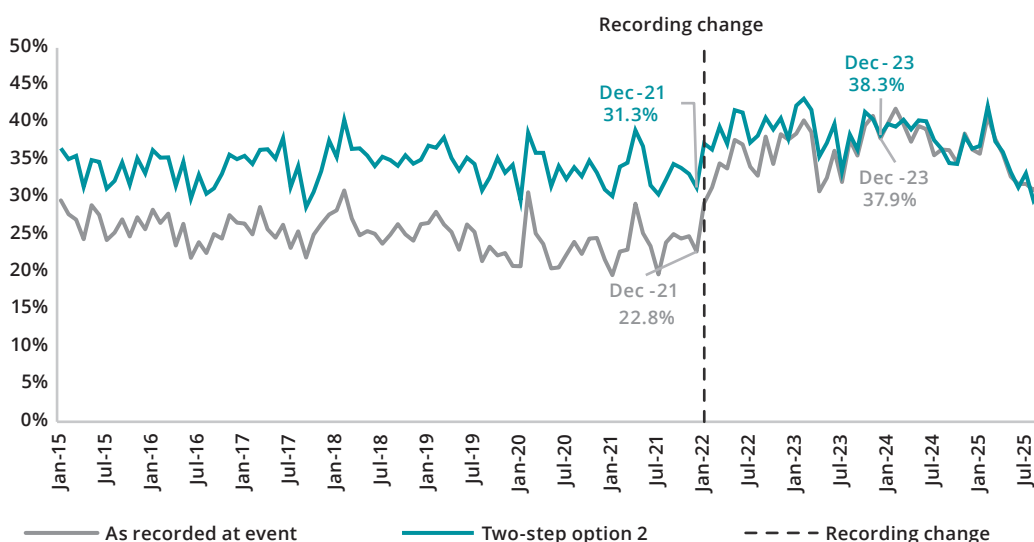
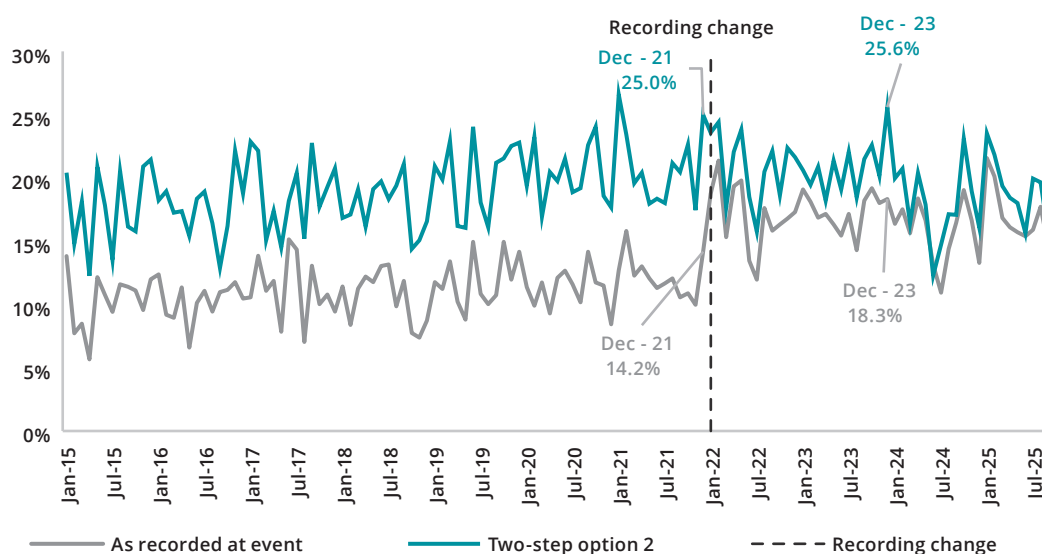


Figure 15. Monthly percentage⁵ of NSW Police recorded under 18 victims of DV assault counted as Aboriginal as recorded at the time of each event and under the two-step option 2 method



DISCUSSION

Prior to 2022, a high proportion of victims and POIs who came into contact with NSW Police were of unknown Aboriginality. This study used several methods to examine whether Aboriginality data in justice datasets could be improved by applying an algorithmic approach to the linked police records. Of the algorithms tested percentage-based methods produced the most similar counts of Aboriginal individuals to the two sources of truth comparison datasets and had the lowest classification errors. However, the best performing of these methods varied depending on the comparison dataset used and the test cohort.

Differences in algorithm performance between under 18 and adult test cohorts suggested the use of a two-stepped approach in which different percentage-based methods were applied depending on the presence or absence of an adult police record. The preferred method is as follows:

1. a person with an adult record with Aboriginality reported is counted as Aboriginal if 25% of their adult records list them as Aboriginal;
2. those with no adult record containing Aboriginality are counted as Aboriginal if they are recorded as such in 35% of their youth records with Aboriginality recorded.

This method produced similar counts of Aboriginal adults to those in the more representative comparison dataset (i.e. the police post-recording change dataset) whilst avoiding substantial overcounting of the number of young Aboriginal people.

Overall, the results show that algorithm performance generally trades off the volume of people counted as Aboriginal with the proportion of assignments that are correct (precision). Less precise methods correctly count a higher proportion of Aboriginal people, but they also misidentify a higher volume of non-Aboriginal individuals as Aboriginal, resulting in overcounts of Aboriginal people and high classification errors (CE). As a method becomes more precise the number of incorrect assignments decrease, but counts of Aboriginal people become more conservative as fewer individuals meet the algorithm's threshold. This results in an undercount of Aboriginal people because more Aboriginal people are misidentified as non-Aboriginal.

Of the methods tested, the ever-identified method invariably had the lowest precision and misidentified the highest number of individuals as Aboriginal, resulting in high CE and overcounts of Aboriginal individuals ranging from 37% to 96%. The twice-identified method also performed poorly and was usually only second to the ever-identified in terms of overcounting Aboriginal individuals, low precision, and high CE. As both the ever-identified and twice-identified methods consistently had high error rates and substantially over-estimated the number of Aboriginal people, neither are considered viable options for improving the NSW Police data on an ongoing basis. Whilst variations of the twice-identified method have been shown to be effective in improving the accuracy and completeness of counts of Aboriginal people in health datasets (Centre for Epidemiology & Health NSW, 2012; Nelson et al., 2020), the poor performance of this method when applied to NSW Police data suggests that its effectiveness varies depending on the nature of the data to which it is applied.

Previous studies have noted that ever-identified methods tend to overcount Aboriginal individuals in administrative datasets (Badgery-Parker, 2012; Kennedy et al., 2009; Randall et al., 2013). This is likely due to recording or linkage errors resulting in some non-Aboriginal people being recorded as Aboriginal. This is problematic as a single such error can define an individual as Aboriginal regardless of the rest of the recorded history of that person (Badgery-Parker, 2012; Christensen et al., 2014; Draper et al., 2009; Kennedy et al., 2009; Nelson et al., 2020; Neville et al., 2011; Randall et al., 2013). The high median number of recorded events for individuals in the comparison datasets in the current study increases the risk of one incorrect recording of a person as Aboriginal and potentially explains why the ever-identified method generates a high number of misassignments of non-Aboriginal people to Aboriginal. This same problem also appears to have impacted the twice-identified method which similarly misidentified a high number of individuals as Aboriginal according to the comparison datasets.

In cohorts with high numbers of administrative records, percentage-based methods are less vulnerable to recording errors compared to ever-identified and twice-identified methods. This is because a person's Aboriginality can be updated as new information is added to the system. Previous analyses testing percentage-based algorithms applied variations of a 50%- or majority-rule (Badgery-Parker, 2012; Briffa et al., 2010; Draper et al., 2009; Neville et al., 2011; Randall et al., 2013). However, in the current study the 50% method undercounted the number of Aboriginal people in the NSW police data by 10-25% when compared with the police post-recording change dataset and 40-50% when using the custody comparison data. This is substantially greater than the undercounts of <1% to 15% (varying by year) reported by Badgery-Parker (2002) in his analysis of linked hospital data. These differences again highlight that the optimal counting method will vary depending on the nature of the datasets of interest.

The lowest CEs in our analyses belonged to percentage-based methods. These methods also had the highest precision and closest similarity of Aboriginal counts. However, the best percentage threshold varied depending on the comparison dataset.

Using the custody comparison dataset, similar counts of Aboriginal individuals were returned at lower thresholds of 10% for adults and 15% for under 18s. The police post-recording change datasets saw better results at higher thresholds of 20-35% (varying by test group). The differences between the two comparison datasets are likely due to differences in the characteristics of the cohorts represented in those datasets. Individuals with a custodial episode often have many past contacts with NSW Police and therefore more records to draw from; young people with experience in custody had a median of 38 police recorded events with recorded Aboriginality while adults with a custody episode had 45. These numbers are substantially higher than the median number of events for the overall test groups which ranged from five records among young DV assault victims to 13 records for adults proceeded to court. Whilst the medians for those individuals appearing in the post-recording change police data were higher than the overall test groups, they were substantially lower than the custody cohort and closer to the total group (ranging from nine for young DV assault victims to 23 for adults proceeded to court). The high median number of police recorded events for individuals in the linked custody data indicates that this cohort is less representative of the broader population of people who have contact with police, the majority of whom never enter custody. Based on the median number of contacts, the sample of individuals contained within the police post-recording change data is somewhat more representative of the population recorded in NSW Police data. In addition, the profile of offences and proceeding types for individuals in the custody comparison data is likely to differ from those in the post-recording change police data. If the accuracy of Aboriginality records varies across different offence and proceeding types, this may also have affected algorithm performance as each instance of a recorded Aboriginality is treated equally by these methods.

Whilst a method with a single percentage threshold to apply to all individuals recorded in police data is desirable for simplicity of application and communication, the results here indicate that applying a single threshold to all individuals leads to Aboriginal young people being over counted. The overwhelming majority of individuals in police data are adults, however applying the rule which works best for adults leads to substantial overcounting of the number of Aboriginal young people. The situation is reversed if the best method for under 18s is applied to adults. To attempt to resolve this, a two-step approach was tested whereby different counting methods were applied depending on whether an individual had a record as an adult. Applying a 35% rule for individuals with only youth records and a 25% rule for individuals with an adult record (applied only to their adult records, regardless of whether the person has youth records) yielded promising results. When compared with the police post-recording change data, this method undercounted the number of Aboriginal adults by less than 1% (Table 16, Appendix Tables A3 and A4) and overcounted the number of Aboriginal young POIs and DV assault victims by 5.2% and 3.9% respectively (Table 18). Whilst there remained an overcounting of Aboriginal young people with the two-step approach, these figures are a marked improvement on the 16-20% overcount that was generated by applying the 20% algorithm to all individuals' records (when compared with the post-recording change data).

There are several limitations of this study. Firstly, the linkage that underpins the study relies on linkage via the NSW Police's CNI to identify unique individuals. It is possible for one person to have multiple CNIs if police do not recognise that a person already exists in their system (which can be exacerbated by offenders giving false personal details) (Hua & Fitzgerald, 2006). Whilst it is difficult to quantify the degree to which this impacts the results presented here, one avenue to check the robustness of the results would be to repeat the analysis on a dataset of individuals whose records were linked through probabilistic matching of personal information such as name and date of birth instead of solely relying on CNI.

Secondly, it is not possible to count Aboriginal individuals who never voluntarily identified as such in either the test data or the source of truth comparison dataset. Aboriginal identification is complex, with varied definitions including those based on community acceptance, knowledge of descent, and/or self-identification. Identification in police data necessarily relies on self-identification. This is because the high volume of people interacting with police and the sometimes-fraught circumstance of that interaction makes determining Aboriginality by community acceptance or other means impractical. It is an individual's right to self-identify as Aboriginal and whether they do so may change over time. For example, analysis of the Australian Census Longitudinal Dataset estimated that the counted NSW Aboriginal population increased by 20.8% due to changes in self-identification between the 2011 and 2016 censuses (Biddle & Markham, 2018). The choice of whether to identify can depend on a range of contextual factors such as who asked the question, the manner in which the question was asked, perceived cultural safety at the time of questioning, the intended use of data, and the potential for discrimination (AIHW, 2012; Biddle, 2015; NSW Aboriginal Affairs, 2015). An individual's uncertainty of their ancestry may also prevent self-identification. In a survey administered by NSW Aboriginal Affairs, uncertainty of ancestry was the most common barrier to identification for those who reported having never identified to a government agency (Biddle, 2015; NSW Aboriginal Affairs, 2015). These contextual factors may also vary over time, resulting in changes in an Aboriginal individual's tendency to identify (Biddle, 2015). The fact that lower percentage methods performed better in the current study compared to the 50% algorithm may partly be due to inconsistent self-identification by Aboriginal people resulting from a reluctance to identify as Aboriginal to police. The reduced weight of evidence required for lower percentage thresholds (e.g. 20%, 30%) compared to a 50% rule is an additional benefit in these circumstances, as the relative number of recordings of Aboriginal identification required to infer an individual as Aboriginal is lower.

Finally, no source of truth comparison dataset is perfect. The custody cohort used in the current study is highly skewed toward individuals with more extensive histories of contact with police and is therefore not representative of the majority of people recorded in NSW Police data. The police post-recording change dataset is likely to be more representative of the overall population in the NSW Police data, however it is still biased towards individuals with more records. Further, while the proportion of unknowns declined after the introduction of a mandatory question on self-identification, Aboriginal people would still be undercounted in the comparison dataset if a large number of Aboriginal persons chose to identify as non-Aboriginal. The second of these issues is not unique to police data.

Whilst the application of algorithmic counting methods can lead to marked improvements in the accuracy and completeness of administrative data (e.g., Mak & Watkins, 2008; Nelson et al., 2020; Rowe & Cowie, 2016; Tervonen et al., 2019), they should not substitute continuing efforts to improve the quality of recording of Aboriginality and removing barriers to identification. It is hoped that such improvements will bring the quality of Aboriginality data to a standard where there is no longer a need to apply algorithms to account for incompleteness or quality concerns. Even if this is not fully achieved, continued improvements to the underlying data will enhance the performance of these methods and as such remains a worthwhile endeavour.

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APPENDIX

Appendix A: Additional algorithm results

Table A1. Aboriginality assignments from various algorithms for adults recorded as DV assault victims between 2017 and 2021 who also had a custody episode between January 2012 and January 2024 (n=10,019), and algorithm performance measures

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Custody comparison data	3,885	-	6,134	-	-	3,885	38.8%	-	-	-
Ever-identified	3,806	2,312	3,822	79	0	6,118	61.1%	23.9%	62.2%	157.5%
Twice-identified	3,747	1,675	4,459	138	0	5,422	54.1%	18.1%	69.1%	139.6%
10% algorithm	3,411	539	5,595	474	0	3,950	39.4%	10.1%	86.4%	101.7%
15% algorithm	3,163	266	5,868	722	0	3,429	34.2%	9.9%	92.2%	88.3%
20% algorithm	2,927	176	5,958	958	0	3,103	31.0%	11.3%	94.3%	79.9%
25% algorithm	2,724	108	6,026	1,161	0	2,832	28.3%	12.7%	96.2%	72.9%
30% algorithm	2,525	72	6,062	1,360	0	2,597	25.9%	14.3%	97.2%	66.8%
35% algorithm	2,391	50	6,084	1,494	0	2,441	24.4%	15.4%	98.0%	62.8%
40% algorithm	2,284	37	6,097	1,601	0	2,321	23.2%	16.3%	98.4%	59.7%
45% algorithm	2,183	26	6,108	1,702	0	2,209	22.0%	17.2%	98.8%	56.9%
50% algorithm	2,117	18	6,116	1,768	0	2,135	21.3%	17.8%	99.2%	55.0%

Table A2. Aboriginality assignments from various algorithms for under 18s who were recorded as DV assault victims between 2017 and 2021 who also had a custody episode between January 2012 and January 2024 (n=1,333), and algorithm performance measures

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Total Aboriginal	% Aboriginal	Classification error (CE)	Precision (Aboriginal)	Similarity
Custody comparison data	714	-	619	-	-	714	53.6%	-	-	-
Ever-identified	702	240	379	12	0	942	70.7%	18.9%	74.5%	131.9%
Twice-identified	690	182	437	24	0	872	65.4%	15.5%	79.1%	122.1%
10% algorithm	667	100	519	47	0	767	57.5%	11.0%	87.0%	107.4%
15% algorithm	632	54	565	82	0	686	51.5%	10.2%	92.1%	96.1%
20% algorithm	591	35	584	123	0	626	47.0%	11.9%	94.4%	87.7%
25% algorithm	547	26	593	167	0	573	43.0%	14.5%	95.5%	80.3%
30% algorithm	491	25	594	223	0	516	38.7%	18.6%	95.2%	72.3%
35% algorithm	446	16	603	268	0	462	34.7%	21.3%	96.5%	64.7%
40% algorithm	410	12	607	304	0	422	31.7%	23.7%	97.2%	59.1%
45% algorithm	381	5	614	333	0	386	29.0%	25.4%	98.7%	54.1%
50% algorithm	359	3	616	355	0	362	27.2%	26.9%	99.2%	50.7%

Table A3. Aboriginality assignments from algorithms applied to only adult records, for adults who were proceeded to court by NSW Police between 2017 and 2021 and were recorded in a police event after the 2022 recording change (n=77,910)

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	9,896	-	68,014	-	-	-	-	-
Ever-identified	9,888	7,910	60,101	8	3	10.2%	55.6%	179.9%
Twice-identified	9,247	4,292	63,719	649	3	6.3%	68.3%	136.8%
10% algorithm	9,279	3,588	64,423	617	3	5.4%	72.1%	130.0%
15% algorithm	8,882	2,496	65,515	1,014	3	4.5%	78.1%	115.0%
20% algorithm	8,572	1,939	66,072	1,324	3	4.2%	81.6%	106.2%
25% algorithm	8,299	1,513	66,498	1,597	3	4.0%	84.6%	99.2%
30% algorithm	7,991	1,151	66,860	1,905	3	3.9%	87.4%	92.4%
35% algorithm	7,685	865	67,146	2,211	3	4.0%	89.9%	86.4%
40% algorithm	7,555	759	67,252	2,341	3	4.0%	90.9%	84.0%
45% algorithm	7,330	618	67,393	2,566	3	4.1%	92.2%	80.3%
50% algorithm	7,226	560	67,451	2,670	3	4.1%	92.8%	78.7%

Table A4. Aboriginality assignments from algorithms applied to only adult records, adults recorded as DV assault victims between 2017 and 2021 and were recorded in a police event after the 2022 recording change (n=31,306)

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	5,065	-	26,241	-	-	-	-	-
Ever-identified	5,056	2,760	23,476	9	5	8.9%	64.7%	154.3%
Twice-identified	4,642	1,432	24,804	423	5	5.9%	76.4%	119.9%
10% algorithm	4,840	1,451	24,785	225	5	5.4%	76.9%	124.2%
15% algorithm	4,645	1,034	25,202	420	5	4.7%	81.8%	112.1%
20% algorithm	4,518	830	25,406	547	5	4.4%	84.5%	105.6%
25% algorithm	4,396	668	25,568	669	5	4.3%	86.8%	100.0%
30% algorithm	4,254	504	25,732	811	5	4.2%	89.4%	93.9%
35% algorithm	4,072	368	25,868	993	5	4.4%	91.7%	87.7%
40% algorithm	4,020	330	25,906	1,045	5	4.4%	92.4%	85.9%
45% algorithm	3,921	270	25,966	1,144	5	4.5%	93.6%	82.7%
50% algorithm	3,889	253	25,983	1,176	5	4.6%	93.9%	81.8%

Table A5. Aboriginality assignments from various algorithms, for under 18s proceeded against by NSW Police between 2017 and 2021 and were recorded in a police event after the 2022 recording change; only those with no adult record (n=4,304)

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	858	-	3,446	-	-	-	-	-
Ever-identified	858	334	3,112	0	0	7.8%	72.0%	138.9%
Twice-identified	811	164	3,282	47	0	4.9%	83.2%	113.6%
10% algorithm	854	263	3,183	4	0	6.2%	76.5%	130.2%
15% algorithm	843	217	3,229	15	0	5.4%	79.5%	123.5%
20% algorithm	838	184	3,262	20	0	4.7%	82.0%	119.1%
25% algorithm	819	156	3,290	39	0	4.5%	84.0%	113.6%
30% algorithm	793	111	3,335	65	0	4.1%	87.7%	105.4%
35% algorithm	760	80	3,366	98	0	4.1%	90.5%	97.9%
40% algorithm	755	73	3,373	103	0	4.1%	91.2%	96.5%
45% algorithm	734	61	3,385	124	0	4.3%	92.3%	92.7%
50% algorithm	729	58	3,388	129	0	4.3%	92.6%	91.7%

Table A6. Aboriginality assignments from various algorithms, for under 18s who were recorded as DV assault victims between 2017 and 2021 and were recorded in a police event after the 2022 recording change; only those with no adult record (n=1,407)

Algorithm	Correct Aboriginal	Incorrect Aboriginal	Correct non-Aboriginal	Incorrect non-Aboriginal	Incorrect unknown	Classification error (CE)	Precision (Aboriginal)	Similarity
Police post-recording change comparison data	244	-	1,163	-	-	-	-	-
Ever-identified	244	128	1,035	0	0	9.1%	65.6%	152.5%
Twice-identified	226	62	1,101	18	0	5.7%	78.5%	118.0%
10% algorithm	244	108	1,055	0	0	7.7%	69.3%	144.3%
15% algorithm	242	86	1,077	2	0	6.3%	73.8%	134.4%
20% algorithm	241	69	1,094	3	0	5.1%	77.7%	127.0%
25% algorithm	235	52	1,111	9	0	4.3%	81.9%	117.6%
30% algorithm	227	42	1,121	17	0	4.2%	84.4%	110.2%
35% algorithm	216	28	1,135	28	0	4.0%	88.5%	100.0%
40% algorithm	214	25	1,138	30	0	3.9%	89.5%	98.0%
45% algorithm	212	20	1,143	32	0	3.7%	91.4%	95.1%
50% algorithm	212	19	1,144	32	0	3.6%	91.8%	94.7%

Appendix B: Is there still a break in the time series of young POIs using the two-step method?

This section assesses whether the two-step method successfully addresses the January 2022 series interruption in Aboriginal identification, enabling continuous measurement over time of the number of Aboriginal young people interacting with police.

As shown in figure 14 in the main report, there appears to be a substantial increase in the percentage of youth POIs identified as Aboriginal after January 2022, despite the application of the two-step method. Figure B1 explores this data further by presenting separate results for young POIs proceeded against by different police actions: proceedings to court and diversions under the Young Offenders Act. The potential interruption in the two-step time series is observable among young people proceeded against to court (increasing from 47.4 in 2021 to 53.2% in 2022). However, the percentage of young POIs counted as Aboriginal is more consistent across the recording change for those receiving a diversion. This indicates that the proportional increase in young POIs counted as Aboriginal under the two-step method is primarily attributable to an increase among under18s who were proceeded against to court.

Figure B2 explores the proceeded to court cohort by dividing it into those proceeded for violent versus property offences. Under the two-step method, the percentage of POIs counted as Aboriginal remains relatively stable for violent offences (up 3.3 p.p., from 39.3% to 42.5%) but increases substantially for property offences— up 8.5 p.p. from 58.8% in 2021 to 67.3% in 2022. If the recording change was causing an increase in the proportion of under 18s counted as Aboriginal by the two-step method, a similar pattern would be expected across all offence types. Instead, the data suggests that property offences are the main driver of the observed increase in the proportion of Aboriginal youth POIs proceeded against to court.

A potential explanation for this is a genuine increase in the number of Aboriginal young people coming to police attention for property offences around the time of the recording change. Figure B3 shows the total number of youth POIs proceeded to court for property offences, revealing that the rise in the proportion of under18 POIs counted as Aboriginal coincides with an increase in the overall volume of young people proceeded to court for property offences at the end of 2021. This, combined with the fact that the increase in Aboriginal POIs is concentrated among property offenders proceeded to court, suggests that the increase in Aboriginal identification under the two-step method reflects a real shift in the underlying cohort rather than an artefact of the recording rule change.

Taken together, the data indicates that the two-step method does smooth out the time series break in counts of young Aboriginal POIs caused by the recording change and that the increase after January 2022 is driven by changes in the composition and volume of property offending youth, rather than by a methodological issue in the two-step rule itself.

Figure B1. Monthly percentage of under 18 POIs counted as Aboriginal as recorded at the time of each event and under the two-step option 2 method, split by proceeding type

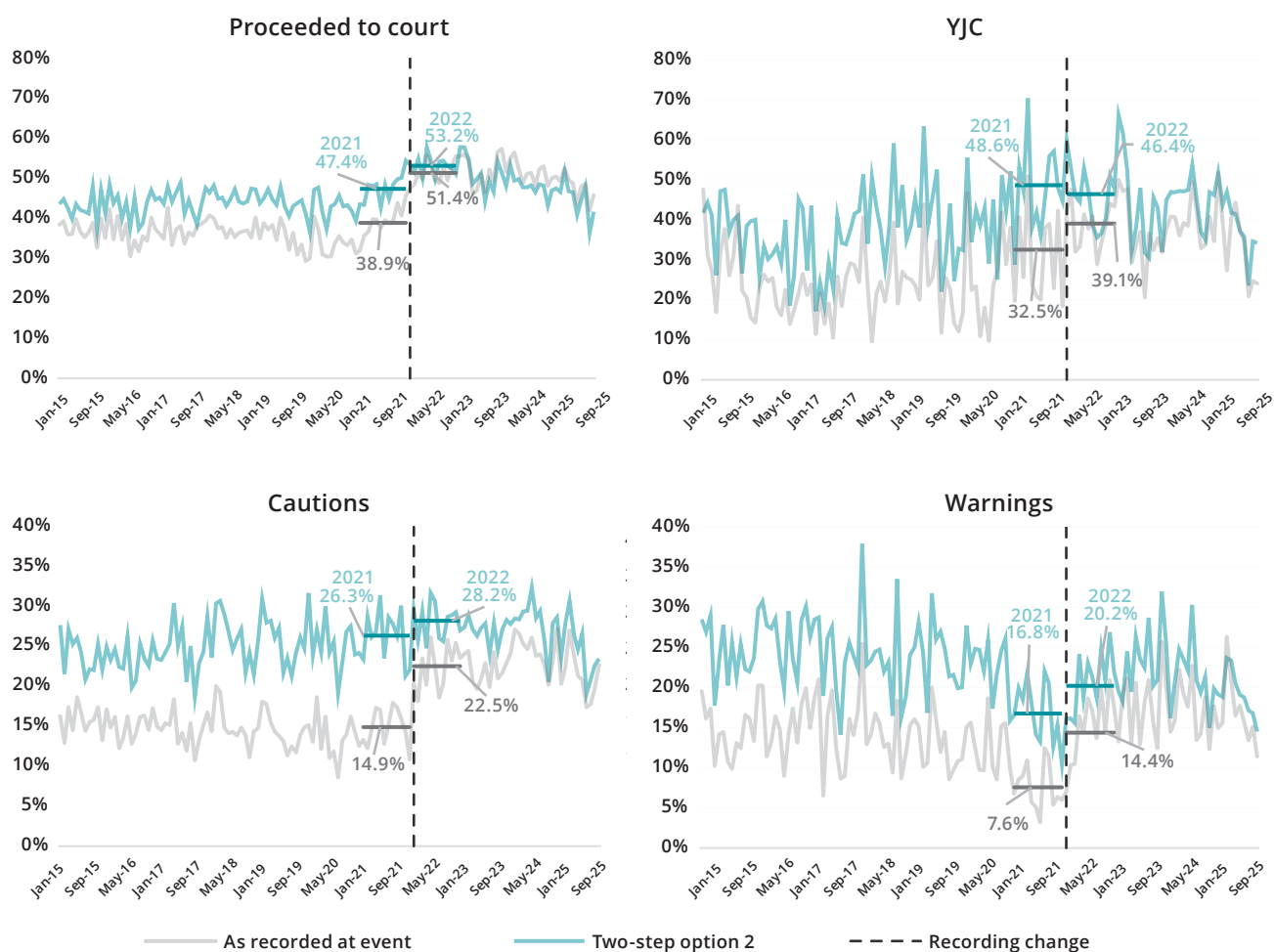


Figure B2. Monthly percentage of under 18 POIs proceeded to court offences counted as Aboriginal under the two-step option 2 method, violent and property offences

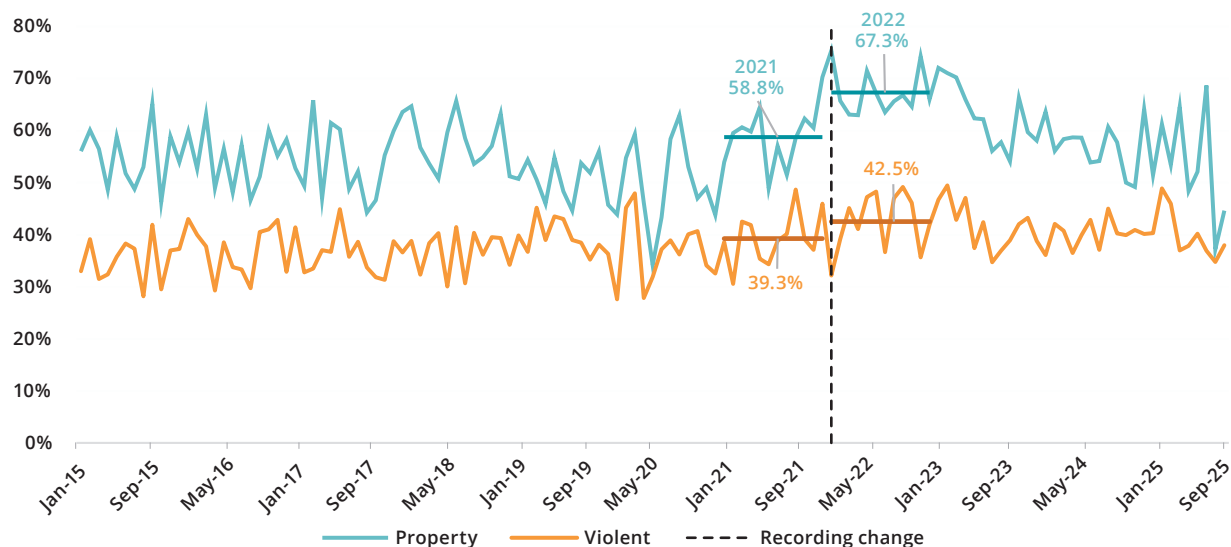


Figure B3. Monthly total number of under 18 POIs proceeded to court by NSW Police for property offences

