



Royal Commission
into Aged Care Quality and Safety

THE COST OF RESIDENTIAL AGED CARE

APPENDICES

RESEARCH PAPER 9

AUGUST 2020

The Royal Commission into Aged Care Quality and Safety was established by Letters Patent on 8 October 2018. Replacement Letters Patent were issued on 6 December 2018, and amended on 13 September 2019 and 25 June 2020.

The Honourable Tony Pagone QC and Ms Lynelle Briggs AO have been appointed as Royal Commissioners. They are required to provide a final report by 26 February 2021.

The Royal Commission releases consultation, research and background papers. This research paper has been prepared by the University of Queensland for the information of Commissioners and the public. The views expressed in this paper are not necessarily the views of the Commissioners.

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The cost of residential aged care

APPENDICES



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Appendix A

Data preparation and exploration: Facility level



A-1 Introduction

This appendix describes the facility-level data that was available to conduct the quality-adjusted efficiency analysis of aged care facilities and providers in Australia. The University of Queensland received the facility-level data in multiple datasets from the Royal Commission between January and April 2020. The data provided spanned a period of five financial years 2014/15 to 2018/19. The data was aggregated by facility, such that all data related to the same facility within a given financial year were combined.

Preliminary data screening and visualisation to check the data completeness, quality and outliers was conducted on the facility-level data before performing the main data analysis, including constructing the composite quality index (*Technical Supplementary Report 1*) and estimating the efficient cost frontier (*Technical Supplementary Report 2*).

All data items received were grouped into five categories:

- (i) *Characteristics of individual facilities*: Characteristics include location by state and territory, and remoteness, type of provider, and the number of available beds. The primary source for this data is the Department of Health.
- (ii) *Costs*: Expenditure data was provided from two different sources (Department of Health and Stewart Brown). The two data sources had different units of analysis: the Department of Health and Stewart Brown data are the provider and facility level, respectively. The two data sources had different levels of coverage; the Department of Health data covered all active providers in the sector and the Stewart Brown data covered 34% of active facilities.
- (iii) *Outputs*: The number of occupied bed days and casemix in the National Weighted Activity Units (NWAU) which measures the relative price, and Relative Value Units (RVU) which measures the relative resource consumption.
- (iv) *Inputs*: Labour inputs were derived from Stewart Brown data and additional data acquired by the Royal Commission (workforce) and capital inputs (building activity and room size) from the Department of Health. A detailed description of the preparation and exploration of the workforce data are summarised in Appendix B below.
- (v) *Quality*: Items considered as a proxy for the quality of aged care facilities are (1) structure, (2) process, and (3) outcomes, including clinical outcomes, consumer experience, complaints and issues. A detailed description and preparation of the quality variables used in the construction of the composite quality index is provided in the *Technical Supplementary Report 1*.

A-2 Facility characteristics

The characteristics of individual facilities was sourced from the Department of Health. Facility characteristics includes the location (remoteness, geographical classification), organisation type, and provider type. Facility characteristics were complete for all facilities in the sector.

The distributions of the sample by characteristics were examined. Facility distributions across the five-year period (financial years 2014/15 to 2018/19) are summarised in Table A-1.

There were approximately 2,800 active facilities each year of the 5-year period across Australia. The number of facilities reduced slightly in the last two years of the period (financial years 2017/18 and 2018/19).

The number of facilities in each state and territory are proportional to the population of each respective state and territory. New South Wales and Victoria accounted for the more than half of all facilities, followed by Queensland.

The majority of facilities operated in major cities or inner regional areas. Annually, approximately 45–50 facilities operated in remote and very remote regions of Australia (according to the Australian Bureau of Statistics remoteness and the Modified Monash Model classifications).

The facilities operated by not-for-profit providers accounted for over half of the residential aged care market, consisting of charitable, community based and religious organisations. The private for-profit segment operated about 950 facilities annually, the majority of which had more than 30 beds (places). The government owned about 250 facilities annually, of which approximately 65% had fewer than 30 beds.

Table A-1. Facility characteristics and distributions by financial year

| | Financial year | | | | | Total |
|--|----------------|--------------|--------------|--------------|--------------|---------------|
| | 2014/2015 | 2015/2016 | 2016/2017 | 2017/2018 | 2018/2019 | |
| Total | 2,811 | 2,813 | 2,801 | 2,782 | 2,762 | 13,969 |
| State/territory | | | | | | |
| New South Wales | 920 (33%) | 918 (33%) | 916 (33%) | 907 (33%) | 898 (33%) | 4559 |
| Victoria | 786 (28%) | 787 (28%) | 791 (28%) | 788 (28%) | 782 (28%) | 3934 |
| Queensland | 478 (17%) | 485 (17%) | 480 (17%) | 475 (17%) | 473 (17%) | 2391 |
| South Australia | 258 (9%) | 256 (9%) | 249 (9%) | 248 (9%) | 248 (9%) | 1259 |
| Western Australia | 250 (9%) | 251 (9%) | 249 (9%) | 251 (9%) | 250 (9%) | 1251 |
| Tasmania | 79 (3%) | 76 (3%) | 76 (3%) | 73 (3%) | 72 (3%) | 376 |
| Australian Capital Territory | 28 (1%) | 28 (1%) | 28 (1%) | 28 (1%) | 27 (1%) | 139 |
| Northern Territory | 12 (0.4%) | 12 (0.4%) | 12 (0.4%) | 12 (0.4%) | 12 (0.4%) | 60 |
| Australian Bureau of Statistics remoteness | | | | | | |
| Major cities | 1,762 (63%) | 1,761 (63%) | 1,758 (63%) | 1,751 (63%) | 1,738 (63%) | 8,770 |
| Inner regional | 666 (24%) | 668 (24%) | 665 (24%) | 659 (24%) | 657 (24%) | 3,315 |
| Outer regional | 332 (12%) | 330 (12%) | 328 (12%) | 325 (12%) | 321 (12%) | 1,636 |
| Remote | 34 (1%) | 34 (1%) | 33 (1%) | 33 (1%) | 33 (1%) | 167 |
| Very remote | 17 (1%) | 20 (1%) | 17 (1%) | 14 (1%) | 13 (0.5%) | 81 |
| Modified Monash Model geographical classification^a | | | | | | |
| MM 1 | 1,752 (62%) | 1751 (62%) | 1,748 (62%) | 1,741 (63%) | 1,728 (63%) | 8,720 |
| MM 2 | 225 (8%) | 227 (8%) | 224 (8%) | 220 (8%) | 218 (8%) | 1,114 |
| MM 3 | 231 (8%) | 230 (8%) | 230 (8%) | 228 (8%) | 227 (8%) | 1,146 |
| MM 4 | 186 (7%) | 187 (7%) | 186 (7%) | 185 (7%) | 183 (7%) | 927 |
| MM 5 | 364 (13%) | 362 (13%) | 361 (13%) | 359 (13%) | 358 (13%) | 1,804 |
| MM 6 | 37 (1%) | 37 (1%) | 36 (1%) | 36 (1%) | 35 (1%) | 181 |
| MM 7 | 16 (1%) | 19 (1%) | 16 (1%) | 13 (0.5%) | 13 (0.5%) | 77 |
| Organisation type | | | | | | |
| Charitable | 484 (17%) | 482 (17%) | 477 (17%) | 485 (17%) | 504 (18%) | 2,432 |
| Community based | 440 (16%) | 447 (16%) | 448 (16%) | 436 (16%) | 430 (16%) | 2,201 |
| Religious | 693 (25%) | 675 (24%) | 675 (24%) | 666 (24%) | 650 (24%) | 3,359 |
| Private | 939 (33%) | 959 (34%) | 953 (34%) | 950 (34%) | 936 (34%) | 4,737 |
| Government | 255 (9%) | 250 (9%) | 248 (9%) | 245 (9%) | 242 (9%) | 1,240 |
| Provider type | | | | | | |
| Not-for-profit | 1,617 (58%) | 1,604 (57%) | 1,600 (57%) | 1,587 (57%) | 1,584 (57%) | 7,992 |
| For-profit | 939 (33%) | 959 (34%) | 953 (34%) | 950 (34%) | 936 (34%) | 4,737 |
| Government | 255 (9%) | 250 (9%) | 248 (9%) | 245 (9%) | 242 (9%) | 1,240 |

^a The model measures remoteness and population size on a scale of Modified Monash (MM) category MM 1 to MM 7. MM 1 is a major city and MM 7 is very remote.

The distribution of facility sizes, as measured by the number of places (beds) per facility, are summarised by financial year in Figure A-1. The majority of facilities had between 40–100 beds (average of approximately 70 beds per facility). A small number of facilities were very large with over 200 beds per facility.

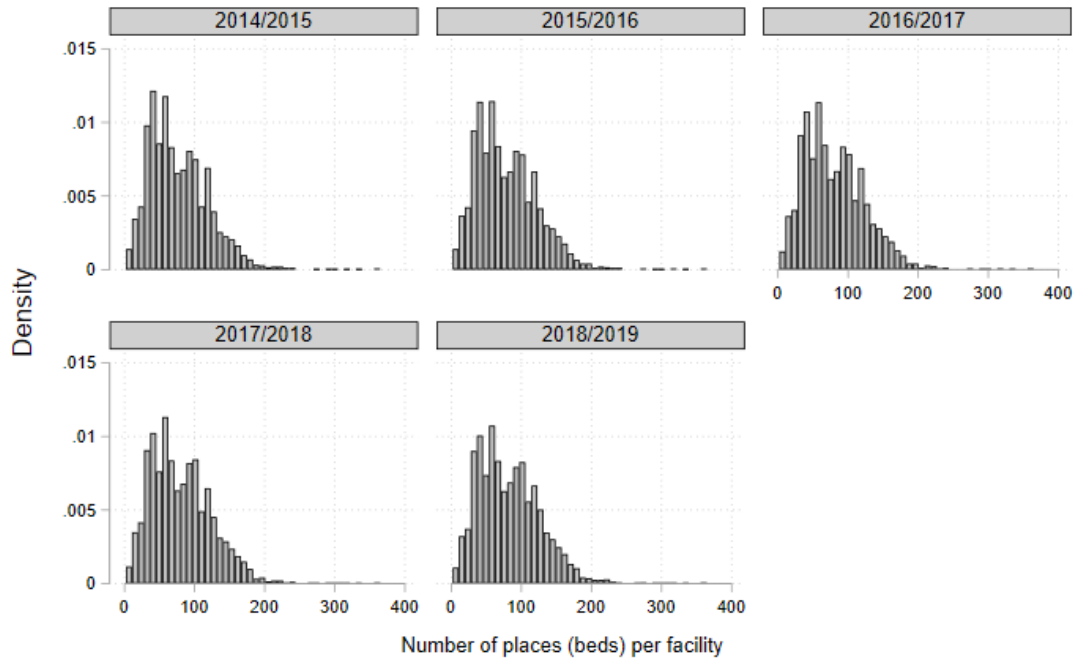


Figure A-1. Histograms of facility size (number of places/beds per facility) by financial year

The number of facilities per provider was examined. Approximately 18% of providers operated only one facility (the majority of which had over 30 beds), and a similar proportion of providers operated more than 50 facilities. The median number of facilities per provider was 10 facilities. The distributions of the number of facilities per provider are presented in Figure A-2 below.

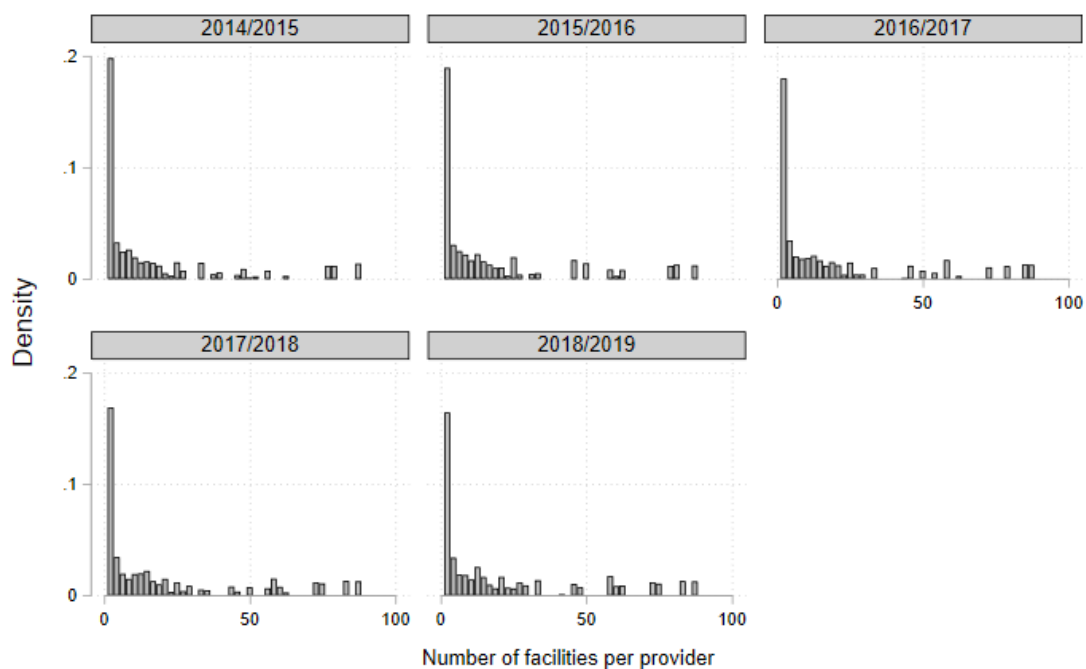


Figure A-2. Histogram of number of facilities per provider by financial year

A-3 Cost data

Financial information was provided for the facility-level analysis from two different sources, Stewart Brown and the Department of Health. The financial reports from the Department of Health and Stewart Brown were examined and compared.

The Stewart Brown financial reports contained expenditure data at a facility level for 34% of all individual facilities across Australia (over a five-year period). The Department of Health financial reports contained data at a provider level on all providers of residential aged care in Australia. As noted above, approximately 18% of providers had one facility.

The Stewart Brown financial data has facility level data. To increase the sample size of facilities, the data was examined to determine whether the data could be combined. Specifically, whether financial data for the single-facility providers in the Department of Health data could be used to supplement the Stewart Brown data for those facilities without Stewart Brown financial data. It was considered appropriate to combine these two data sources if (i) there were facilities with Department of Health financial data but without Stewart Brown financial data, and (ii) the costs reported by the two sources were similar.

The total number of facilities with financial data from either data source or both data sources were examined and are summarised in Table A-2. There were 274 facilities out of 6,247 facilities (multiple years) that had financial data from both sources.

Table A-2. Number of facilities with financial data by source and financial year

| Data sources | 2014/2015 | 2015/2016 | 2016/2017 | 2017/2018 | 2018/2019 | Total |
|----------------------|-----------|-----------|-----------|-----------|-----------|-------|
| Stewart Brown | 703 | 727 | 836 | 859 | 1,009 | 4,134 |
| Department of Health | 508 | 488 | 440 | 430 | 0 | 1,866 |
| Both | 58 | 64 | 76 | 76 | 0 | 274 |
| Total | 1,269 | 1,279 | 1,352 | 1,365 | 1,009 | 6,274 |

The distributions of the facilities with financial data by data source and organisation type were examined and are provided in Table A-3. The majority of the Stewart Brown financial data (94%) was for facilities operated by not-for-profit (charitable, community based and religious) organisations. The private for-profit sector was underrepresented in the Stewart Brown data (3%) compared to nearly a third of the market share (34%) of the whole residential aged care sector as shown in Table A-1. This suggests that it is imperative to supplement the Stewart Brown data with financial data from the Department of Health.

Table A-3. Number of facilities with financial data by source and organisation type

| | Charitable | Community | Religious | Private | Government | Total |
|----------------------|-------------|-------------|-------------|-----------|------------|-------|
| Stewart Brown | 1,366 (33%) | 420 (10%) | 2,078 (51%) | 134 (3%) | 117 (3%) | 4,115 |
| Department of Health | 112 (6%) | 688 (37%) | 165 (9%) | 740 (40%) | 156 (8%) | 1,861 |
| Both | 67 (24%) | 119 (43%) | 41 (15%) | 32 (12%) | 15 (5%) | 274 |
| Total | 1,545 (25%) | 1,227 (20%) | 2,284 (37%) | 906 (15%) | 288 (5%) | 6,250 |

It was determined that the Stewart Brown dataset will be used as the primary source of cost data, and the Department of Health cost data for single-facility providers will be used to supplement the Stewart Brown data for those facilities without Stewart Brown financial data.

A mapping exercise to check the reporting consistency between the two data sources was conducted for both the total cost (aggregated) and total cost by different categories (disaggregated). The mapping exercise for the *total cost* was conducted to determine whether (i) the individual cost items collected and reported in the Department of Health and Stewart Brown financial reports were comparable, (ii) the total cost recorded in the two data sources were similar enough that the Department of Health financial data from single-facility providers could be used to supplement the Stewart Brown data, and (iii) adjustment of the total cost from Department of Health database is required before using it for the cost frontier estimation. The mapping exercise for the disaggregated costs is presented in Appendix B below.

The total cost (aggregated) was calculated as the sum of all cost items provided for each facility in the Stewart Brown data (supplemented with the sum of all cost items for the single-facility providers in the Department of Health data, as required).

The total cost (aggregated) for the two data sources were plotted and the correlation examined. There were 274 observations (274/6,274, or 4.4% of the facility sample, over the five-year period) that had both Stewart Brown and Department of Health financial data. The scatter plot of the Department of Health and Stewart Brown total costs (aggregate) for the sample of the 274 facilities is shown in Figure A-3. The correlation coefficient is 0.96 and there are a few outliers. In general, the total cost (aggregate) from the Stewart Brown and the Department of Health data sources were reported consistently as shown by most of the observations lying on or clustering around the 45 degree line intercepting the origin. There was no clear pattern of variance associated with the cost values (i.e. heteroskedasticity is unlikely to be an issue requiring adjustment).

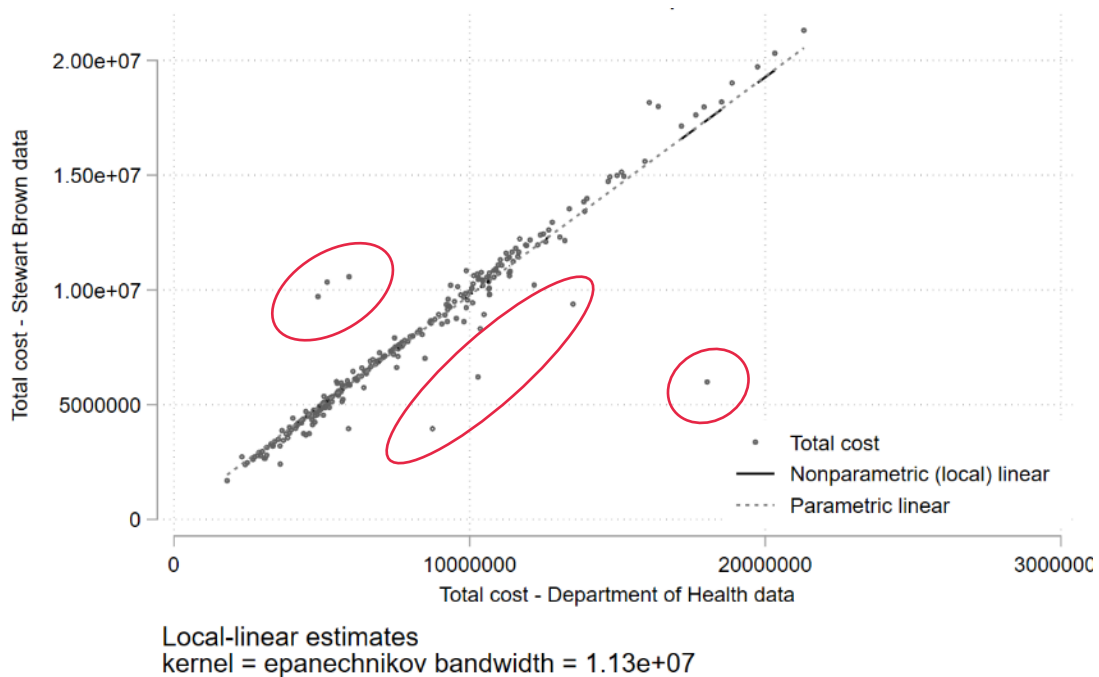


Figure A-3. Scatter plot of total costs (aggregated) from Stewart Brown vs. Department of Health

The histograms and boxplots of the total cost (aggregated) for the combined data (Stewart Brown total cost supplemented with Department of Health data, as required) and Stewart Brown only data were examined and are shown in Figure A-4. Overall, the distributions of the total cost were similar to that from both data sources.

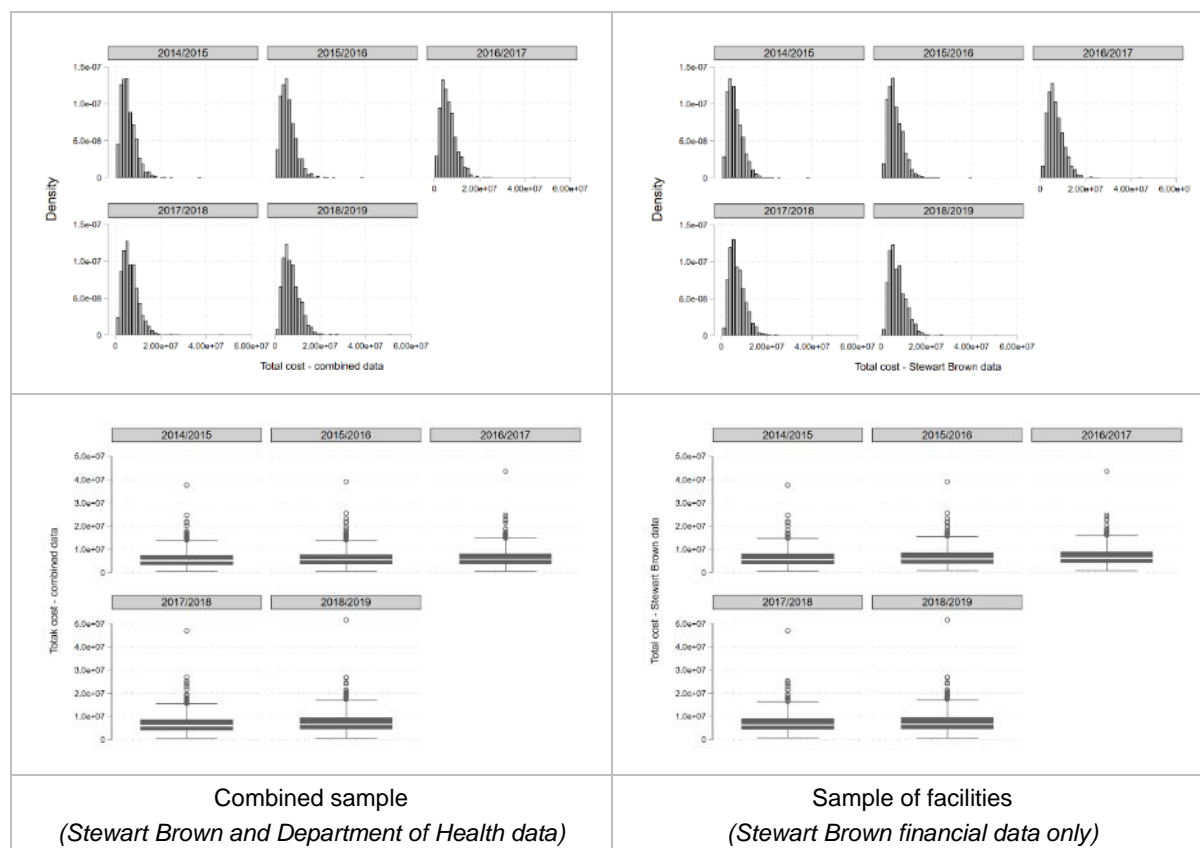


Figure A-4. Histograms and boxplots of total cost (aggregated) for combined vs. Stewart Brown only sample

Summary statistics for the combined sample (both data sources) versus the sample of facilities (Stewart Brown only data) are shown in Figure A-4. The combined sample had a slightly lower mean than the Stewart Brown only data; however, the spread of the distribution, in terms of the standard deviation and range, were similar between the samples.

Table A-4. Summary statistics for the combined vs. Stewart Brown only sample

| Years | Sample with combined data (Department of Health and Stewart Brown) | | | Sample with Stewart Brown data only | | |
|---------|---|-----------|--------------------|-------------------------------------|-----------|--------------------|
| | N | Mean | Standard deviation | N | Mean | Standard deviation |
| 2014/15 | 1,211 | 5,663,905 | 3,381,096 | 761 | 6,176,278 | 3,559,479 |
| 2015/16 | 1,215 | 5,973,121 | 3,491,060 | 791 | 6,471,322 | 3,639,105 |
| 2016/17 | 1,276 | 6,331,766 | 3,644,206 | 912 | 6,847,744 | 3,792,693 |
| 2017/18 | 1,289 | 6,697,893 | 3,812,564 | 935 | 7,106,434 | 3,895,317 |
| 2018/19 | 1,009 | 7,387,357 | 4,068,363 | 1,009 | 7,387,357 | 4,068,363 |

From the above analysis, it was considered appropriate to supplement the Stewart Brown financial data with the Department of Health financial data, without the need for additional adjustments. This achieved a sample

of 6,274 observations. The number of observations with total cost information available for the efficiency analysis is shown in Table A-5.

Table A-5. Number of observations with total cost information available for the efficiency analysis

| Financial year | Total number of residential aged care facilities (A) | Number of residential aged care facilities included in final data | | | Coverage of final data | | |
|----------------|--|---|------------------------|-------------------------------------|------------------------|--------------------------|---------------------------------------|
| | | Total (B) | From Stewart Brown (C) | Added from Department of Health (D) | Total (B/A) | From Stewart Brown (C/A) | Added from Department of Health (D/A) |
| 2014/15 | 2,811 | 1,269 | 761 | 508 | 45% | 27% | 18% |
| 2015/16 | 2,813 | 1,279 | 791 | 488 | 45% | 28% | 17% |
| 2016/17 | 2,801 | 1,352 | 912 | 440 | 48% | 33% | 16% |
| 2017/18 | 2,782 | 1,365 | 935 | 430 | 49% | 34% | 15% |
| 2018/19 | 2,762 | 1,009 | 1,009 | 0 | 37% | 37% | 0% |
| Total | 13,969 | 6,274 | 4,408 | 1,866 | 45% | 32% | 13% |

A-4 Output data

The ideal measures of outputs of a residential aged care facility should reflect the health and quality of life status of the residents during the period living in the facility. In other words, an ideal output measure should be *number of bed days adjusted for casemix and quality of care* in the facility. This measure requires three components: (i) the number of occupied bed days (count), (ii) the casemix to capture the relative severity of the residents, and (iii) the quality of care and life experienced by the residents. Obtaining all these measures are challenging in practice. No studies in the literature have used this measure (Tran et al., 2019), with most studies using *residential bed days* as a measure of outputs of facilities, with or without adjustment for casemix.

The database contains several items that allow us to conduct the cost efficiency analysis with all three components. The first two components, occupied bed days and casemix, are described briefly below. The quality of care experienced by residents was explored further in Sections C-7 to C-12 of Appendix C below, and in the *Technical Supplementary Report 1*.

A-4-1 Occupied bed days

The first component of the output of a residential aged care facility is the number of occupied bed days. The two data sources, Stewart Brown and the Department of Health, contained the number of occupied bed days. A consistency check of the difference in occupied bed day counts between the two data sources was conducted. There are 4,408 observations for occupied bed days in the Stewart Brown data versus 6,274 facilities in Department of Health data. As shown in Figure A-5, there are large discrepancies in occupied bed days between the two data sources across the financial years. Stewart Brown reported a larger number of bed days per annum compared to the Department of Health on the 4,408 observations that are common across the two datasets.

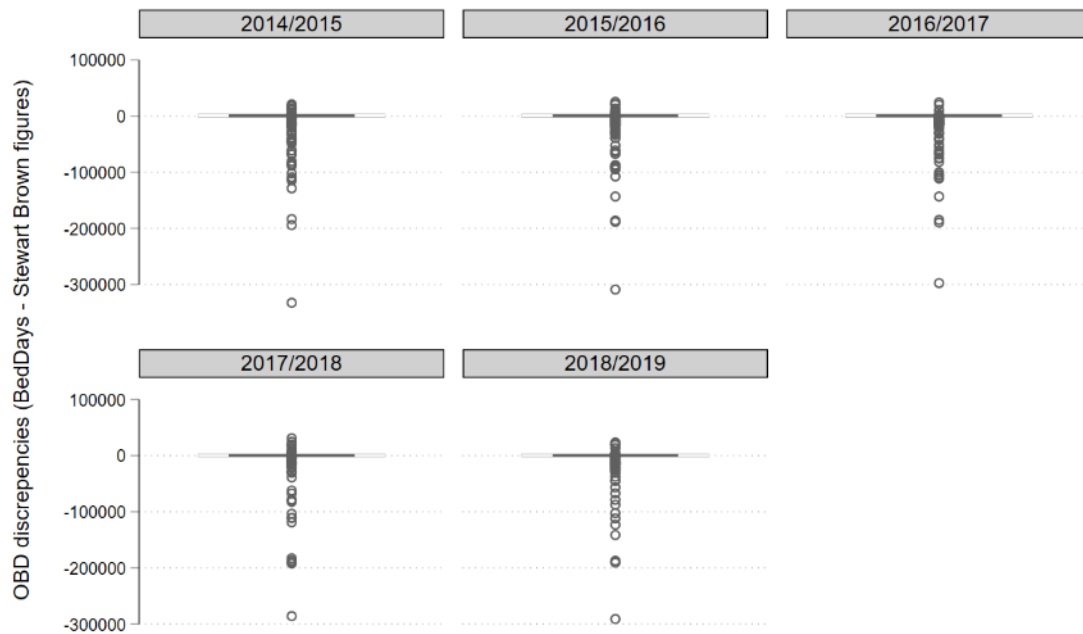


Figure A-5. Differences in occupied bed days between the two data sources by financial year

In the Department of Health data, residential care bed days were classified into four categories: days in permanent residential, days in respite, days of social leave, and days of hospital leave. On average, days in permanent residential care accounted for the highest proportion of total bed days (95.7%), followed by days in respite (2.9%), days of hospital leave (1.1%) and days of social leave (0.3%).

While it is inevitable that residents might require presentations to the emergency department or admissions to hospital, a large number of days spent in hospitals could be seen as an indicator of cost-shifting strategies by facilities. That is, a facility that does not provide a sufficient quality of care may lead to (potentially preventable) illness or health deterioration (faster than would have been expected if the resident had received good quality care) of residents that requires emergency department presentations or hospital admissions. It is difficult in practice to know the exact level of *optimal* hospitalisations and/or emergency department presentations.

The distribution of hospital leave days per annum, and hospital leave days per bed per annum, by financial year are summarised in Figure A-6 and Figure A-7, respectively. The average number of hospital leave days was approximately 280 days for each facility per annum (standard deviation around 250 days), equivalent to about 3.5 days per bed per annum. The mean value of hospital leave days per bed per annum was the lowest for the government sector (2.4 days), followed by the private for-profit sector (3.0 days), and was the highest for the not-for-profit sector (3.7 days).

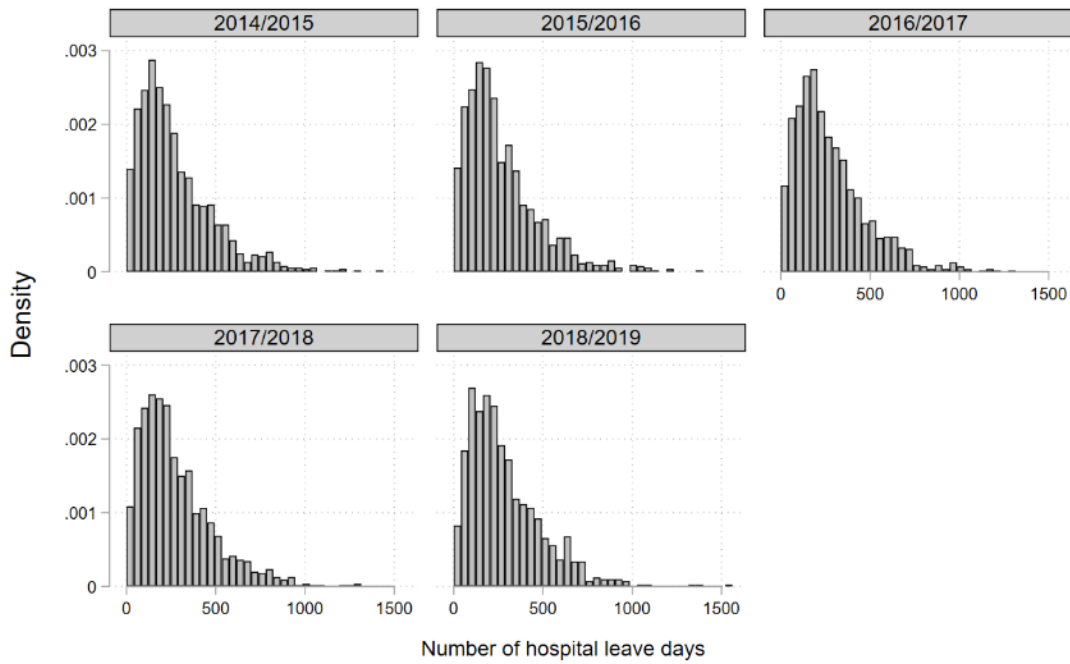


Figure A-6. Histograms of hospital leave days per annum by financial year

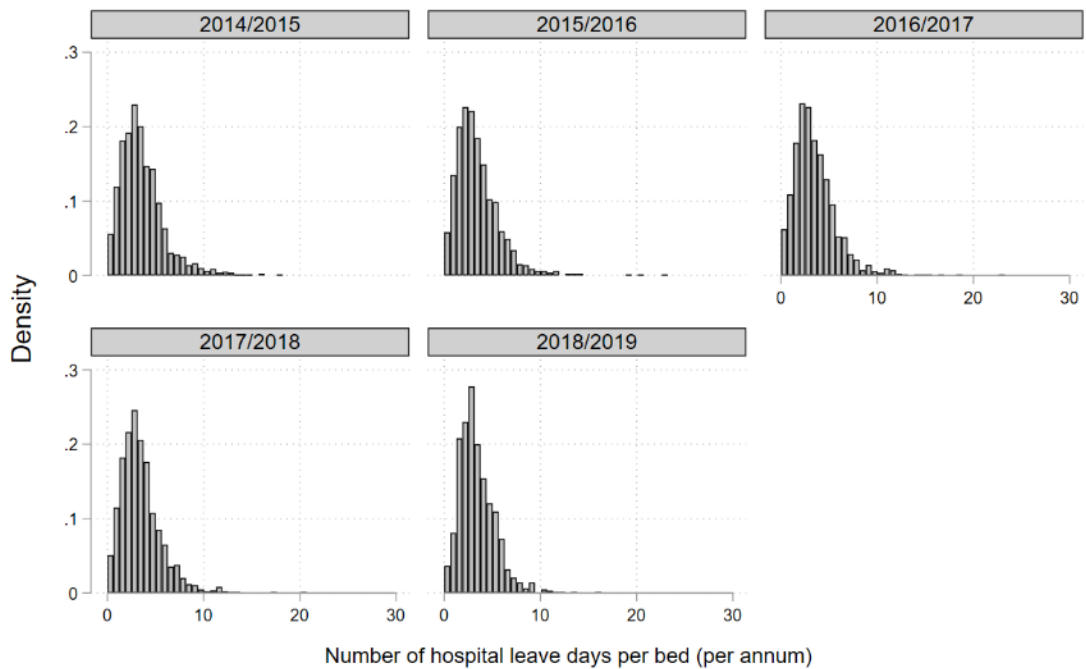


Figure A-7. Histograms of hospital leave days per bed per annum by financial year

The number of occupied bed days was used as the raw output (i.e. not casemix-adjusted) in the cost frontier estimation. Further details can be found in the *Technical Supplement Report 2*. The distribution of the occupied bed days (total) by financial year is presented in Figure A-8. The left-skewed distribution with a long right tail indicates that there may be a large number of outliers.

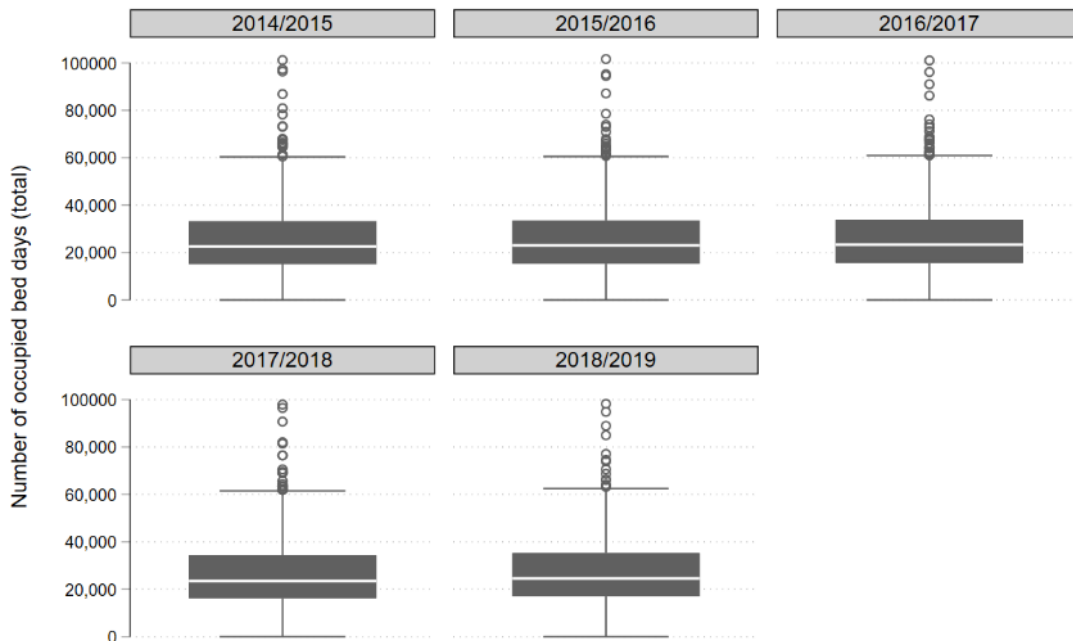


Figure A-8. Total number of occupied bed days by financial year

A-4-2 Casemix

The second component of the output of a residential aged care facility is casemix to capture the relative severity or care needs of the residents. Casemix generally refers to a classification system that allocates care recipients into classes, where care recipients within a class will have similar clinical attributes and their care will involve similar levels of resource consumption.

The Australian National Aged Care Classification (AN-ACC) is a new casemix classification system developed by the Australian Health Services Research Institute at the University of Wollongong. It comprises a new assessment, casemix classification and funding model. The AN-ACC is underpinned by a clinical assessment instrument that can be completed by an external clinical assessor. Details can be found in the suite of 7 reports (Eagar et al., 2019a, 2019c, 2019b; Loggie et al., 2019; McNamee et al., 2019a, 2019b; Westera et al., 2019).

For this project, the most up-to-date estimates of the casemix index were provided for all facilities in Australia. This data contained two types of casemix indices: the National Weighted Activity Unit (NWAU) which measures the relative price, and Relative Value Unit (RVU) which measures the relative resource consumptions (staff time on dollars). Each index includes an individual weight and base tariff weight. For both NWAU and RVU, the individual weight reflects the severity and thus complexity of care. The base tariff reflects the *complexity* of the facility. That is, it takes into account the characteristics associated with the facility location (e.g. the remoteness of the facility making it difficult to source care labour and the low demand of residents), leading to a small-sized facility with high fixed and operating costs.

Both NWAU and RVU were derived from the same underlying AN-ACC classification of 13 classes, which was mapped from the existing resource allocation instrument, the Aged Care Funding Instrument (ACFI). Ideally, both the NWAU and the RVU should be derived directly from the AN-ACC assessment. However, as

the implementation of the new AN-ACC system in Australian facilities has not yet occurred, the ACFI scores were mapped to the AN-ACC.

The Aged Care Funding Instrument (ACFI) is used by residential aged care providers to assess residents need for care and to claim a residential care subsidy for each resident that permanently enters their care. The ACFI consists of 12 questions about the assessed care needs of the resident and two diagnostic sections. Needs are classified under the three funding domains of activities of daily living, behaviour and complex health care. Each domain has four levels: nil, low, medium and high. The mapping was conducted by the Australian Health Services Research Institute at the University of Wollongong and is reported elsewhere (Kobel and Eagar, 2020).

RVU measures the relative resource consumption, which reflects the real (as opposed to nominal) consumption. As such, the RVU individual was used to calculate the casemix-adjusted output. The base tariff was not used because characteristics of facilities were incorporated in the frontier estimation; the inclusion of base tariff into the casemix-adjusted output would be double counting. Distributions of casemix measured by RVU individual by financial year are shown in Figure A-9. For all the facilities with complete financial data (n=6,274), the average RVU individual is 0.97 (range: 0.55–1.56) and is normally distributed.

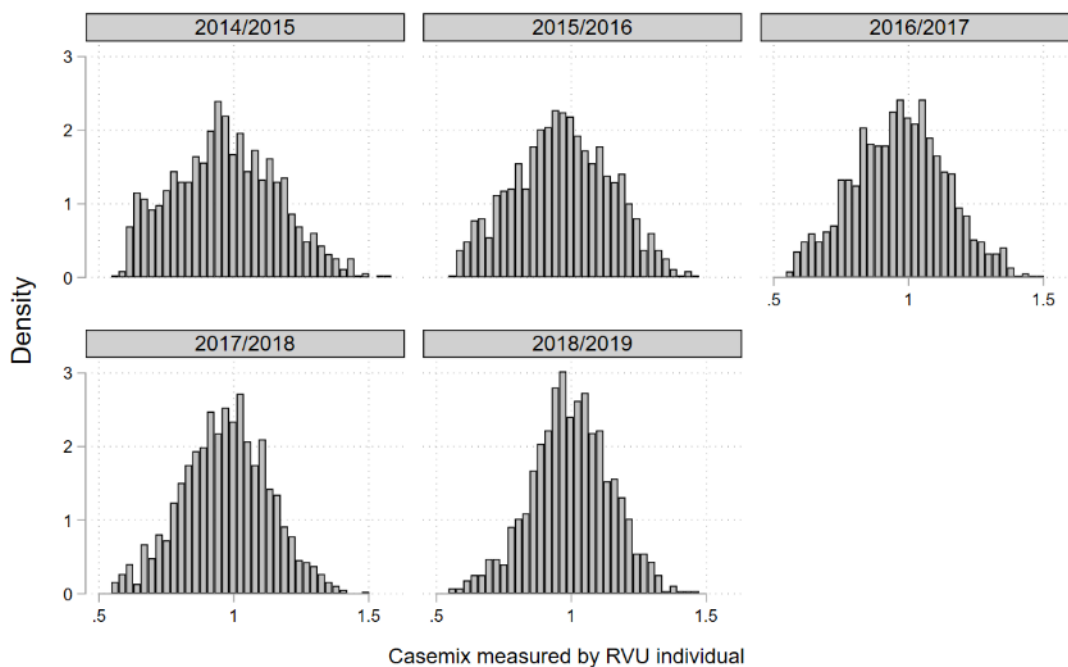


Figure A-9. Histograms of casemix measured by RVU individual by financial year

The casemix-adjusted output, used in all analyses of the cost functions and frontiers, is calculated as the product of the *total number of occupied bed days* and the *RVU individual casemix weight*. Boxplots of the casemix-adjusted output by financial year is summarised in Figure A-10 below. There were outliers observed, which were driven by the outliers in the number of occupied bed days as observed in Figure A-8 above.

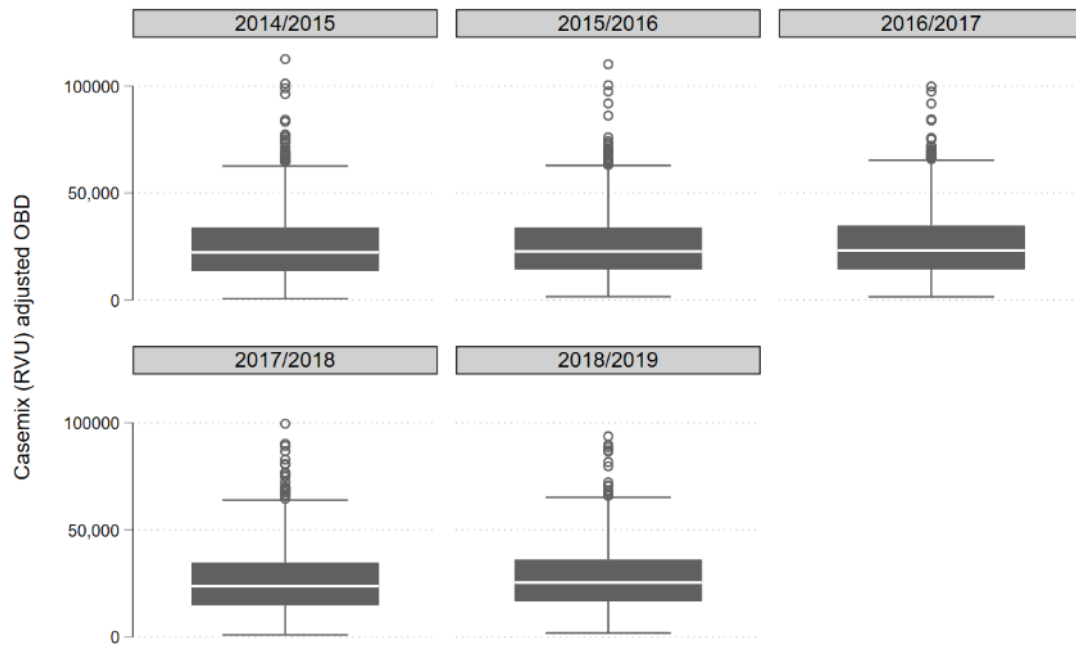


Figure A-10. Boxplots of the casemix (RVU) adjusted output by financial year

Appendix B

Direct care cost and workforce data: Facility level



B-1 Introduction

While the total cost of a residential aged care facility is relevant to understand the overall operation of the facility, it contains a wide range of cost items that are not directly relevant to providing care services to residents. The main resources required to deliver personal care for residents living in residential aged care are labour (approximately 85–90% of the total cost of direct care is accounted for by care staffing). The literature on quality of care in residential aged care facilities highlights the strong correlation between quality of care and staffing (e.g. staff hours per resident, skilled mix of staff, staff quality, turnover and work continuity). Therefore, we investigated the feasibility of conducting an analysis of direct care cost, and the labour cost efficiency, which might provide a guide to the level of staffing needed to achieve different levels of care quality.

It is important to establish whether there are sufficient data of an acceptable quality to conduct such analysis. A sub-set of the full database was explored containing: (1) workforce for direct care, (2) total cost associated with direct care, (3) casemix adjusted occupied bed days, and (4) quality of care. In this data exploration, the following were investigated.

- (i) whether the two data sources, Stewart Brown and Department of Health, can be combined for the *total cost of direct care* for the full sample where both total cost and outcome (casemix) are available
- (ii) whether the two data sources, Stewart Brown and Department of Health, can be combined for the *total cost of direct care* for the sample of residential aged care facilities that have workforce data
- (iii) whether the two data sources, Stewart Brown and Department of Health, can be combined for the *labour cost associated with providing direct care* for the sample of residential aged care facilities that have workforce data, and whether to use *labour cost only* or *total cost of direct care*.
- (iv) if the data can be combined, determine the sample size available for the analysis in which there are complete workforce data (*total hours paid per year, for the total occupied bed days*), labour costs associated with providing direct care, output (casemix), and the composite quality indicator.
- (v) determine the extent to which the data decreases in size due to the data quality associated with either cost or workforce items and establish the final sample size available for the analysis.
- (vi) additionally,
 - whether it is possible to split total cost, in both Stewart Brown and Department of Health data sources into sub-categories: care, hotel services and accommodation, administration, finance and other.
 - whether or not these categories are comparable / substitutable between Stewart Brown and Department of Health data sources.
 - if these categories are not interchangeable, is it possible to supplement the data with the other data source in the efficiency analysis of direct care?

B-2 Total cost for direct care, full sample

The full database contained two financial data sources, Stewart Brown and Department of Health financial reports. Following an initial data exploration, the two data sources were combined to maximise the number of observations. The direct-care items from the two data sources are not directly comparable.¹ Additionally, the Department of Health financial reporting requirements changed between financial years 2015/16 and 2016/17.

The data availability of the *total costs of direct care* from the two datasets was examined after excluding the non-comparable items, and is shown in Table B-1. Compared to the full sample available for analysis over the 5-year period, the direct care cost sample accounted for 84% (5,278/6,274). As all the missing data for direct-care costs for the Department of Health data were for three financial years (2014/15, 2015/16 and

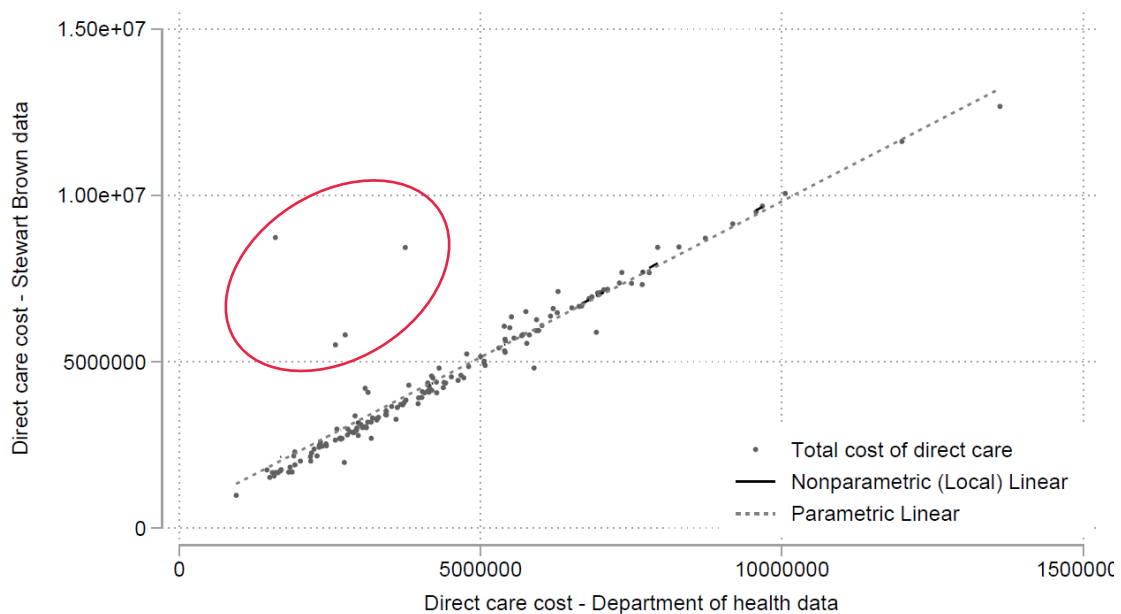
¹ Data items labelled CARE in both data sources

2018/19), Stewart Brown financial data was used for these years. This full sample for the 5-year period is different from the complete residential aged care facility population (N=13,969; ~2,800 facility observations each year) in the *Main Report*.

Table B-1: Number of facilities with financial data by data source and financial year

| Financial year | Stewart Brown | Department of Health | Both | Total |
|----------------|---------------|----------------------|------------|--------------|
| 2014/2015 | 761 | 0 | 0 | 761 |
| 2015/2016 | 791 | 0 | 0 | 791 |
| 2016/2017 | 836 | 430 | 76 | 1,352 |
| 2017/2018 | 859 | 430 | 76 | 1,365 |
| 2018/2019 | 1,009 | 0 | 0 | 1,009 |
| Total | 4,256 | 870 | 152 | 5,278 |

The data correlations between the *total cost of direct care* from the two datasets was examined after excluding the non-comparable items, and is shown in Figure B-1 below. The *total cost of direct care* data from the Department of Health source is highly correlated with that of the Stewart Brown source. The correlation coefficient is high (0.93) and there are a few outliers. Most of the observations are lying on or clustering around the 45 degree line intercepting the origin. There is no clear pattern of variance associated with the cost values (i.e. heteroskedasticity is unlikely to be an issue requiring adjustment). This analysis relied on the common observations in both Stewart Brown and Department of Health (152/3,626, or 4.1%) data.



Local-linear estimates
kernel = epanechnikov bandwidth = 802565.1

Figure B-1: Correlation between total cost of direct care by two data sources

The two data sources were combined. The Department of Health *total cost of direct care* data was replaced with the Stewart Brown *total cost of direct care* data, where required. Boxplots and histograms of the *total cost of direct care* for the Stewart Brown data only and for the combined *total cost of direct care* are shown in Figure B-2. The distribution of Stewart Brown data and that of the combined Stewart Brown/Department of

Health data are very similar. From the above analysis, it was considered appropriate to supplement the Stewart Brown direct care cost data with the direct care cost from the Department of Health data for the purpose of increasing the available sample. This achieved a sample of 5,278 observations over the 5-year period; three years of total cost of direct care data was sourced from the Stewart Brown data only and two years of total cost of direct care data was sourced from both the Stewart Brown data and Department of Health (see Table B-1 above).

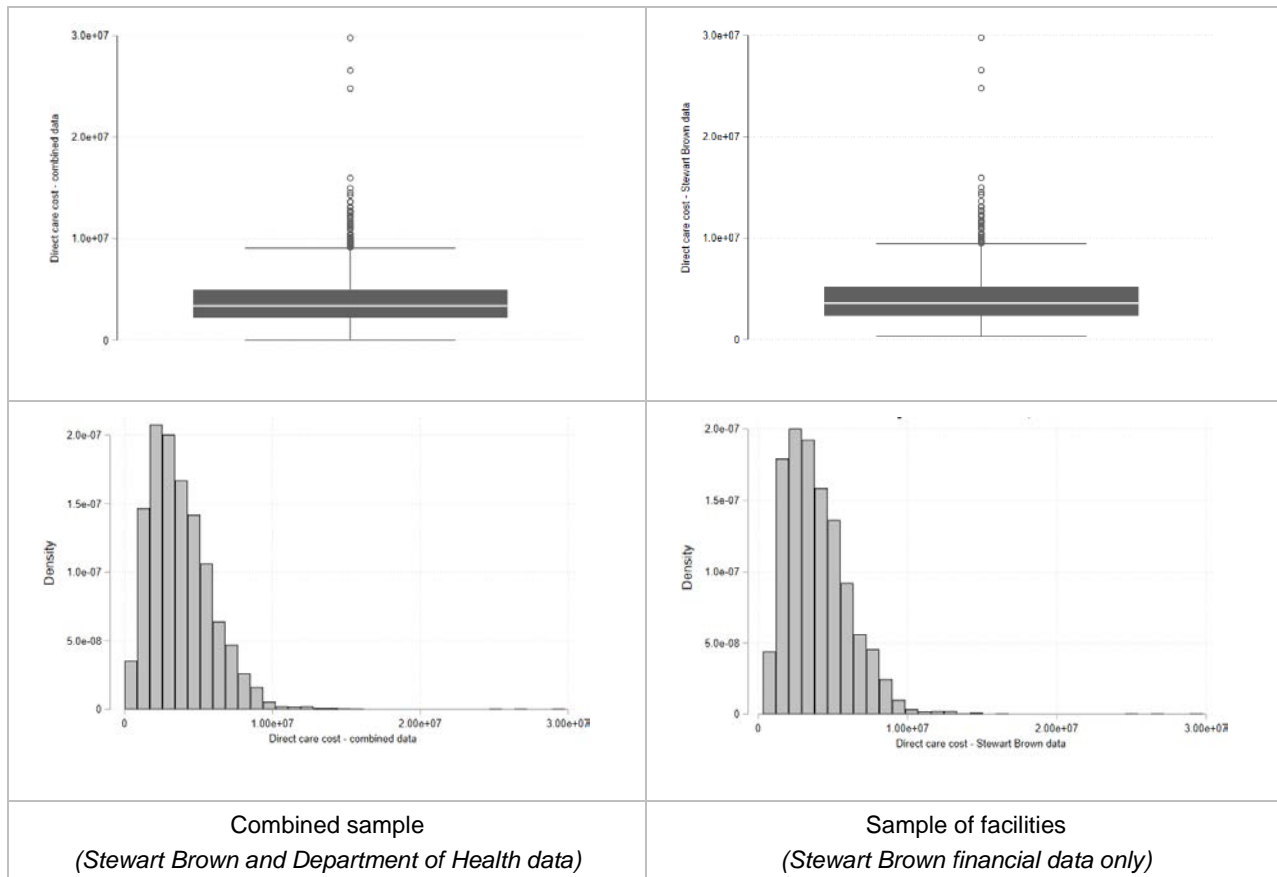


Figure B-2: Boxplots and histograms of total cost of direct care by combined vs. Stewart Brown only sample

B-3 Total cost for direct care, sample with workforce

Availability of the total cost of direct care data for facilities with workforce data is shown in Table B-2. The sample size reduced significantly as not all the facilities had workforce data. The maximum number of observations with total cost of direct care and workforce data is 3,043 facilities, which accounts for 48.5% of the full sample available for the total cost analysis (N=6,274).

Table B-2: Number of facilities with total direct care cost and workforce data by source and financial year

| Financial year | Stewart Brown only | Department of Health only | Both | Total |
|----------------|--------------------|---------------------------|------------|--------------|
| 2014/2015 | 1 | 0 | 0 | 1 |
| 2015/2016 | 607 | 0 | 0 | 607 |
| 2016/2017 | 668 | 27 | 61 | 756 |
| 2017/2018 | 716 | 24 | 62 | 802 |
| 2018/2019 | 877 | 0 | 0 | 877 |
| Total | 2,869 | 51 | 123 | 3,043 |

For the two financial years where the *total cost of direct care* data from both Stewart Brown and Department of Health sources are available (2016/17 to 2017/18), a visualisation and correlation analysis was conducted for the sample of workforce data, as shown in Figure B-1 (N=2,435). Similar to the full sample, the *total cost of direct care* from the Department of Health source is highly correlated with that of the Stewart Brown source. The correlation coefficient is high (0.9195) and there are a few outliers. Most of the observations are lying on or clustering around the 45 degree line intercepting the origin.

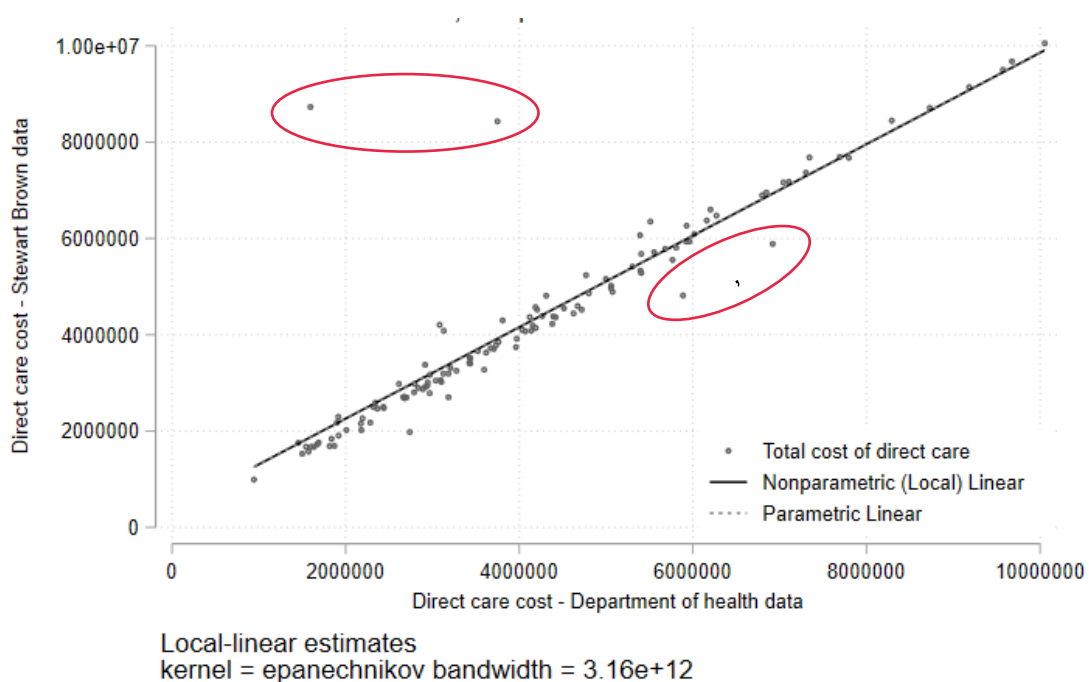


Figure B-3: Correlation between total cost of direct care by data source for facilities with workforce data

Boxplots and histograms of the *total cost of direct care* for the Stewart Brown data only and for the combined two sources are shown in Figure B-4 for the residential aged care facility sample with workforce data (financial year 2016/17 and 2017/18). The distribution of Stewart Brown data and that of the combined Stewart Brown/Department of Health data are very similar. This suggests that if the few outliers are excluded, the Department of Health financial data can be used to supplement the Stewart Brown data for those facilities without Stewart Brown financial data that do have workforce data. Like in Section B-2, this correlation is the common observations (N=123) in both Stewart Brown and Department of Health data for the two financial years 2016/17 and 2017/18.

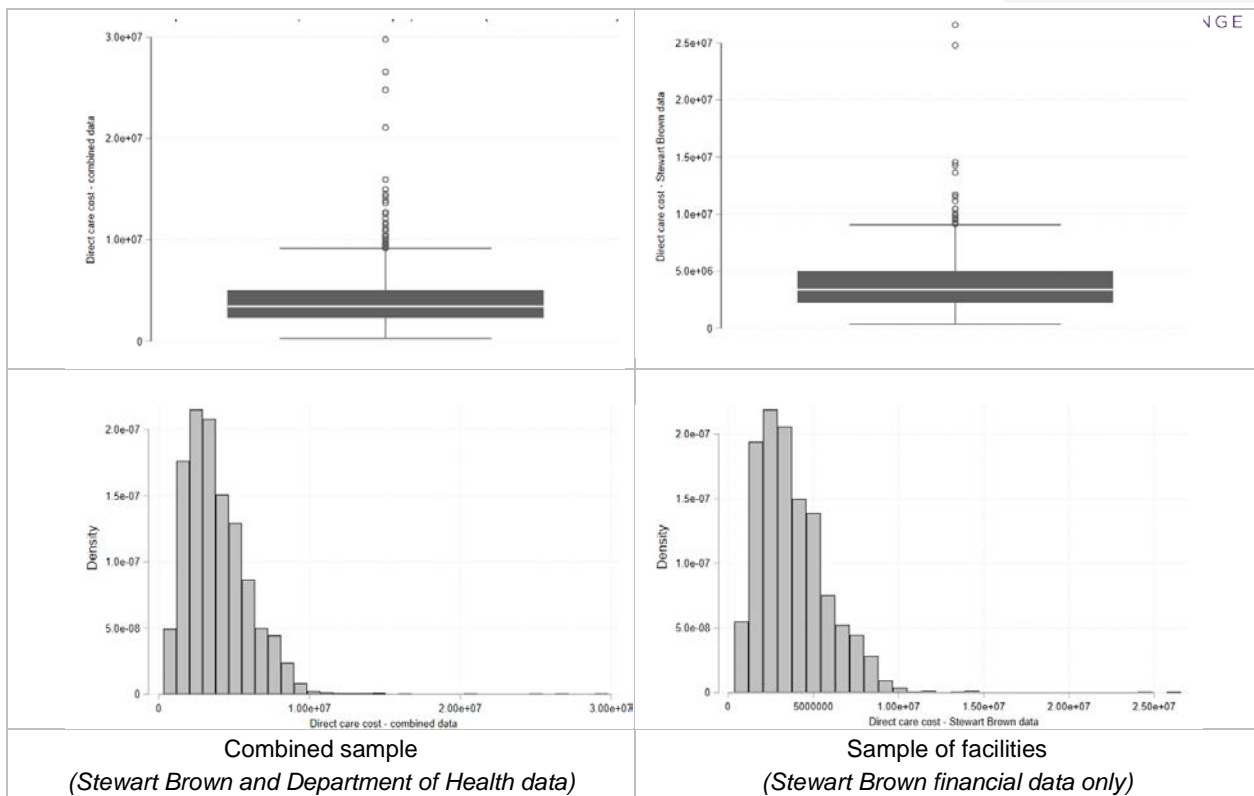


Figure B-4: Boxplots and histograms of total cost of direct care by combined vs. Stewart Brown only for the facility sample with workforce data

B-4 Workforce and labour cost for direct care

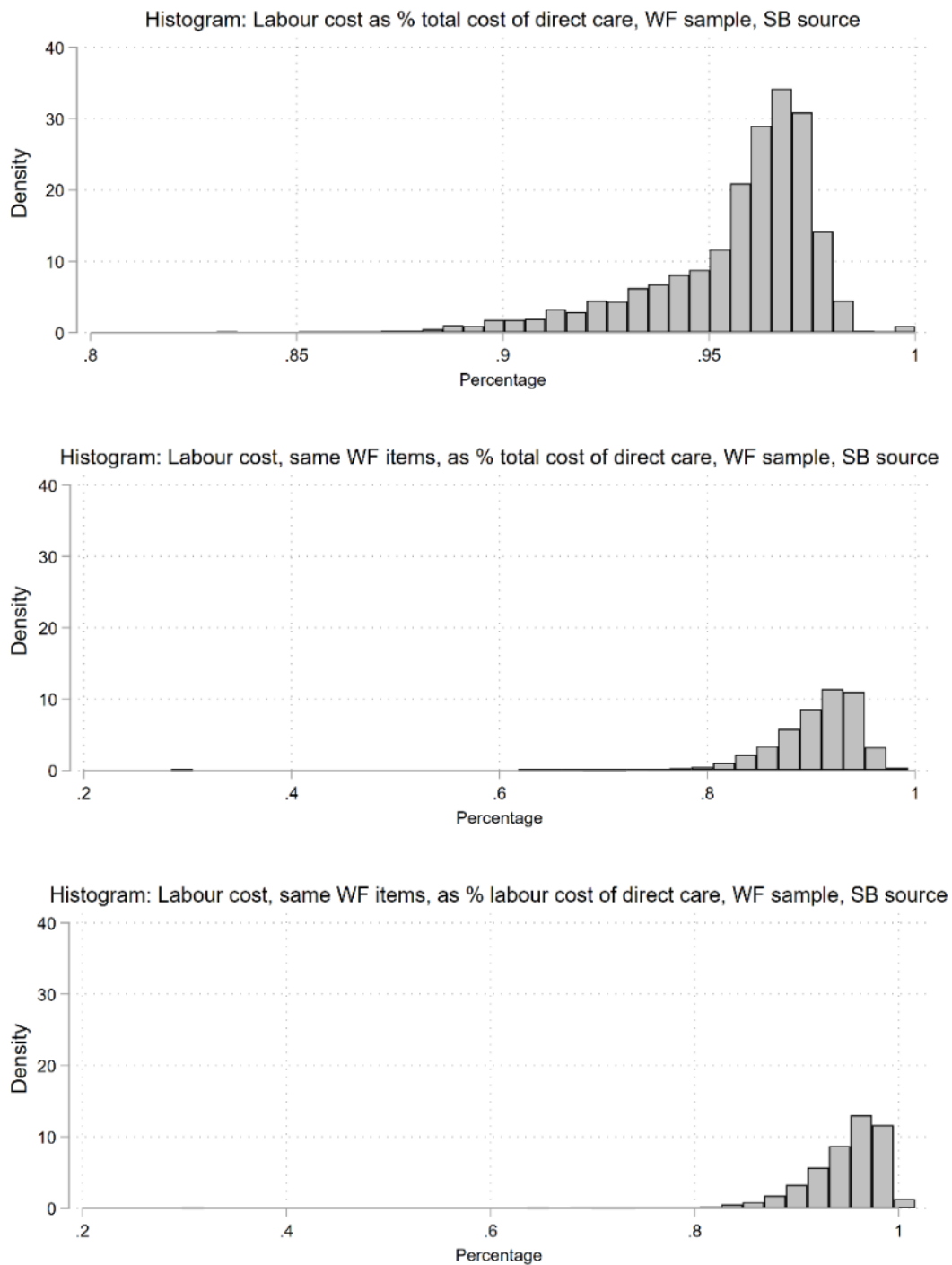
The database contains a workforce dataset. The items for direct care services in the workforce dataset closely resemble labour cost items collected in the Stewart Brown financial data (see Table B-3).

Table B-3: Labour inputs and cost associated with direct care services

| Labour inputs and costs associated with direct care services | |
|---|--|
| Residential care workforce (hrs/resident/day) | Stewart Brown financial data (\$) |
| Care hours (paid hours per resident per day) | Labour and non-labour costs for direct care (\$) |
| Care Management | (A) Care management |
| Registered Nurses | (B) Registered nurses |
| Enrolled and licenced nurses | (C) Enrolled and licenced nurses (registered) |
| Other unlicensed nurses/personal care staff | (D) Other unlicensed nurses/personal care staff |
| Allied health & lifestyle | (E) Allied health & lifestyle |
| Total care hours | (F) Agency staff |
| | (G) Workers' compensation - care services |
| | (H) Chaplaincy pastoral care |
| | (I) Medical, personal care, nutrition |
| | (J) Other residential care |
| <i>Total labour cost for direct care excl. agency staff, workers comp. and compliancy (Sum A to E)*</i> | |
| <i>Total labour costs for direct care (Sum A to H)</i> | |
| <i>Total cost for direct care (Sum A to J)</i> | |

* Same items as reported in residential care workforce data

Based on the cost items in Table B-3 above, three different cost totals for direct care were calculated: (i) labour cost for direct care excluding agency staff, workers compensation and compliancy and pastoral care, (ii) labour cost for direct care, and (iii) total cost of direct care. To examine the distributions and to identify outliers, three ratios of *labour costs* and *total cost of direct care* are summarised in Figure B-5.



Abbreviations: WF: workforce, SB: Stewart Brown

Figure B-5: Share of labour cost in direct care cost, workforce and Stewart Brown data sources

As seen in Figure B-5 above, *labour costs* accounted for a large proportion of the *total cost for direct care*. The distributions had long left tails which may be due to outliers that may be either due to data quality or specific operational characteristics of the residential aged care facility of interest.

Table B-4 below shows the availability of labour cost and total cost of direct care data from Stewart Brown and Department of Health, for the facilities that had workforce data. The sample size after combining the labour costs and total cost of direct care data from the two data sources is 3,043 facilities. In financial year 2014/15, there was data for one facility only, which will be omitted in any subsequent panel data analyses.

Table B-4: Number of facilities with labour, total direct care costs and workforce by source and financial year

| Financial year | Data sources for the total cost of direct care | | |
|----------------|--|----------------------|--------------|
| | Stewart Brown | Department of Health | Total |
| 2014/2015 | 1 | 0 | 1 |
| 2015/2016 | 607 | 0 | 607 |
| 2016/2017 | 729 | 27 | 756 |
| 2017/2018 | 778 | 24 | 802 |
| 2018/2019 | 877 | 0 | 877 |
| Total | 2,992 | 51 | 3,043 |

B-5 All data items required for an analysis of quality-adjusted labour cost efficiency

The cost data was merged with the output (casemix) and composite quality index datasets to investigate the completeness of all the variables required for the analysis of the labour cost efficiency for direct care. The quality of the output (casemix) and composite quality index datasets have been examined and described elsewhere.

The availability of casemix adjusted occupied bed days and the composite quality indices for facilities with cost and workforce data is shown in Table B-5. The number of observations (3,043 facilities) dropped down to 3,032 facilities after combining with output, and down to 2,391 facilities after combining with the composite quality index data.

Table B-5: Number of facilities with casemix adjusted occupied bed days and composite quality indices for facilities with cost and workforce data

| Financial year | Casemix adjusted occupied bed days | Composite quality index (both latent class analysis and factor analysis methods) |
|----------------|------------------------------------|--|
| 2014/2015 | 1 | 1 |
| 2015/2016 | 603 | 472 |
| 2016/2017 | 752 | 591 |
| 2017/2018 | 802 | 631 |
| 2018/2019 | 874 | 696 |
| Total | 3,032 | 2,391 |

The distributions across the quality levels for the two approaches, latent class analysis and weight-based approaches, by financial year are shown in Table B-6 and Table B-7, respectively. The distributions appear to be reasonable. It should be noted that the distribution over the year is less meaningful because the composite quality indices were calculated over a 5-year period (i.e. constant over the 5 years where the data is available, see discussion elsewhere).

Table B-6: Number of facilities by quality level (latent class analysis approach) and financial year

| Financial year | Quality levels (latent class analysis approach) | | | | | |
|----------------|---|------------|--------------|------------|-----------|--------------|
| | 1 | 2 | 3 | 4 | 5 | Total |
| 2014/2015 | 0 | 0 | 1 | 0 | 0 | 1 |
| 2015/2016 | 43 | 25 | 336 | 53 | 15 | 472 |
| 2016/2017 | 52 | 34 | 425 | 63 | 17 | 591 |
| 2017/2018 | 58 | 41 | 461 | 59 | 12 | 631 |
| 2018/2019 | 68 | 50 | 499 | 69 | 10 | 696 |
| Total | 221 | 150 | 1,722 | 244 | 54 | 2,391 |

Table B-7: Number of facilities by quality level (weight-based approach) and financial year

| Financial year | Quality level (weight-based approach) | | | | | | |
|----------------|---------------------------------------|------------|------------|------------|------------|------------|--------------|
| | 0 | 1 | 2 | 3 | 4 | 5 | Total |
| 2014/2015 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 2015/2016 | 9 | 80 | 100 | 95 | 113 | 75 | 472 |
| 2016/2017 | 12 | 92 | 120 | 122 | 140 | 105 | 591 |
| 2017/2018 | 7 | 95 | 128 | 129 | 150 | 122 | 631 |
| 2018/2019 | 3 | 109 | 132 | 154 | 163 | 135 | 696 |
| Total | 31 | 376 | 480 | 501 | 566 | 437 | 2,391 |

Level 0 had no sanctions in the analysis period

As shown in Figure B-6, the distribution of RVU values and RVU-adjusted OBDs look very reasonable and well spread. Note in Figure B-8, there are a number of RAC facilities that had sanctions over the year yet received a relatively good quality scores. This warrants further investigation.

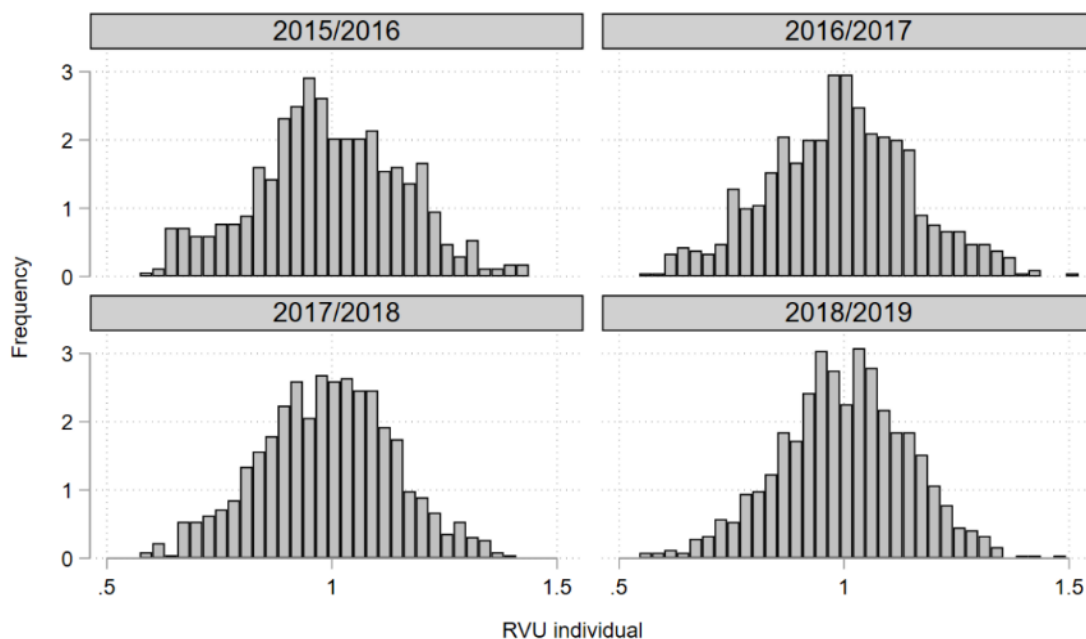


Figure B-6: Histograms of RVU casemix index for facilities with workforce and labour cost data

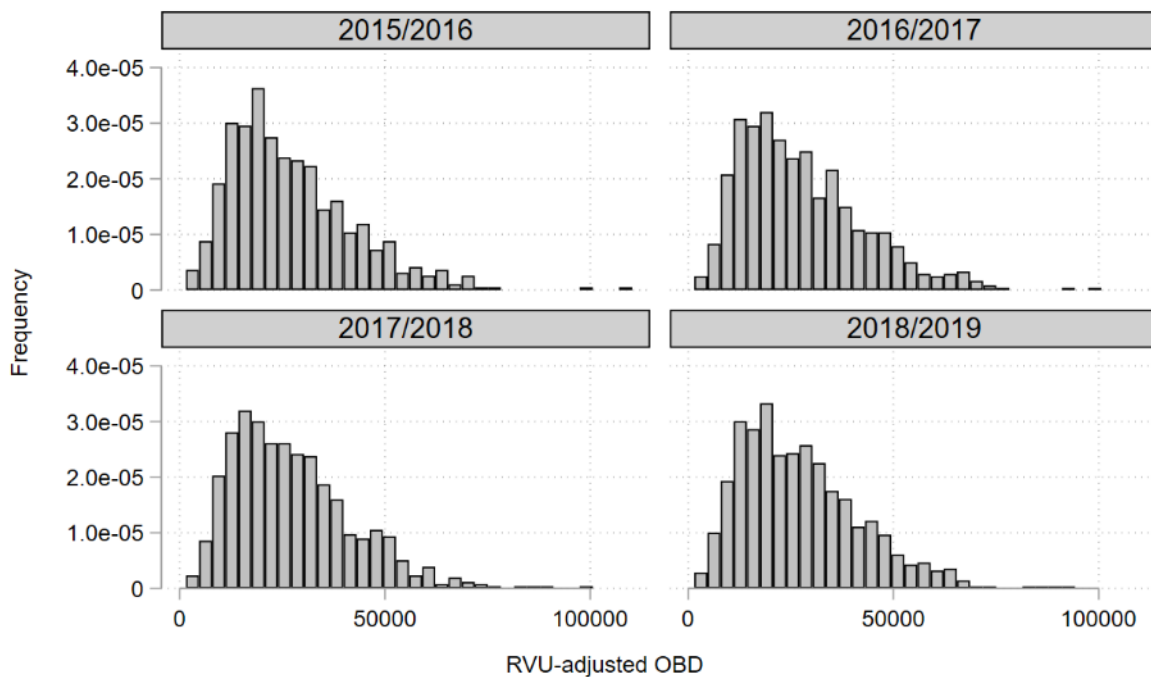


Figure B-7: Histograms of RVU-adjusted occupied bed days for facilities with workforce and labour cost data

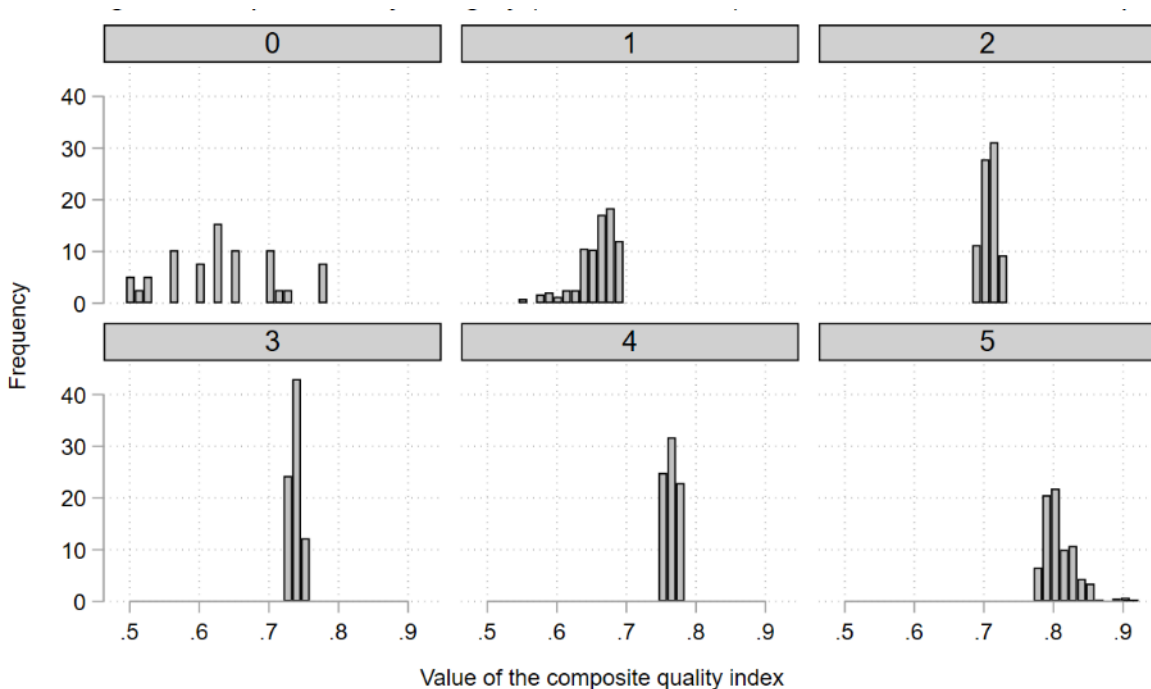


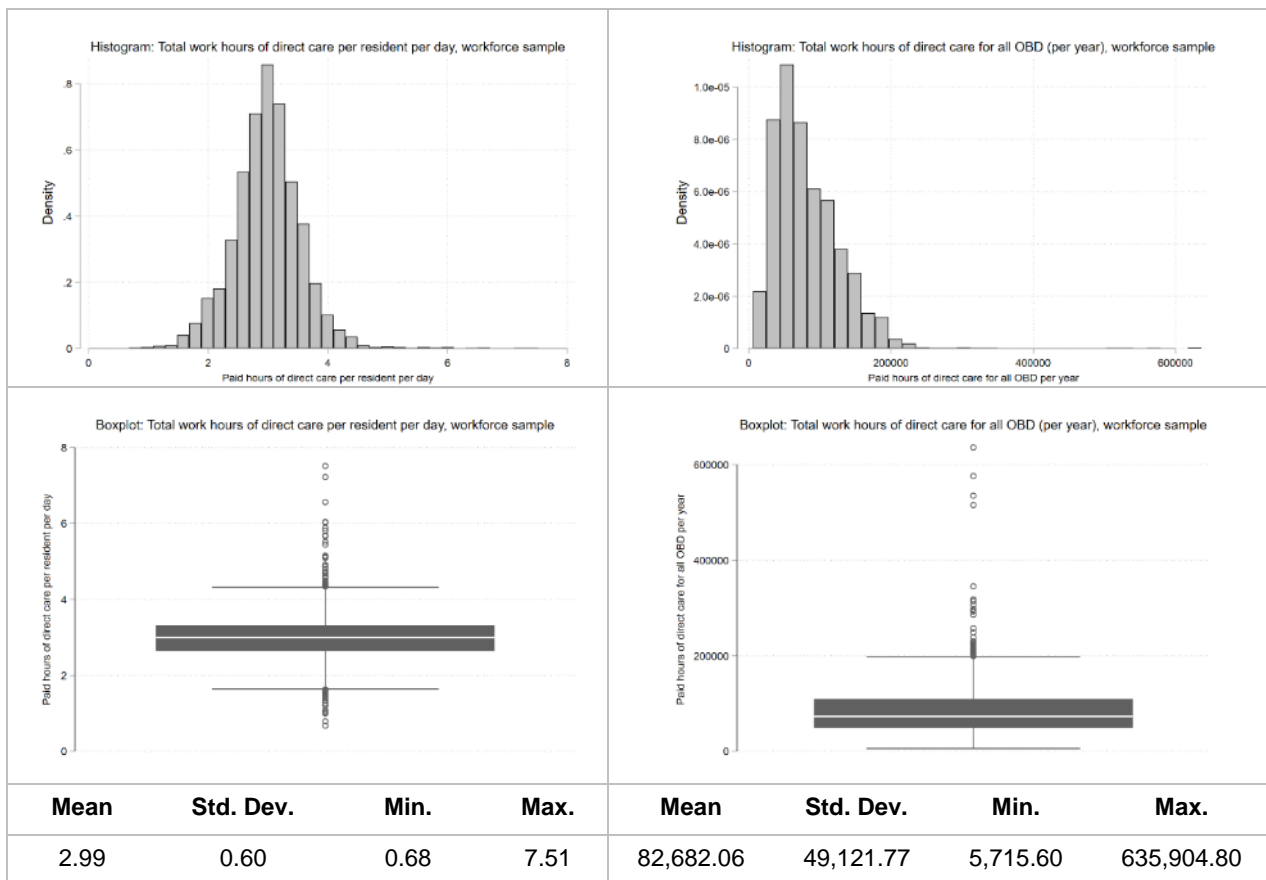
Figure B-8: Histograms of composite quality index by quality level for facilities with workforce and labour cost data

After combining all the data sources for labour cost, staff hours, output and quality, the complete sample size is 2,391 facilities. This represents approximately 38% of the full sample of 6,274 facilities (and approximately 17% of the whole sector) over the five year period. The financial year 2014/15 will be omitted from any subsequent panel data analyses as there was only data for one facility in that year. Therefore, the sample size for panel analysis for the four financial years (2015/16 to 2018/19) is 2,390 facilities.

B-6 Quality of the workforce data

The data quality was examined. While the casemix-adjusted occupied bed days, total costs and labour data have very long left tails, the nature of these outliers has not yet been established. In the workforce data, a common sense approach can be used to do a preliminary evaluation of data quality.

The *total paid hours of direct care per resident per day* was calculated from the staff paid hours items listed in Table B-3. The *total paid hours of direct care per year* was calculated by multiplying the *paid hours per resident per day* with the *total number of occupied bed days*. The outliers in these data items were examined for the sample identified in Section B-5 (2,391 facilities with complete labour cost of care, workforce, casemix adjusted OBD and quality index). The histograms and boxplots of work hours for direct care per resident per day versus total work hours for direct care for all occupied bed days per year are shown in Figure B-9 below.



Abbreviations: Std. Dev: standard deviation; min: minimum; max: maximum; OBD: occupied bed days

Figure B-9: Histograms and boxplots of work hours of direct care per resident per day vs. total hours for all occupied bed days per year (n=2,391)

While there is a slightly long right tail, the normal distribution of the *total work hours of direct care per resident per day* with a mean of three hours per resident per day seems to be reasonable (histogram and boxplot on left hand side). Similarly, the left-skewed distribution of the *total staff hours of direct care for all occupied bed day per year* due to facility size seems to be reasonable. However, it is unclear whether the outliers in the data are due to data quality or whether they are true outliers that require further investigation.

For completeness, the correlation between the total staff hours and labour cost for direct care was examined. A visualisation and correlation analysis was conducted for the (i) total labour cost associated with direct care and total staff hours for direct care, and (ii) labour cost per resident per day and paid hours per resident per day, as shown in Figure B-10 and Figure B-11 below.



Figure B-10: Correlation between total labour cost and total paid hours of direct care for all occupied (OBD) per year (n=2,391)

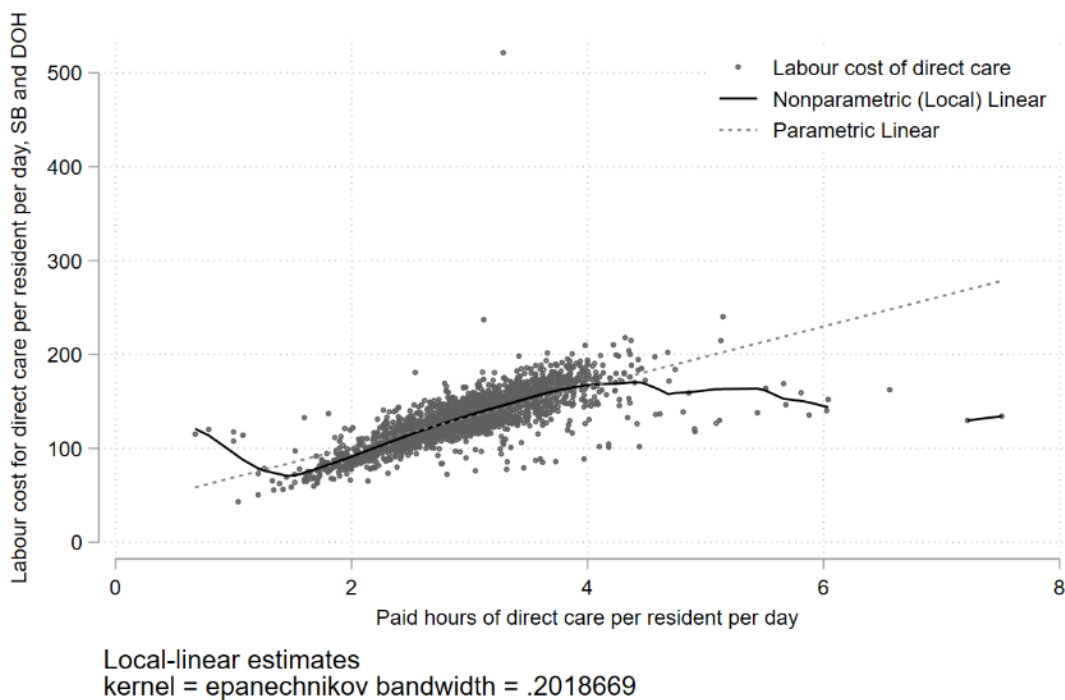


Figure B-11: Correlation between labour cost and paid hours of direct care per resident per day (n=2,391)

In both cases, the correlations between labour cost and paid hours are relatively good. However, the correlation coefficient for total labour cost and total paid hours per year is much higher (0.97) compared to that of *per resident per day* (0.73). Most observations are well clustered around the fitted curve for the total labour cost and paid hours, while much wider variations are observed for the *per resident per day* values. Overall, it is likely to be possible to conduct further analysis on the sample of 2,391 facilities (cross-sectional

sample over a 5-year period) where both the labour cost, workforce for direct care (in hours), casemix adjusted output and quality index are all available. There was data from four financial years (2015/16 to 2018/19) with a sample size of 2,390 facilities. Prior to such analysis, extensive data exploration would be required to achieve a parsimonious and stable model. As the data only represents approximately 17% of the whole sector across a 4-year period, the results would be indicative only.

The distributions of the sample by characteristics were examined. Facility distributions across the five-year period (financial years 2014/15 to 2018/19) are summarised in Table B-8.

Table B-8: Facility characteristics and distributions by financial year

| | Financial year | | | | | Total |
|--|----------------|------------|------------|------------|------------|--------------|
| | 2014/2015 | 2015/2016 | 2016/2017 | 2017/2018 | 2018/2019 | |
| Total | 1 | 472 | 591 | 631 | 696 | 2,391 |
| State/territory | | | | | | |
| New South Wales | 0 (0%) | 160 (34%) | 224 (38%) | 245 (39%) | 254 (36%) | 883 |
| Victoria | 0 (0%) | 59 (13%) | 85 (14%) | 103 (16%) | 112 (16%) | 359 |
| Queensland | 1 (100%) | 118 (25%) | 146 (25%) | 147 (23%) | 170 (24%) | 582 |
| South Australia | 0 (0%) | 60 (13%) | 60 (10%) | 63 (10%) | 65 (9%) | 248 |
| Western Australia | 0 (0%) | 54 (11%) | 56 (9%) | 48 (8%) | 67 (10%) | 225 |
| Tasmania | 0 (0%) | 17 (4%) | 12 (2%) | 16 (3%) | 18 (3%) | 63 |
| Australian Capital Territory | 0 (0%) | 4 (1%) | 8 (1%) | 9 (1%) | 10 (1%) | 31 |
| Northern Territory | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 |
| Australian Bureau of Statistics remoteness | | | | | | |
| Major cities | 0 (0%) | 288 (61%) | 377 (64%) | 404 (64%) | 434 (62%) | 1,503 |
| Inner regional | 0 (0%) | 130 (28%) | 158 (27%) | 168 (27%) | 192 (28%) | 648 |
| Outer regional | 1 (100%) | 47 (10%) | 51 (9%) | 54 (9%) | 65 (9%) | 218 |
| Remote | 0 (0%) | 6 (1%) | 4 (0.7%) | 4 (0.6%) | 4 (0.6%) | 18 |
| Very remote | 0 (0%) | 1 (0.1%) | 1 (0.2%) | 1 (0.2%) | 1 (0.1%) | 4 |
| Modified Monash Model geographical classification^a | | | | | | |
| MM 1 | 0 (0%) | 288 (61%) | 377 (64%) | 404 (64%) | 434 (62%) | 1,503 |
| MM 2 | 1 (100%) | 41 (9%) | 43 (7%) | 49 (8%) | 56 (8%) | 190 |
| MM 3 | 0 (0%) | 59 (13%) | 71 (12%) | 68 (11%) | 79 (11%) | 277 |
| MM 4 | 0 (0%) | 27 (6%) | 40 (7%) | 45 (7%) | 49 (7%) | 161 |
| MM 5 | 0 (0%) | 50 (11%) | 55 (9%) | 59 (9%) | 72 (10%) | 236 |
| MM 6 | 0 (0%) | 5 (1%) | 4 (0.7%) | 5 (0.8%) | 5 (0.7%) | 19 |
| MM 7 | 0 (0%) | 2 (0.4%) | 1 (0.2%) | 1 (0.2%) | 1 (0.1%) | 5 |
| Organisation type | | | | | | |
| Charitable | 0 (0%) | 135 (29%) | 173 (29%) | 205 (32%) | 227 (33%) | 740 |
| Community based | 0 (0%) | 76 (16%) | 75 (13%) | 89 (14%) | 103 (15%) | 343 |
| Religious | 0 (0%) | 233 (49%) | 273 (46%) | 263 (42%) | 304 (44%) | 1073 |
| Private | 1 (100%) | 7 (1%) | 48 (8%) | 55 (9%) | 43 (6%) | 154 |
| Government | 0 (0%) | 21 (4%) | 22 (4%) | 19 (3%) | 19 (3%) | 81 |
| Provider type | | | | | | |
| Not-for-profit | 0 (0%) | 444 (94%) | 521 (88%) | 557 (88%) | 634 (91%) | 2,156 |
| For-profit | 1 (100%) | 7 (1%) | 48 (8%) | 55 (9%) | 43 (6%) | 154 |
| Government | 0 (0%) | 21 (4%) | 22 (4%) | 19 (3%) | 19 (3%) | 81 |

^a The model measures remoteness and population size on a scale of Modified Monash (MM) category MM 1 to MM 7. MM 1 is a major city and MM 7 is very remote.

B-7 Decomposition of total cost into sub-categories

Finally, the feasibility of decomposing total cost into sub-categories was investigated, in both the Stewart Brown and Department of Health data sources, including whether these categories are comparable and/or substitutable between these two data sources.

The cost items that comprise the total costs in both data sources were compared using their labels and definitions. Table B-9 below summarises the data items available for total cost calculation and decomposition items. It is suggested that the items should be grouped into the following four categories in subsequent analyses: (i) care, (ii) hotelling, (iii) accommodation, (iv) administration, and (v) others (including finance).

First, the *care* category should remain a standalone category as this category will be used to investigate the cost efficiency associated with direct care.

Second, the *administration* category should remain a standalone category. The administration items and the average cost of the administration category matched well across the two data sources.

Third, the *finance* and *other* categories could be merged together to form a *finance/other* category.² The finance and other items matched well across the two data sources.

Each of the items appear to match each sub-category fairly well, with the exception of the *quality and education* costs, which are contained in the Stewart Brown data but are not contained in the Department of Health data. It is, therefore, suggested that the *quality and education* items be moved from the *care*, *hotel and accommodation*, and *administration* categories to the *other* category. The values of the *quality and education* costs are extremely low compared to the total cost.

As outlined in Sections B-5 and B-6 above, if the Department of Health financial data is used to supplement the missing items in the Stewart Brown financial data, it is important to know whether the values at the defined sub-categories are comparable. Preliminary data exploration for total and labour cost for direct care in this appendix indicates that this may be acceptable. However, inevitably some distortions (noise) will be introduced into the data analysis. If the level of distortion is acceptable, then 51 observations where Department of Health data are available for the two years 2016/17 and 2017/18 could be added. It was however determined that adding 51 observations to a dataset with a sample size of 2,340 is not worth the risk of contamination that it might introduce to the analysis.

² An alternative option is to group all three categories (administration, finance, and other) into a combined category.

Table B-9: List of data items available for total cost calculation and decomposition

| Data items | Care | Hotel and accommodation | Administration | Finance | Other |
|--|---|--|---------------------------------|--|---|
| Stewart Brown data source. Unit = cost per resident bed day | | | | | |
| Labour | Management Registered nurses Enrolled and licensed nurses Other unlicensed nurses/personal Allied health and lifestyle Agency staff Workers compensation Chaplaincy/ Pastoral care | Hotel – Catering Hotel – Cleaning Hotel – Laundry Hotel – Workers compensation Accomm. – Maintenance | Admin Workers compensation | | |
| Quality and education | Quality and education (allocation) | Quality and education (everyday) | Admin- Quality and education | | Other - Quality and education |
| Services/ Outsources/ Utilities | | Hotel - Catering (internal service) Hotel - Catering (external service) Hotel - Income (sale of meals) Hotel - Cleaning (internal service) Hotel - Cleaning (external service) Hotel - Laundry (internal service) Hotel - Laundry (external service) Accomm. - Electricity Accomm. - Gas Accomm. - Rates Accomm. - Rubbish removal | Admin - Recharges | | |
| Building | | Accomm. - Repairs & maintenance Accomm. - Property rental Accomm. - Refurbishment | | Depreciation (building) | |
| Others | Medical, personal care & nutrition Other resident care | | Other admin costs Insurances | Depreciation (non-building) Bond/RAD interest expense | Motor vehicle expenses |
| Department of Health financial data. Unit = cost per year for each item | | | | | |
| Labour | Labour | Hotel - Labour Costs Accomm. - Labour Costs | Labour | | |
| Services/ Outsources/ Utilities | | Hotel - Costs (external service) Hotel - Costs (internal service) | Management | | |
| Building/ Equipment/ Assets | | Accomm. - Repair & maintenance Accomm. - Rent | | Amortisation Depreciation | Loss-on-sale-of-assets Revaluation-of-assets |
| Other | Other | Hotel - other Accomm. - Other | Other | Interest | Other |

Accomm: accommodation

Appendix C

Data preparation and exploration: Provider level



C-1 Introduction

This appendix describes the provider-level data that was available to conduct the quality-adjusted efficiency analysis of aged care facilities and providers in Australia. The University of Queensland received the provider-level data in multiple datasets from the Royal Commission between April and May 2020. The data was provided in a similar format to the facility-level data and spanned the same time period from financial years 2014/15 to 2018/19. Most data items had similar data definitions to those in the facility-level data. The facility data was aggregated by provider, such that all facilities under the same provider within a given financial year were combined.

Preliminary data screening and visualisation to check the data completeness, quality and outliers was conducted on the provider-level data before performing the main data analysis, including constructing the composite quality index and estimating the efficient cost frontier. Although the data structure (i.e. items and columns) of the provider-level data is almost identical to the structure of the facility-level data, the aggregation of analysis units (i.e. one or more facilities for each provider) may influence the latent class analysis models used to create the quality composite index, and the cost function used to estimate the frontier and inefficiencies. Therefore, careful examination of the data items was performed as was undertaken for the facility-level analyses.

C-2 Summary of characteristics

The total sample of residential aged care providers over the 5-year period from financial year 2014/15 to 2018/19 is 4,935 providers. Residential aged care providers can be categorised into five main type of organisations: private, community based, religious, charitable and government. The provider organisation type by financial year is shown in Table C-1. Private and community based providers account for more than half of the providers of residential aged care facilities in the data.

Table C-1. Number of providers by organisation type and financial year

| Financial year | Private | Community | Religious | Charitable | Government | Total |
|----------------|--------------|--------------|------------|------------|------------|--------------|
| 2014/2015 | 419 | 298 | 134 | 119 | 99 | 1,069 |
| 2015/2016 | 404 | 291 | 132 | 113 | 94 | 1,034 |
| 2016/2017 | 374 | 283 | 128 | 113 | 94 | 992 |
| 2017/2018 | 335 | 275 | 123 | 111 | 91 | 935 |
| 2018/2019 | 309 | 272 | 126 | 110 | 88 | 905 |
| Total | 1,841 | 1,419 | 643 | 566 | 466 | 4,935 |

Residential aged care providers can be categorised into three main provider types: not-for-profit, for-profit and government. The provider type by financial year is shown in Table C-2. The number of providers active in the residential aged care sector reduced steadily during the study period. Notably, the for-profit segment reduced by 25% over five years (from approximately 400 down to 300 providers). This might be an outcome of the most recent reform, consumer-directed care, which is intended to promote competition (through merging or restructuring) and/or exit from the industry.

Table C-2. Number of providers by provider type and financial year

| Financial year | Not-for-profit | For-profit | Government | Total |
|----------------|----------------|--------------|------------|--------------|
| 2014/2015 | 551 | 419 | 99 | 1,069 |
| 2015/2016 | 536 | 404 | 94 | 1,034 |
| 2016/2017 | 524 | 374 | 94 | 992 |
| 2017/2018 | 509 | 335 | 91 | 935 |
| 2018/2019 | 508 | 309 | 88 | 905 |
| Total | 2,628 | 1,841 | 466 | 4,935 |

C-3 Cost data

The financial reports from the Department of Health and Stewart Brown were examined and compared. The number of providers with cost by data source and financial year are shown in Table C-3. The Department of Health financial data has more providers than the Stewart Brown data; however, the total cost cannot be disaggregated reliably into different functions for financial years 2014/15 and 2015/16 due to different reporting requirements. This means, if the disaggregated-cost analysis is conducted at the provider level, the sample size reduces significantly for these two years.

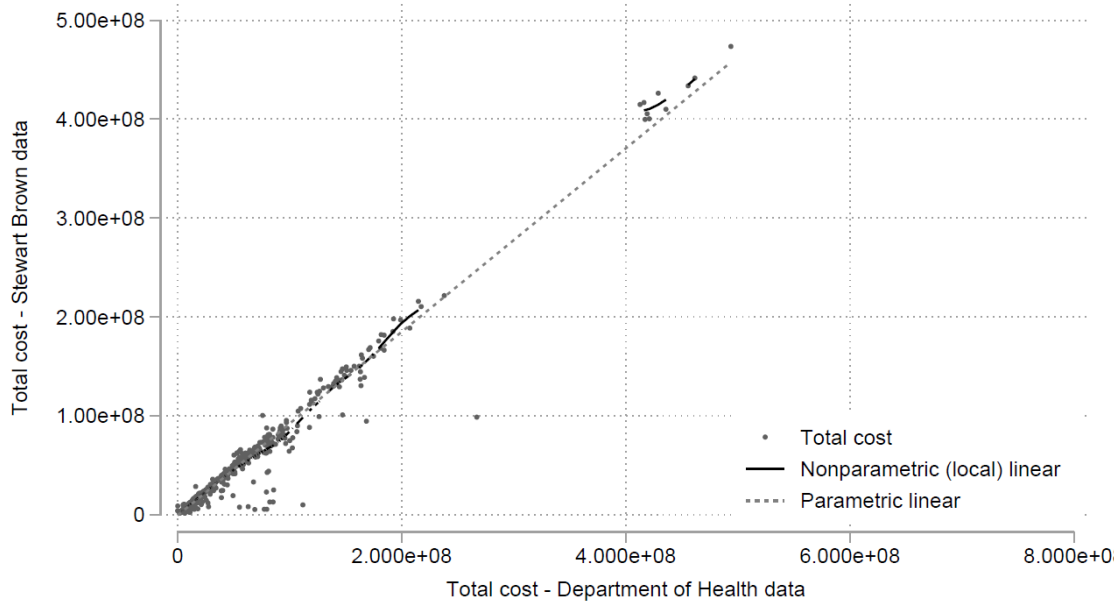
Table C-3. Number of providers with total cost data by source financial year

| Data sources | Financial year | | | | | Total |
|---------------------------|----------------|--------------|------------|------------|------------|--------------|
| | 2014/2015 | 2015/2016 | 2016/2017 | 2017/2018 | 2018/2019 | |
| Department of Health only | 809 | 778 | 699 | 673 | 630 | 3,589 |
| Stewart Brown only | 0 | 1 | 1 | 0 | 2 | 4 |
| Both | 153 | 162 | 183 | 194 | 213 | 905 |
| No data | 107 | 93 | 109 | 68 | 60 | 437 |
| Total | 1,069 | 1,034 | 992 | 935 | 905 | 4,935 |

Next we examined the consistency in the cost reporting between the Department of Health and Stewart Brown data, both aggregated (total) and disaggregated (by five functions: direct care, accommodation, hoteling, administration, and others). The correlations (and sample size) for the aggregated and disaggregated costs are summarised in Table C-4 and are their relationships are illustrated in Figure C-1 to Figure C-6 below.

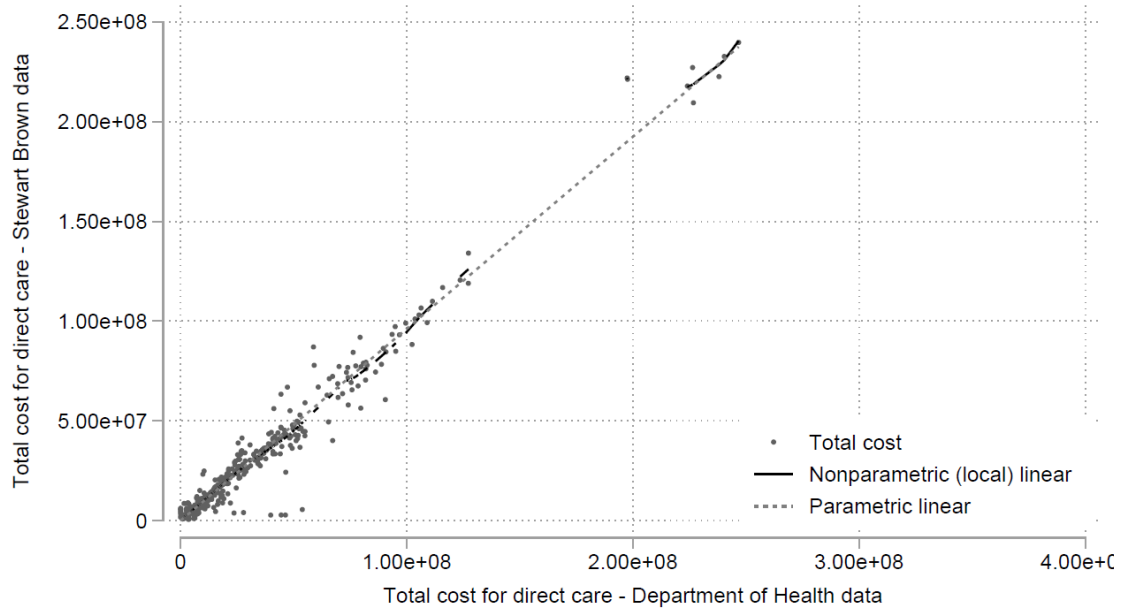
Table C-4. Correlations and sample size for aggregated and disaggregated costs by financial year

| | Financial year | | | | |
|------------------------------------|----------------|---------------|---------------|---------------|---------------|
| | 2014/2015 | 2015/2016 | 2016/2017 | 2017/2018 | 2018/2019 |
| Aggregated (total cost) | | | | | |
| Total cost | 0.986 (n=154) | 0.986 (n=163) | 0.994 (n=188) | 0.982 (n=196) | 0.976 (n=216) |
| Disaggregated (total costs) | | | | | |
| Direct care | 0.984 (n=81) | 0.988 (n=84) | 0.989 (n=188) | 0.985 (n=196) | 0.987 (n=216) |
| Accommodation | 0.873 (n=86) | 0.884 (n=92) | 0.898 (n=188) | 0.942 (n=196) | 0.945 (n=216) |
| Hotel services | NA (n=0) | NA (n=0) | 0.987 (n=188) | 0.979 (n=196) | 0.986 (n=216) |
| Administration | 0.548 (n=83) | 0.476 (n=90) | 0.961 (n=188) | 0.944 (n=196) | 0.889 (n=216) |
| Finance/other | 0.829 (n=154) | 0.871 (n=162) | 0.908 (n=188) | 0.928 (n=194) | 0.792 (n=215) |



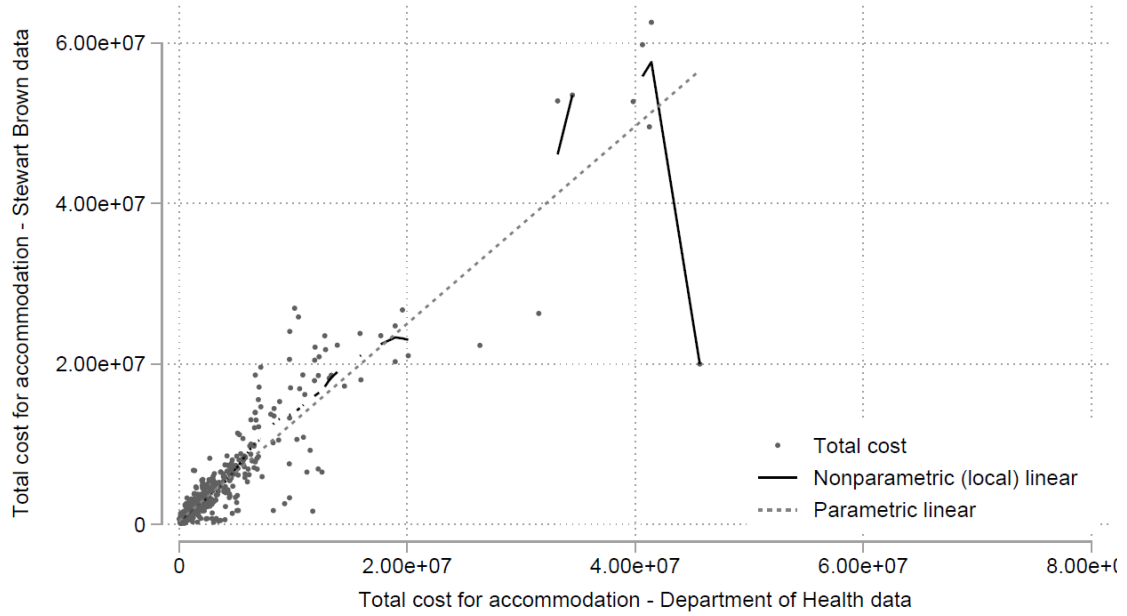
Local-linear estimates
kernel = epanechnikov bandwidth = 1.51e+07

Figure C-1. Total cost (aggregated): Stewart Brown vs. Department of Health data



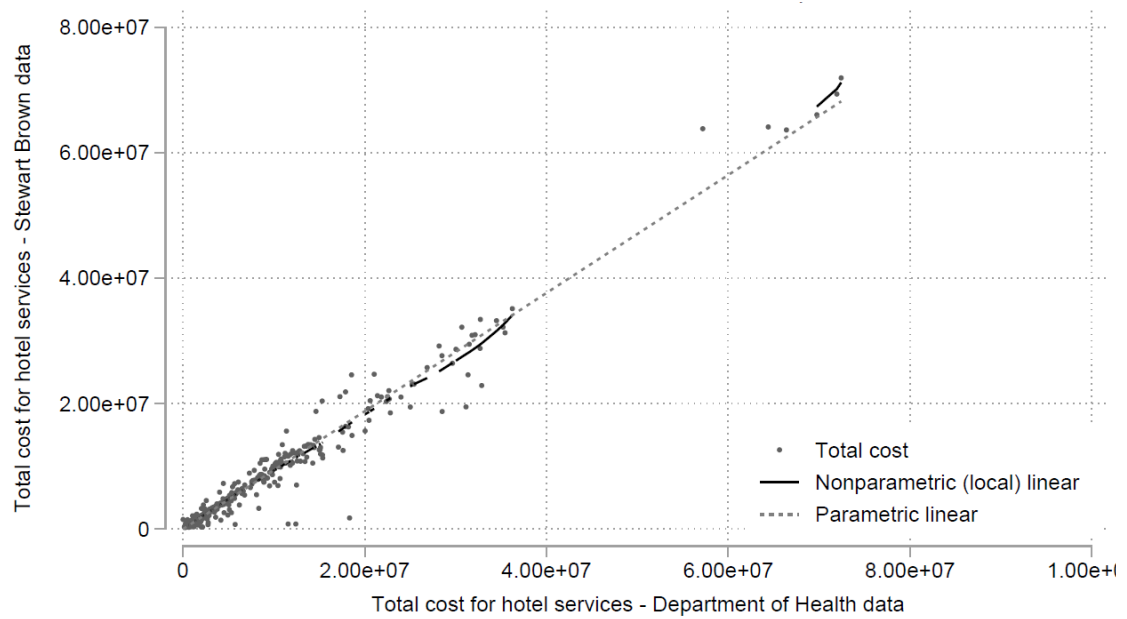
Local-linear estimates
kernel = epanechnikov bandwidth = 8228654

Figure C-2. Total cost (disaggregated) for direct care: Stewart Brown vs. Department of Health data



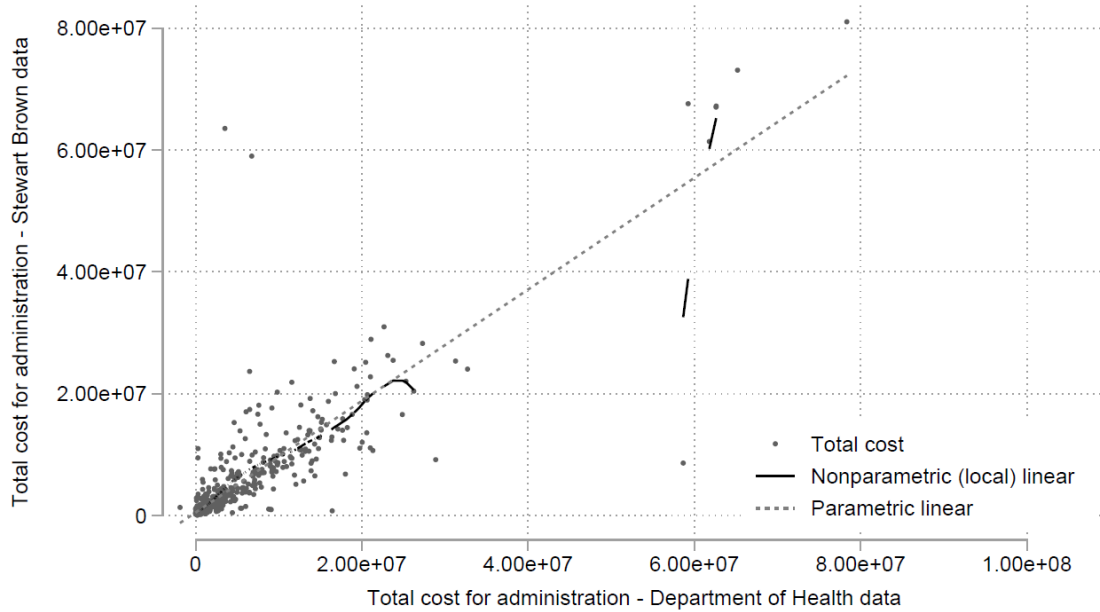
Local-linear estimates
kernel = epanechnikov bandwidth = 1288060

Figure C-3. Total cost (disaggregated) for accommodation: Stewart Brown vs. Department of Health data



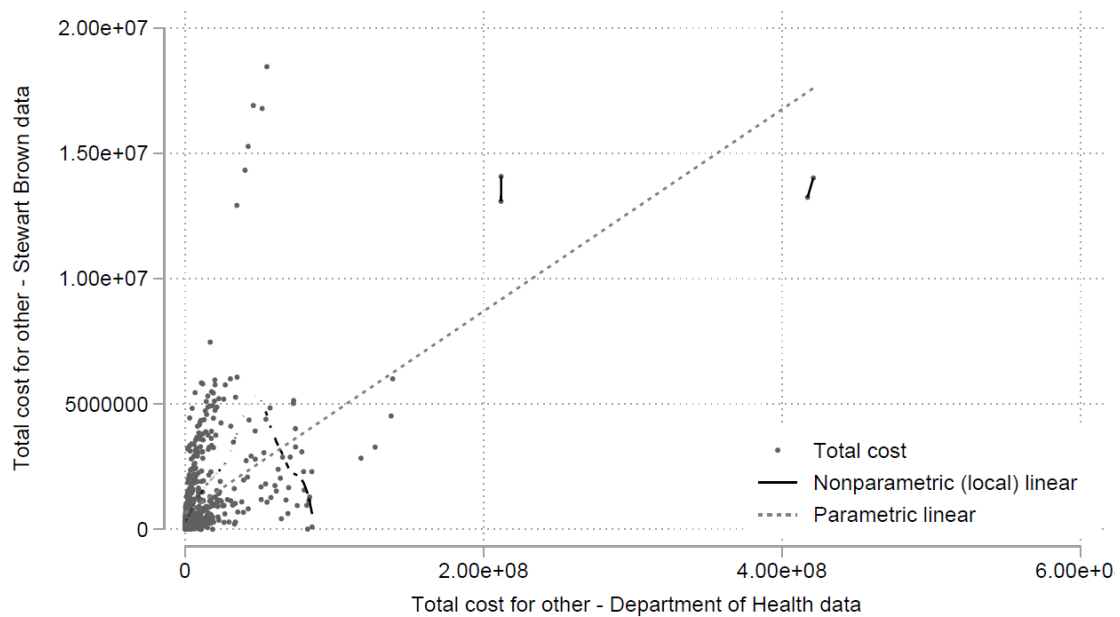
Local-linear estimates
kernel = epanechnikov bandwidth = 2603729

Figure C-4. Total cost (disaggregated) for hotel services: Stewart Brown vs. Department of Health data



Local-linear estimates
kernel = epanechnikov bandwidth = 2065752

Figure C-5. Total cost (disaggregated) for administration: Stewart Brown vs. Department of Health data



Local-linear estimates
kernel = epanechnikov bandwidth = 6968567

Figure C-6. Total cost (disaggregated) for other: Stewart Brown vs. Department of Health data

As shown in the figures above, the total cost (aggregated) and total cost by different categories (disaggregated) for direct care, hotel services, and other reported by the provider to the Department of Health tended to be higher than those collected by Stewart Brown. The reverse was observed for total costs (disaggregated) for accommodation and administration reported by the provider to the Department of Health which were lower than those collected by Stewart Brown. The consistency in reporting of total costs

(disaggregated) for direct care and hotel services was considerably higher than that of the other three categories (accommodation, administration, and other). The inconsistency in reporting of the other costs may have been largely because it is comprised of the uncategoryed cost items from the other four categories.

As the consistency in reporting for the total cost (disaggregated) for direct care is higher than the other four categories, and as the direct care costs are a primary focus of this project, the disaggregated cost analysis conducted with the total cost split into direct care and not direct care will help reduce measurement error.

The total cost distribution suggests that there are two main clusters of data, relatively small and relatively large with an absence of the middle-sized providers. Given this, we hypothesise that large providers might have very different operational models, compared to the relatively small providers.

At the provider level, the Department of Health data will be used to estimate the cost frontier as it represents financial data for considerably more providers than the Stewart Brown data. Where needed, the analysis will be supplemented by the Stewart Brown data.

C-4 Output

C-4-1 Occupied bed days

The number of occupied bed days in the Department of Health and the Stewart Brown financial report data were compared and examined. There are 909 observations for occupied bed days in the Stewart Brown data. A consistency check of the difference in occupied bed day counts between the two data sources was conducted. As shown in Figure C-7, there are large discrepancies in occupied bed days between the two data sources across the financial years.

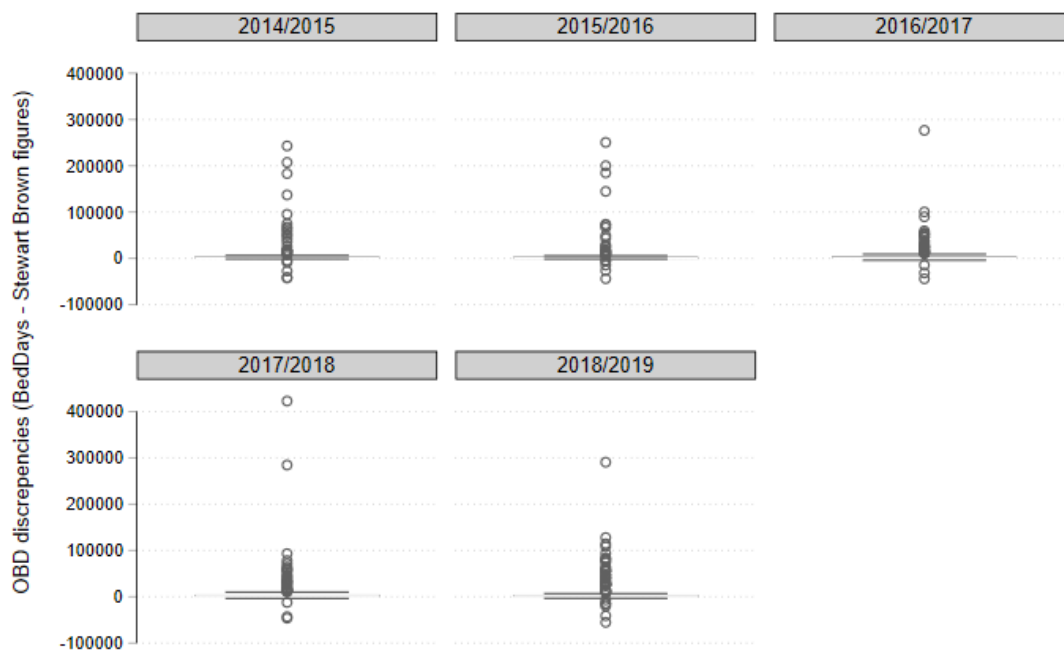
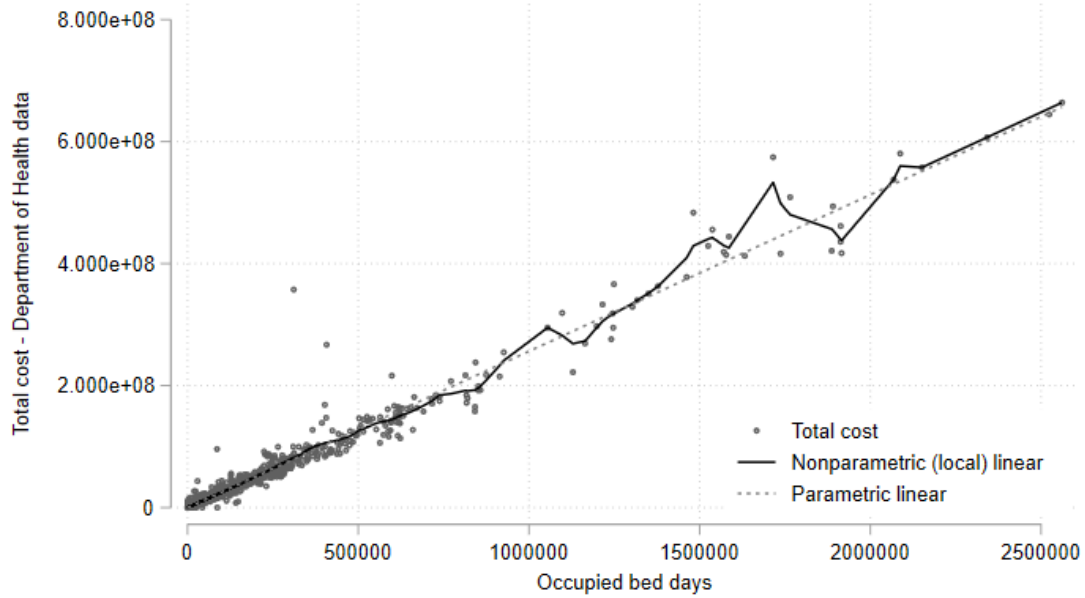


Figure C-7. Differences in occupied bed days between two data sources by financial year

As the Department of Health financial data will be used as the main data source for cost, the number of occupied bed days in this data source will be used as it too represents a more complete sample. The correlation between total cost and occupied bed days is shown in Figure C-8.



Local-linear estimates
kernel = epanechnikov bandwidth = 32413.05

Figure C-8. Relationship between total cost and occupied bed days

C-4-2 Casemix adjusted occupied bed days

Similar to facility-level analysis, RVU was used to adjust for the casemix difference. The distribution of the RVU-adjusted occupied bed days for the 5-year period is shown in Figure C-9. It shows a group of very large providers with casemix adjusted occupied bed days reaching 3 million.

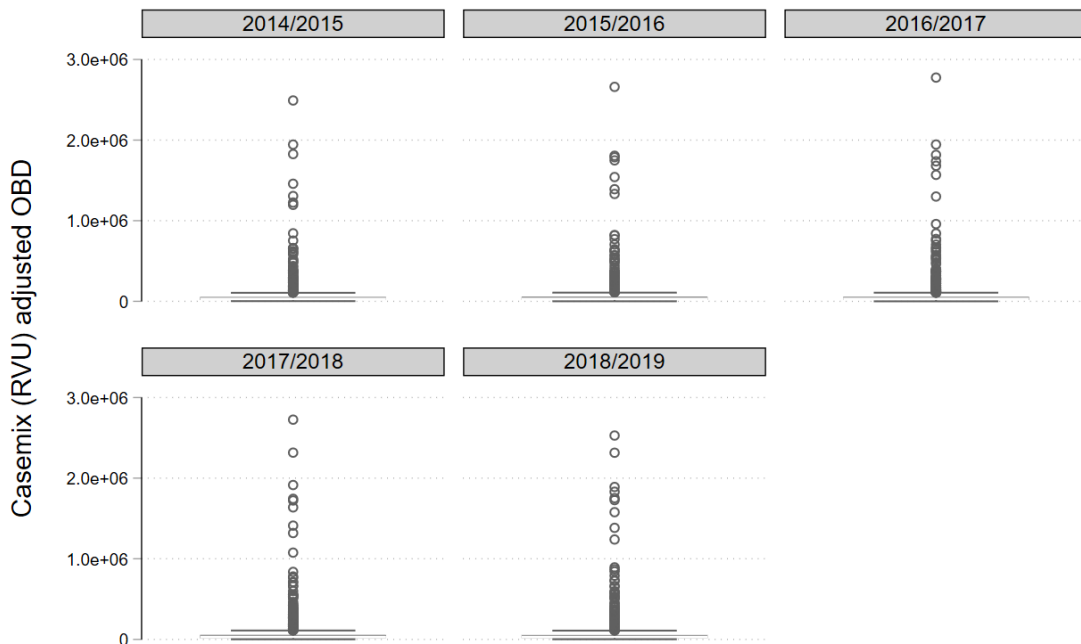


Figure C-9. Distribution of casemix (RVU) adjusted occupied bed days by financial year

The correlation between the total cost and casemix (RVU) adjusted occupied bed days is shown in Figure C-10. The RVU-adjusted occupied bed days explains a large proportion of the variation in the total cost, as evidence by most of the observations clustering around the parametric linear line.

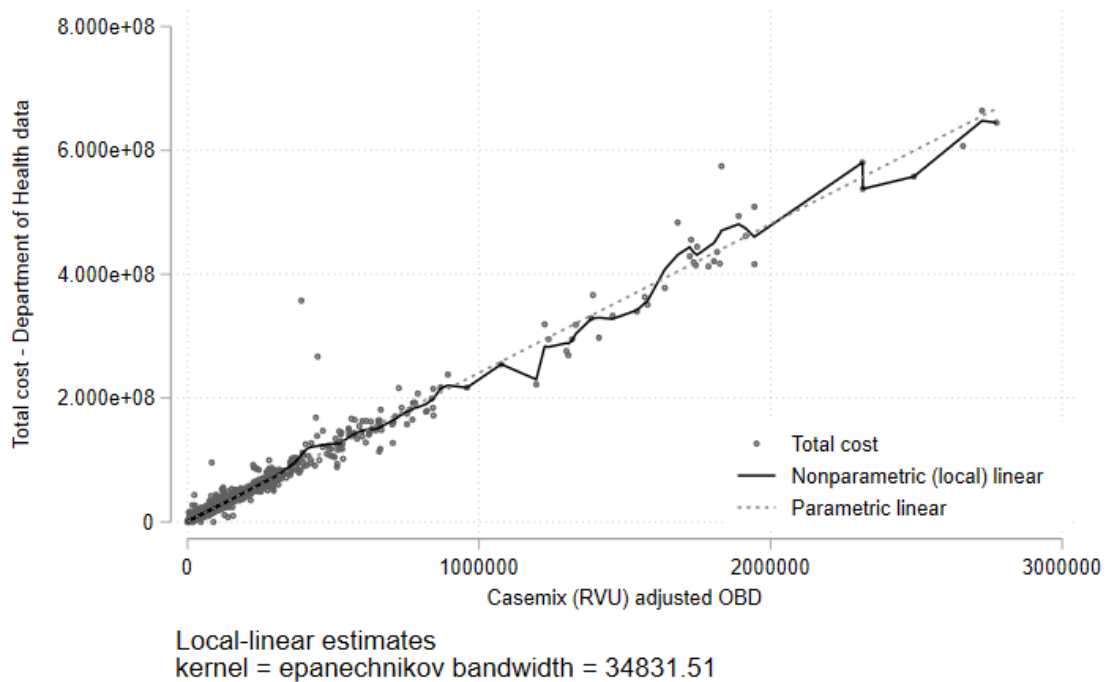


Figure C-10. Relationship between total cost and casemix (RVU) adjusted occupied bed days

C-5 Workforce

The total hours of labour spent delivering care was considered to be the workforce variable of interest. Similar to the facility-level data, the workforce data at the provider-level contains the number of hours spent per day per resident by categories: registered nurses, enrolled nurses, personal care, allied health and lifestyle, care management and administration related to care.

The distribution of hours spent delivering care per day per resident by financial year is provided in Figure C-11. The total hours of labour spent delivering care (per annum) was calculated as the total labour hours spent delivering care per day per resident (across all categories) multiplied by the total number of occupied bed days (per annum).

There are a large number of outliers in the total labour hours spent delivering care *per day per resident* that exceed 50 hours per day. These high values appear to be unrealistic, indicating possible issues in the reporting of the data.

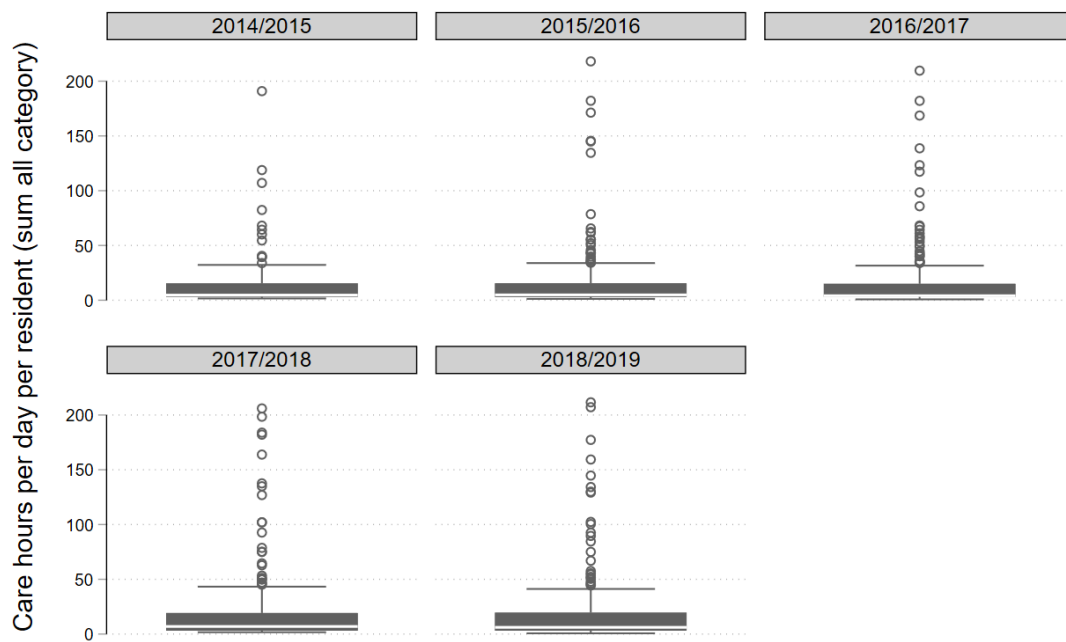


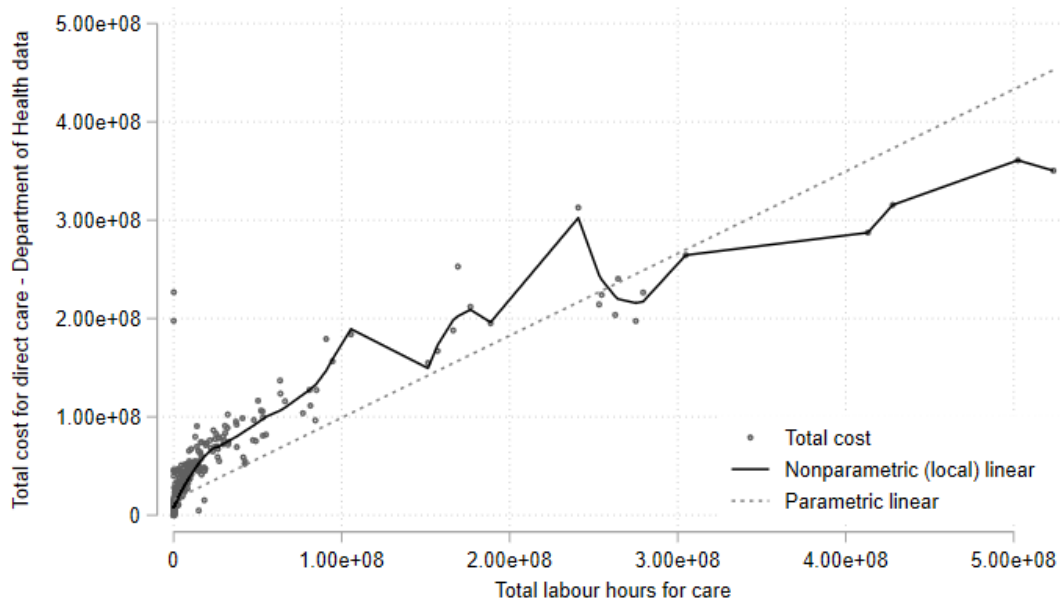
Figure C-11. Distributions of care hours per day per resident (workforce data) by financial year

The distribution of the total labour hours spent delivering care by financial year is summarised in Figure C-12. Similar to over variables, the distribution is left-skewed with a number of outliers.



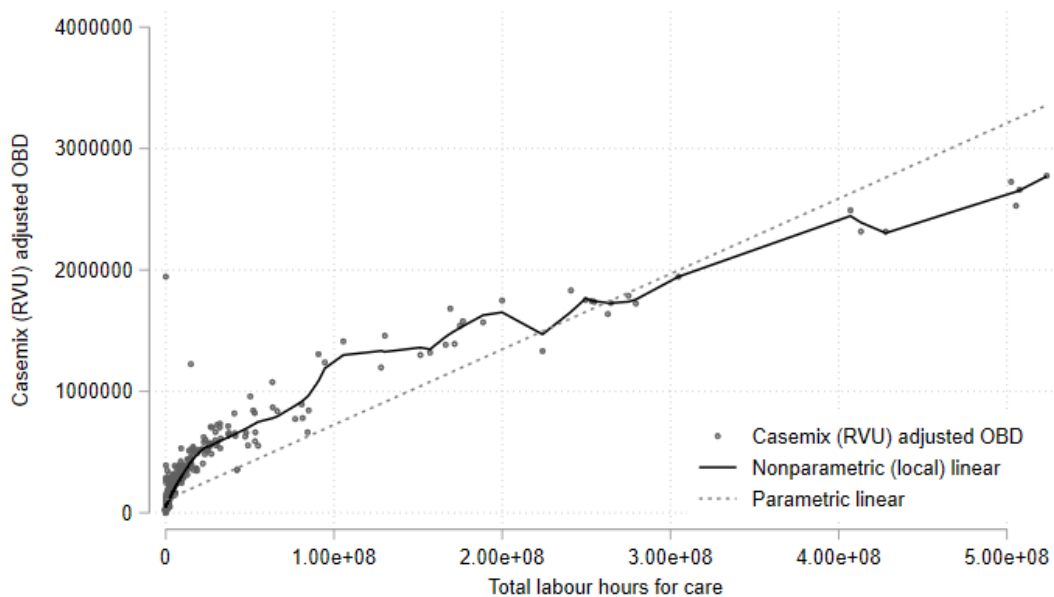
Figure C-12. Distributions of total labour hours for care (workforce data) by financial year

The correlation between total labour hours spent delivering care and total cost for direct care was examined and is shown in Figure C-13. The correlation between total labour hours spent delivering care and casemix (RVU) adjusted occupied bed days was examined and is shown in Figure C-14. These two relationships are not linear.



Local-linear estimates
kernel = epanechnikov bandwidth = 1.15e+07

Figure C-13. Relationship between total cost of direct care and total labour hours for care (total)



Local-linear estimates
kernel = epanechnikov bandwidth = 1.13e+07

Figure C-14. Relationship between casemix adjusted occupied bed days and labour hours for direct care

C-6 Quality indicators

C-6-1 ROSA clinical outcome indicators

There are 12 ROSA indicators: sedative load, antipsychotic use, chronic opioid use, antibiotic use, premature mortality, falls, fractures, medication-related adverse events, malnutrition or weight loss, delirium and/or dementia, emergency department presentations, and pressure injuries (Inacio et al., 2020). Sedative

load and antipsychotic use data were provided for all residents, residents with dementia, and residents without dementia. Emergency department presentations data were provided for short-term and long-term residents and cases of pressure injury were provided by severity. There were only three years of data available for the ROSA indicators at the provider level (financial years 2014/15 to 2016/17).

Five indicators were extracted and calculated from the national administrative data (Pharmaceutical Benefits Scheme; and National Death Index). These five ROSA indicators had good national coverage for providers: high sedative load, antipsychotic use, chronic opioid use, antibiotic use, and premature mortality. The remaining indicators were sourced from hospital-based data and did not have national coverage as they were only currently available for one Australian state (South Australia). The distributions and box plots of the five ROSA indicators by financial year are shown in Figure C-15 to Figure C-19 below.

Overall, the distributions of the five ROSA indicators are relatively normal with long right tails, indicating that some providers had very high incidences. The distributional shape did not change substantially over time.

At the provider level, there was an increase in chronic opioid use over time from financial year 2014/15 to 2016/17. Approximately 60–70% of providers on average had a consistent high use of antibiotics and 40–50% of providers on average had a consistent high sedative load. Premature mortality rate was left skewed, with some providers experiencing a premature mortality rate of above 5% rate.

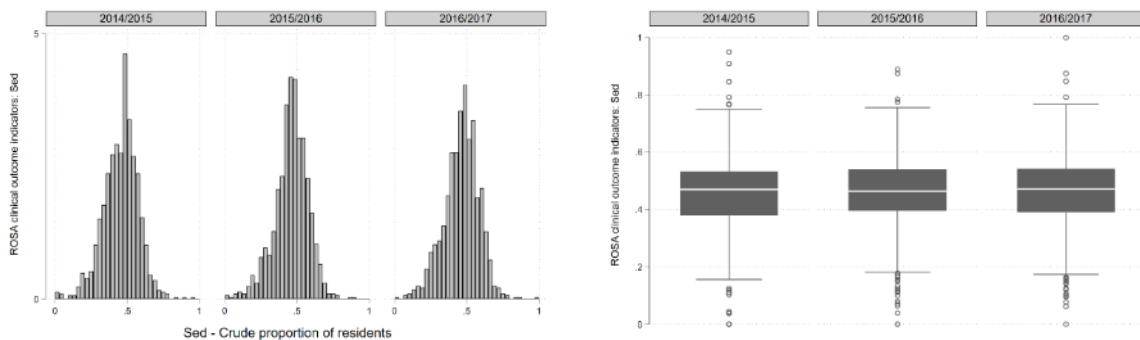


Figure C-15. Distributions and box plots of the ROSA high sedative load by financial year

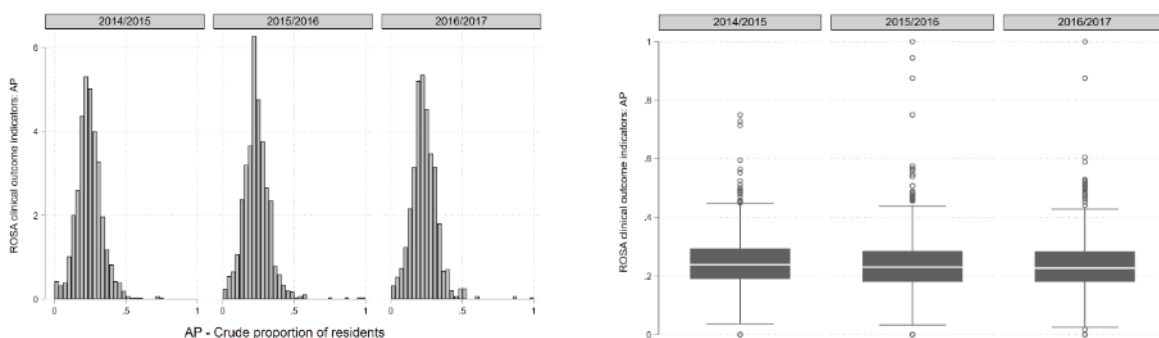


Figure C-16. Distributions and box plots of the ROSA antipsychotic use by financial year

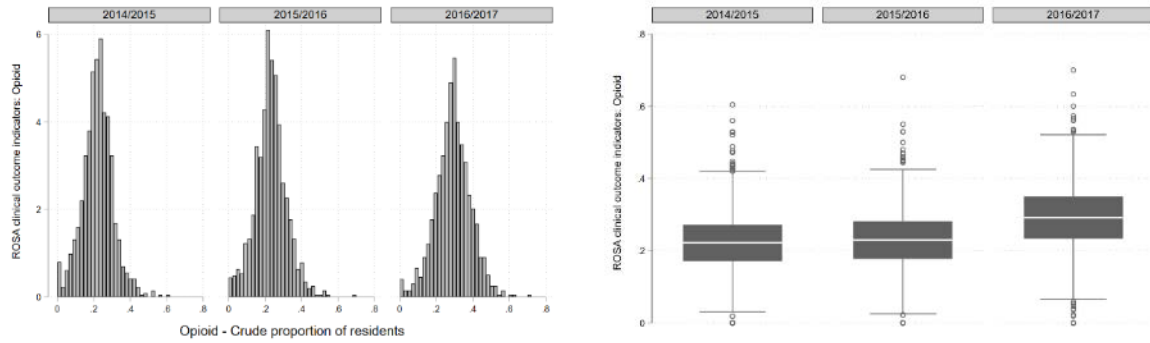


Figure C-17. Distributions and box plots of the ROSA chronic opioid use by financial year

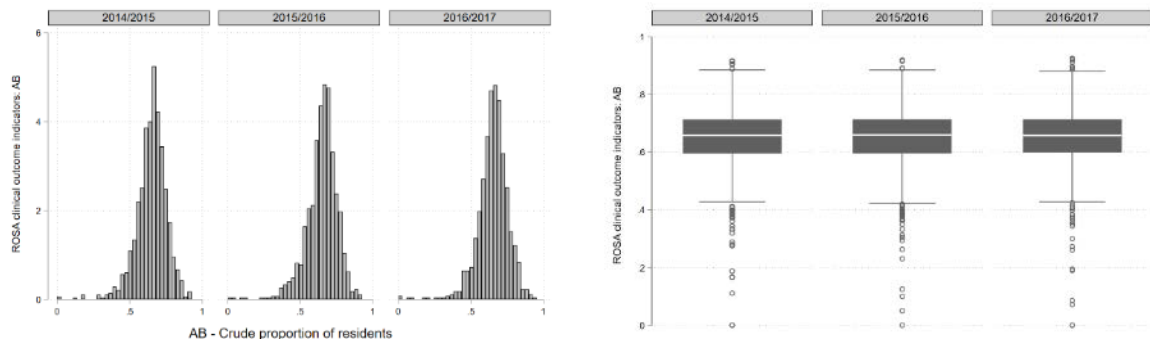


Figure C-18. Distributions and box plots of the ROSA antibiotic use by financial year

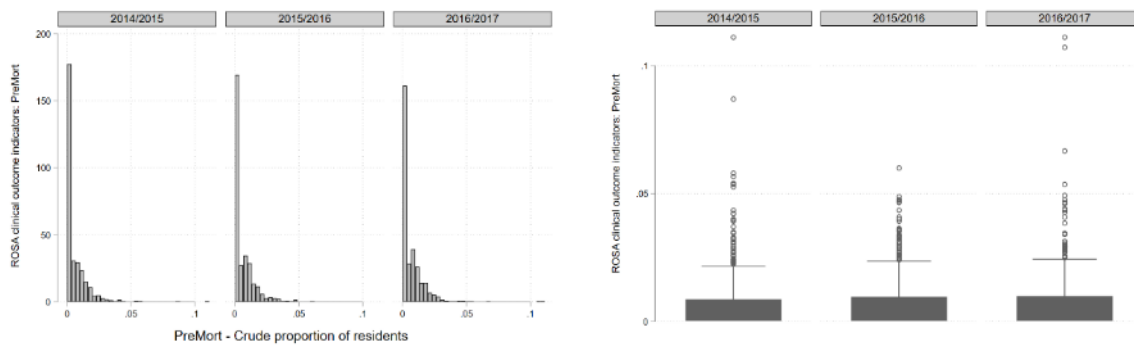


Figure C-19. Distributions and box plots of the ROSA premature mortality by financial year

The correlation between these five ROSA indicators are weak. As shown in Table C-5, a principal component analysis reveals a common pattern underlying the data for the four ROSA indicators of high-risk medicine use (high sedative load, antipsychotics, chronic opioid use, antibiotic use) while premature mortality appears to stand alone which is probably largely due to the shape of its distribution. These variables are examined in further detail during the construction of the composite quality index (See the *Technical Supplementary Report 1*).

Table C-5. Principal component analysis factor loadings for the five ROSA indicators

| Variable | Factor 1 | Uniqueness |
|--------------------------|----------|------------|
| ROSA Antibiotic use | 0.3204 | 0.8973 |
| ROSA Antipsychotic use | 0.4490 | 0.7984 |
| ROSA Chronic opioid use | 0.4904 | 0.7595 |
| ROSA High sedative load | 0.7359 | 0.4584 |
| ROSA Premature mortality | | 0.9982 |

ROSA: Registry of Senior Australians

C-6-2 Complaints and issues

The number of complaints and issues lodged about residential aged care facilities in Australia across a five-year period (financial year 2014/15 to 2018/19) were available for analysis at the provider level. The number of issues was larger than the number of complaints, as each complaint contains one or more issues. As in the facility-level analysis, the number of issues was used in the provider-level analysis. A higher number of issues indicates a poorer level of quality at the provider level.

It is expected that providers with a larger number of facilities and/or residents will have a higher number of complaints and issues than providers with a small number of facilities and/or residents. To account for the number of facilities and facility size, the total number of issues was divided by the number of residential aged care facility places to give the number of issues per residential aged care facility place. The distributions of the size-adjusted number of issues for facilities across five financial years (2014/15 to 2018/19) were explored and are shown in Figure C-20.



Figure C-20. Distributions of the number of issues, adjusted for provider size by financial year

A large number of providers had no issues over the year. However, there were a handful of providers that had more than one issue raised per residential aged care facility place per annum. Mean adjustment was undertaken to address the large number of zero values (i.e. no issues) to centre the mean at unity, (calculated as the size-adjusted number of issues for each provider divided by the mean of this variable across all providers). Providers with mean-adjusted rates of the number of issues (size-adjusted) above 1 indicates the facility had a rate above the national average rate (worse quality), equal to 1 indicates the facility had a rate equal to the national average rate and below 1 indicates the facility had a rate below the

national average rate (better quality). It showed a spread from 0 to above 30, indicating that providers received 30 times more issues, compared to the industry average.

C-6-3 Sanctions

Sanctions placed on aged care facilities are imposed when (i) there is an immediate and severe risk to the safety, health or wellbeing of someone receiving aged care services, (ii) the provider has inappropriate systems in place, and (iii) issues related to a notice of non-compliance but has not addressed within an agreed time period. A small number of facilities and providers received a sanction over the five financial years of available data. The number of sanctions imposed on providers by financial year is shown in Table C-6.

Table C-6. Distributions of the number of sanctions by financial year

| Number of sanctions | Financial year | | | | | Total |
|---------------------|----------------|--------------|--------------|------------|------------|--------------|
| | 2014/2015 | 2015/2016 | 2016/2017 | 2017/2018 | 2018/2019 | |
| 0 | 1,071 | 1,047 | 993 | 936 | 881 | 4,928 |
| 1 | 2 | 0 | 11 | 16 | 30 | 59 |
| 2 | 0 | 1 | 0 | 2 | 4 | 7 |
| 4 | 0 | 0 | 0 | 1 | 0 | 1 |
| 15 | 0 | 0 | 0 | 0 | 1 | 1 |
| Total | 1,073 | 1,048 | 1,004 | 995 | 916 | 4,996 |

The number of sanctions increased over time which is likely to be due in part to the introduction of unannounced (without notice to providers) visits, replacing announced (with notice to providers) visits. As aged care providers are no longer able to prepare and plan for the assessments and audits, the unannounced visits are likely to better identify when providers have poor practices and failed to meet standards of care.

As expected, a small number of providers had one or two sanctions. One provider received 4 sanctions in the financial year 2017/18 and one provider received 15 sanctions in the financial year 2018/19. In the most recent year (financial year 2018/19), 4% (35/916) of providers received at least one sanction.

As sanctions are relatively rare, this variable was not included directly to construct the composite quality index. However, any provider that had at least one sanction imposed during the latest 2-year period was placed into the lowest quality group. Refer to the *Technical Supplementary Report 1* for more details.

C-6-4 Accreditation standards not met

There are 44 expected outcomes across four Accreditation Standards. The Accreditation Standards covered four domains: (1) management system, staffing and organisational development, (2) health and personal care, (3) care recipient lifestyle and (4) physical environment and safe systems.

If the residential aged care facility is assessed as failing to comply with an expected outcome, then the expected outcome is considered to be *not met*. The data provided was the number of expected outcomes not met by the provider during a given financial year. Note that each provider might fail standards more than once per year if they had multiple visits.

The number of expected outcomes not met across all four Accreditation Standards were summed to get the total number of expected outcomes not met per provider per year. The distribution of the total number of expected outcomes not met across financial years (2014/15 to 2016/17) is presented in Figure C-21 below. The distributions are extremely left-skewed (zero inflated) as a small minority of providers had expected outcomes not met.

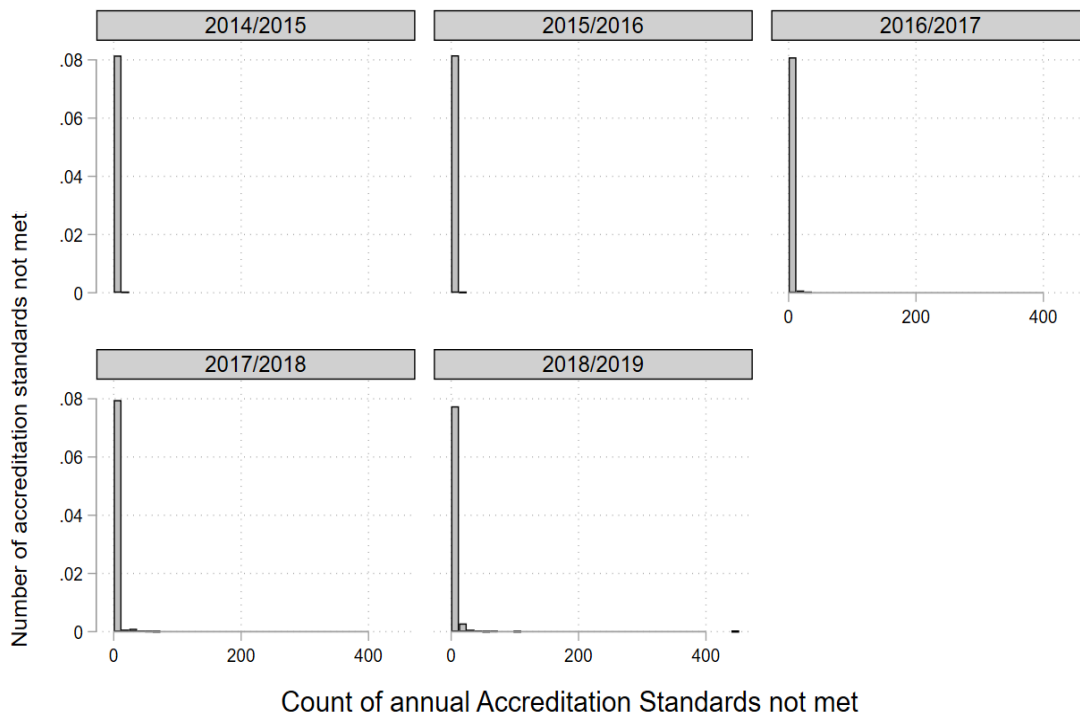


Figure C-21. Distributions of the Accreditation Standards expected outcomes not met by financial year

C-6-5 Consumer Experience Ratings (CER)

The consumer experience ratings is a set of 10 questions designed to capture the experiences of the quality of care and services of residents in residential aged care facilities. The response options are 1 (never), 2 (some of the time), 3 (most of the time) and 4 (always), with higher scores indicating better quality and lower scores indicating poorer quality. The consumer experience data was provided in count format reflecting the number of respondents who had selected each response option for a period of three financial years (2016/17 to 2018/19).³

Similar to the facility-level analysis, a consumer experience rating total score was constructed for each provider. The score for each response option was multiplied by the number of respondents in each response option. The values were summed and then divided by the total number of respondents to give an unweighted average for each item, which is then summed across all 10 items. This consumer experience rating total score is a score out of 40, with a higher score indicating better quality of care and services experienced by residents living in residential aged care facilities. It was used to construct the composite quality index.

The distribution of the consumer experience rating total scores by financial year is summarised in Figure C-22. The sample size of providers in financial year 2016/17 was smaller (n=67) than the other two financial years, which covered approximately 50% of all providers (n=450–500).

³ At the provider level, consumer experience ratings were available for three financial years from 2016/17 to 2018/19. ROSA clinical outcome indicators were available for three financial years from 2014/15 to 2016/17. Therefore, there is only one financial year (2016/17) that has data overlapping for these indicators.

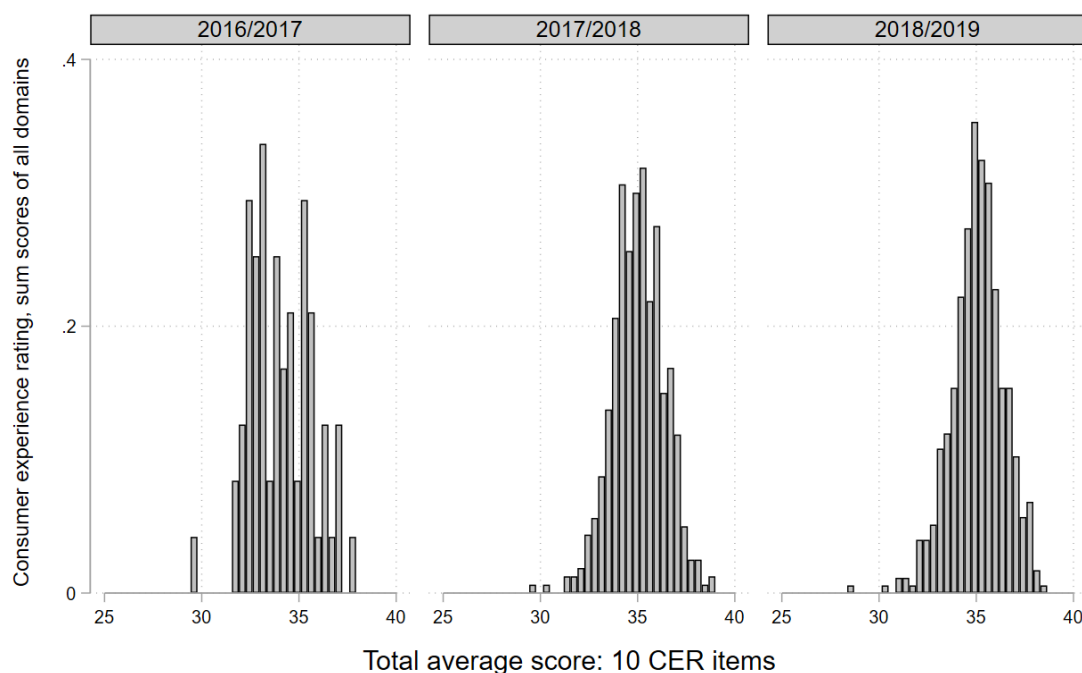


Figure C-22. Distributions of the consumer experience rating (CER) total scores by financial year

C-6-6 All quality indicators

The correlation pattern of all the quality variables were examined and the factor loadings according to the principal component analysis is shown in Table C-7. Four ROSA high-risk medicine use indicators loaded onto one factor (Factor 1), sanctions and expected outcomes not met loaded onto one factor (Factor 2), and ROSA premature mortality, consumer experience ratings, and issues were standalone variables.

Table C-7. Principal component analysis factor loadings for the selected quality indicators

| Variable | Factor 1 | Factor 2 | Uniqueness |
|---|----------|----------|------------|
| ROSA Antibiotic use | 0.6459 | | 0.5629 |
| ROSA Antipsychotic use | 0.4097 | | 0.8299 |
| ROSA Chronic opioid use | 0.4632 | | 0.7715 |
| ROSA High sedative load | 0.8231 | | 0.3215 |
| ROSA Premature mortality | | | 0.9876 |
| Consumer experience rating ^a | | -0.3705 | 0.8543 |
| Issues | | | 0.9551 |
| Sanctions | | 0.6500 | 0.5775 |
| Not met expected outcomes | | 0.7286 | 0.4685 |

^aConsumer experience rating total score

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