

Title: The Registry of Senior Australians (ROSA) Outcome Monitoring System: Quality and Safety Indicators for Residential Aged Care

Abstract

Objectives: To introduce the Registry of Senior Australians (ROSA) *Outcome Monitoring System*, which can monitor the quality and safety of care provided to individuals accessing residential aged care. Development and examination of twelve quality and safety indicators of care and their 2016 prevalence estimates are presented.

Design: Retrospective.

Setting: 2,690 national and 254 South Australian (SA) aged care facilities.

Participants: 208,355 unique residents nationally and 18,956 in SA.

Main Outcome Measures: Risk adjusted prevalence of high sedative load, antipsychotic use, chronic opioid use, antibiotic use, premature mortality, falls, fractures, medication-related adverse events, weight loss/malnutrition, delirium and/or dementia hospitalisations, emergency department presentations, and pressure injuries.

Results: Five indicators were estimated nationally; antibiotic use (67.5%, 95% confidence interval (CI) 67.3-67.7%) had the highest prevalence, followed by high sedative load (48.1%, 95%CI 47.9-48.3%), chronic opioid use (26.8%, 95%CI 26.6-26.9%), antipsychotic use (23.5%, 95%CI 23.4-23.7%), and premature mortality (0.6%, 95%CI 0.6-0.7%). Seven indicators were estimated in SA; emergency department presentations (19.1%, 95%CI 18.3-20.0%) had the highest prevalence, followed by falls (10.1%, 95%CI 9.7-10.4%), fractures (4.8%, 95%CI 4.6-5.1%), pressure injuries (2.9%, 95% CI 2.7-3.1%), delirium and/or dementia related hospitalisations (2.3%, 95%CI 2.1-2.6%), weight loss/malnutrition (0.7%, 95%CI 0.6-0.8%), and medication-related events (0.6%, 95%CI 0.5-0.7%).

Conclusions: Twelve quality and safety indicators were developed to monitor aged care provided to older Australians based on the synthesis of existing literature and expert advisory input. These indicators rely on existing data within the aged care and health care sectors, therefore creating a pragmatic tool to examine quality and unwarranted care variation.

Keywords: Aged Care, Quality and Safety Indicators, Quality Improvement

Introduction

The Australian Royal Commission into Aged Care Quality and Safety was announced in 2018 in response to concerns raised including reports of abuse, neglect, premature mortality, inadequate practice of evidence-based care, suboptimal staffing ratios and skills, and inappropriate care models.¹⁻⁵ The Royal Commission aims to address the safety, quality, mistreatment and abuse in the aged care sector and investigate sustainable strategies to meet the needs of older Australians.¹ It is a pivotal and opportune time for Australia to examine and improve the delivery of aged care services provided by 2,695 aged care facilities nationally to >242,000 individuals, costing the Government \$12.2B annually.⁶

Population-based surveillance measures and an understanding of unwarranted variation are the foundation for evidence-based quality improvement initiatives, care optimisation and personalisation.^{7,8} Unwarranted variation is variation that cannot be explained by underlying population differences, or which arises because of care delivery and organisation, or uncertainty regarding best practices.^{9,10} Safety and quality monitoring in the aged care sector has long been recognised to be valuable for its vulnerable population.^{11,12}

The acknowledgement that ongoing monitoring can identify well- and poor- performing facilities, benchmarking opportunities, and underpin quality improvement initiatives is wide. For example, the USA, UK, Sweden, and other ageing countries have mandatory, and in some instances public, reporting systems since the 1990s.¹¹ While limitations exist, specifically around choice of data sources for monitoring and limited capture, they have been successful in increasing performance transparency, promoting higher standards of care (e.g. ratio of skilled workers to residents) and informing practices.^{11,12} In 2019 Australia established an Aged Care Quality and Safety Commission (ACQSC), which implemented a

program of quality and safety indicators (i.e. pressure injuries, unintended weight loss, and use of physical restraints) for aged care facilities.¹³ The program relies on provider active reporting, does not risk adjust, and uses a single data point estimate.¹³ Therefore, a comprehensive, low burden, and methodologically robust system to measure quality and safety of care is still needed.

Before the establishment of the ACQSC the Registry of Senior Australians (ROSA) was established in 2017 by the Healthy Ageing Research Consortium, a collaborative of aged care providers, clinicians, academics, and consumer representatives with the support of the South Australian government. The aim of ROSA is to improve the quality of ageing and care provided to individuals, supporting the State's Prosperity Through Longevity vision.¹⁵ ROSA undertook the linkage of information from the aged care and health care sectors and now contains the largest Australian population-based cohort of people using aged care services (2.9 million individuals).^{14,16} With the innovation of ROSA the development of an outcome monitoring system for effective, transparent, and scalable reporting of quality and safety indicators for the Australian population accessing aged care services is closer to reality.

The objectives of this study are to: (1) describe the development of the *ROSA Outcome Monitoring System* for safety and quality of aged care services; and (2) examine the 2016 prevalence and variation of twelve quality and safety indicators in a national and South Australian cohort of individuals. Our aim was to create a low burden and efficient set of indicators that can support quality improvement initiatives to improve outcomes and quality of care for older Australians.

Methods

Study Design and Data Sources

Quality and safety indicators for aged care facility performance evaluation were developed using literature review and expert engagement, and was based on the iterative methodology recommended by the US Agency of Health Research and Quality for indicator development.¹⁷ All indicators developed were based on the datasets captured within ROSA. The ROSA contains a Historical National (1997-2017, 2.9 million individuals) and a Prospective South Australian (2018-ongoing, ~16,000 participants/year) cohort. The Historical cohort is currently being updated to include 2018-2019 records. The cohorts are comprised of data from the National Aged Care Data Clearinghouse, Medicare Benefits Schedule, Pharmaceutical Benefits Scheme (PBS), National Death Index, Integrated South Australian Activity Collection, and South Australian Emergency Department Data Collection.¹⁴ The Historical National cohort was used in this study.¹⁶ Five indicators are reported nationally and seven indicators, reliant on hospital data, were examined in the South Australian cohort due to data availability. A cross-sectional evaluation of the ROSA cohort in 2016 was conducted to assess developed indicators.

Literature Review

Using national and international aged care literature (first review completed 11/2018), 23 initial safety and quality indicators for residential aged care facilities were identified for inclusion in the ROSA *Outcome Monitoring System* (**Appendix 1, Supplementary Table S1**). These were selected if they have been implemented in other countries, *or* were recommended for monitoring in this population, *or* have been associated with poor

outcomes and increased risk of harm, *and* are feasible using the ROSA data (**Appendix 1, Supplementary Table S2**).

Expert Consensus

An initial consultation with an Expert Advisory Committee (04/2019), including the ROSA Executive Committee members, geriatricians, general practitioners, aged care providers, and aged care consumer representatives, examined the face and content validity and acceptability of the indicators. The Committee focused on indicators that can be addressed by aged care providers rather than primarily viewed/interpreted as a health care providers' responsibility. Follow up consultations with pharmacists were undertaken. The twelve indicators prioritised for development and monitoring (**Appendix 1, Supplementary Table S1**) were 1) high sedative load, 2) antipsychotic use, 3) chronic opioid use, 4) antibiotic use, 5) premature mortality, 6) falls, 7) fractures, 8) medication-related adverse events, 9) weight loss and malnutrition, 10) delirium and/or dementia hospitalisations 11) emergency department presentation, and 12) pressure injury.

Technical Specifications of Indicators

For each indicator the data source, numerator, denominator, additional inclusion and exclusion criteria, and covariates for consideration in adjustment were determined. This was based on relevant literature.^{2,18-24} Each indicator description, data sources, and coding scheme are outlined in **Table 1 (See Appendix 2 for full specifications)**. Short-term residents were defined as having lived in a specific facility for a cumulative period of <100 days and long-term for a cumulative period of ≥100 days.²⁵ The Rx-Risk-V comorbidity measure was used to determine number of health conditions an individual has using PBS data over a six

months period.²⁶ Because dementia is not well captured with a medication-based measure, it was ascertained based on reporting of conditions from the aged care eligibility assessments, entry into permanent care assessments, and RxRisk-V.

Risk Adjustment of Indicators

Indicators were adjusted to account for the varying profile of individuals living in facilities.²⁷ All indicators are at the minimum, adjusted for age, sex, and number of health conditions, with additional covariates (e.g. dementia, osteoporosis) where relevant (**Table 1**). The probability of a specific event (i.e. *expected rate*) was estimated using logistic regression models that included the specified covariates for that model. For each measure and model variable form specifications were examined and model fit assessed. The *ratio of the observed/expected* multiplied by the overall national rate was the adjusted rate, which is presented.²⁷

Visualising Indicators

Funnel plots display the facility-level variation for each indicator. In these plots, dots represent facilities, the number of individuals in facilities is shown in the X-axis and the adjusted rate of each indicator in the Y-axis (**Figure 1**). The expected variation in performance is shown by upper and lower confidence intervals (95% or 99% CI) around the indicator mean for all facilities. The Wilson method for binomially distributed estimates was used to estimate confidence intervals (CI).²⁷

To ensure appropriate funnel plots, indicators were risk adjusted and model fit was checked. Only facilities with more than 20 residents were displayed in the plots, this excluded at least

139/2690 (5.2%) facilities nationally and 11/243 (4.5%) facilities in South Australia, depending on indicator. There is a small number of individuals (4050/208,355, 2%) that were residents of more than one facility during the year and contributed to the estimates for both facilities. Large facilities (nationally >240 residents or >150 in South Australia, <4.5%) were not shown in plots to avoid re-identification.

Analysis

Descriptive statistics were employed to characterise residents of aged care facilities in 2016 and summarise the number of facilities examined, nationally and for South Australia.

Prevalence estimates of the indicators (adjusted rates) and 95% CIs were presented. Funnel plots display the facility level variation.

Table 1. ROSA Outcome Monitoring System Quality and Safety Indicators Details¹

Indicator	Main Data source(s)	Coding	Numerator	Denominator	Exclusions/Stratification	Covariates
High Sedative Load	Medications (PBS)	PBS/ATC	Number of long-term residents who experienced high sedative load	Number of long-term residents	Stratified by dementia status	Age, sex, comorbidities
Antipsychotic Use	Medications (PBS)	PBS/ATC	Number of long-term residents who have been prescribed an antipsychotic	Number of long-term residents	Stratified by dementia status. Excluded residents with history of schizophrenia or Huntington’s disease	Age, sex, comorbidities, dementia, prior use of antipsychotics
Chronic Opioid Use	Medications (PBS)	PBS/ATC	Number of long-term residents that are chronic opioid users. Chronic opioid use is defined as continuous opioid use for at least 90 days, or for 120 non-consecutive days	Number of long-term residents	Excluded residents with a history of cancer or in palliative care	Age, sex, comorbidities
Antibiotic Use	Medications (PBS)	PBS/ATC	Proportion of long-term residents dispensed an antibiotic	Number of long-term residents		Age, sex, comorbidities
Premature Mortality	Mortality records (NDI)	ICD-10-AM	Number of residents who died from premature causes, i.e. their main cause of death is ‘external’ and considered potentially avoidable	Number of residents		Age, sex, comorbidities
Falls	Hospital and mortality records (ISAAC, EDDC, NDI)	ICD-10-AM	Number of long-term residents who have experienced one or more falls resulting in requiring medical attention	Number of long-term residents		Age, sex, comorbidities, dementia, mobility

Fractures	Hospital, subsidised health encounters, mortality records (ISAAC, EDDC, MBS, NDI)	ICD-10-AM/MBS	Number of long-term residents with fractures	Number of long-term residents		Age, sex, comorbidities, dementia, mobility, osteoporosis
Medication-related Adverse Events	Hospital records (ISAAC, EDDC)	ICD-10-AM	Number of long-term residents with a medication-related hospitalisation/emergency department visit	Number of long-term residents		Age, sex, comorbidities
Weight Loss and Malnutrition	Hospital records (ISAAC, EDDC)	ICD-10-AM	Number of long-term residents with a hospitalisation/emergency department visit for/with malnutrition/weight loss diagnoses	Number of long-term residents		Age, sex, comorbidities
Delirium and/or Dementia Hospitalisations	Hospital records (ISAAC, EDDC)	ICD-10-AM	Number of long-term residents with dementia having a hospitalisation/emergency department visit for dementia or delirium	Number of long-term residents with dementia		Age, sex, comorbidities
Emergency Department Presentation	Hospital records (ISAAC, EDDC)	ICD-10-AM	Number of residents admitted to an emergency department within 30 days of entry/re-entry to care	Number of residents who re-entered after hospital discharge	Stratified by short vs long-term residents	Age, sex, history of hospitalisations, comorbidities, length of stay
Pressure Injury	Hospital records (ISAAC, EDDC)	ICD-10-AM	Number of long-term residents with a hospitalisation/emergency department visit for or with pressure injury diagnoses	Number of long-term residents	Stratified by high vs low risk of pressure injury residents	Age, sex, comorbidities

1. See Appendix 2 for detailed specifications for indicators.

MBS, Medicare Benefits Schedule; PBS, Pharmaceutical Benefits Scheme; NDI, National Death Index; ISAAC, Integrated South Australian Activity Collection; EDDC, South Australian Emergency Department Data Collection. ATC= Anatomical Therapeutic Chemical Classification System. ICD-10-AM= International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification.

Results

National Indicators

In 2016, there were 208,355 unique long-term residents, including 115,038 (55.2%) living with dementia, in 2,690 facilities (**Table 2**). Of the five indicators estimated nationally, antibiotic use (67.5%, 95%CI 67.3-67.7%) had the highest prevalence in aged care facility residents, followed by high sedative load (48.1%, 95%CI 47.9-48.3%), chronic opioid use (26.8%, 95%CI 26.6-26.9%), antipsychotic use (23.5%, 95%CI 23.4-23.7%), and premature mortality (0.6%, 95%CI 0.6-0.7%). Little difference in high sedative load was observed when stratified by the presence of dementia, but the prevalence of antipsychotic use in residents with dementia was higher (32.0%, 95%CI 31.7-32.2%) than in residents without dementia (13.1% 95%CI 13.0-13.3%).

Funnel plots of indicators illustrating national variation are shown in **Appendix 1**. In decreasing order, the five national indicators with most facilities outside the upper 95%CI were: antibiotic use (N=382/2551, 15%), high sedative load (N=319/2518, 12.7%), chronic opioid use (N=277/2543, 10.9%), antipsychotic use (N=131/2527, 5.2%, **Figure 1**), and premature mortality (N=2/2551, 0.1%) (**Table 3**). Premature mortality had the lowest incidence and less variation by facilities than other indicators, while antibiotic use had the highest prevalence and greatest facility variation. There were 664 (26.0%) facilities with at least one of the five indicators outside the upper 95%CI, 164 (6.4%) with two, 37 (1.5%) with three, and 2 (0.1%) with four (**Table 3**).

State Indicators

There were 18,956 unique long-term residents, including 10,499 (55.3%) living with dementia, in 254 facilities in South Australia (**Table 2**). Of the seven indicators estimated, emergency department presentations (short term: 19.4%, 95%CI 17.9-20.9%, long term: 19.1%, 95%CI 18.3-20.0%) had the highest prevalence in residents, followed by falls (10.1%, 95%CI 9.7-10.4%), fractures (4.8%, 95%CI 4.6-5.1%), delirium and/or dementia-related hospitalisations (2.3%, 95%CI 2.1-2.6%), pressure injury (stage II-IV for high-risk individuals) (2.2%, 95%CI 2.0-2.4%), weight loss/malnutrition (0.7%, 95%CI 0.6-0.8%), and medication-related adverse events (0.6%, 95%CI 0.5-0.7%).

Funnel plots of indicators illustrative of state-wide variation are shown in **Appendix 1**. In decreasing order, the state-wide indicators with the most facilities outside the upper 95%CI were: emergency department presentation (N=7/121, 5.8%), falls (N=9/243, 3.7%, **Figure 2**), pressure injuries (N=4/243, 1.6%), fractures (N=2/243, 0.8%), medication-related adverse events (N=1/243, 0.4%). No facilities were above the upper 95%CI for weight loss and malnutrition, or delirium and/or dementia related hospitalisations (**Table 3**). Of the 12 indicators estimated state-wide, there were 57 (23.5%) facilities with at least one indicator outside the upper 95%CI, 20 (8.2%) with two and 4 (1.6%) with three (**Table 3**).

Table 2. Overall Prevalence and 95% Confidence Intervals of ROSA Quality and Safety Indicators for Residents of Permanent Residential Aged Care, 2016

Indicator	Cohort captured	Facilities (N)	Facilities <20 individuals (N)	Facilities ≥20 individuals (N)	Denominator (N)	Numerator (N)	2016 Estimate % (95%CI)
High Sedative Load (overall)	National	2,690	172	2,518	191,285	91,999	48.1 (47.9-48.3)
With dementia	National	2,685	643	2,042	106,313	48,580	45.7 (45.4-45.9)
Without dementia	National	2,667	809	1,858	85,181	43,509	51.1 (50.8-51.4)
Antipsychotic Use (overall)	National	2,690	163	2,527	195,467	46,030	23.5 (23.4-23.7)
With dementia	National	2,685	628	2,057	108,130	34,554	32.0 (31.7-32.2)
Without dementia	National	2,667	780	1,887	87,549	11,502	13.1 (13.0-13.3)
Chronic Opioid Use	National	2,690	147	2,543	203,894	54,598	26.8 (26.6-26.9)
Antibiotic Use ¹	National	2,690	139	2,551	208,355	140,646	67.5 (67.3-67.7)
Premature Mortality	National	2,690	139	2,551	208,355	1,332	0.6 (0.6-0.7)
Falls	State	254	11	243	18,956	1,906	10.1 (9.7-10.4)
Fractures	State	254	11	243	18,956	914	4.8 (4.6-5.1)
Medication-related Adverse Events	State	254	11	243	18,956	110	0.6 (0.5-0.7)
Weight Loss or Malnutrition	State	254	11	243	18,671	136	0.7 (0.6-0.8)
Delirium and/or Dementia	State						2.4 (2.1-2.6)
Hospitalisations		254	50	204	10,515	249	
Emergency Department Presentation							
Long term residents	State	250	129	121	5,441	1,041	19.1 (18.3,20.0)
Short term residents	State	230	214	16	1,984	384	19.4 (17.9-20.9)
Pressure Injury	State	254	11	243	18,956	556	2.9 (2.7-3.1)
Stage II-IV high risk only	State	254	36	218	12,068	269	2.2 (2.0-2.4)

CI, Confidence Interval

¹ Only prevalence antibiotic use indicator is shown

Table 3. Facilities with Indicators Above Upper 95% Confidence Intervals (CI)

Number of indicators above 95%CI	N facilities	Total facilities	%
High Sedative Load	319	2518	12.7
Antipsychotic Use	131	2527	5.2
Chronic Opioid Use	277	2543	10.9
Antibiotic Use	382	2551	15.0
Premature Mortality	2	2551	0.1
Falls	8	243	3.3
Fractures	2	243	0.8
Medication-related Adverse Events	1	243	0.4
Weight Loss or Malnutrition	0	243	0.0
Delirium and/or Dementia Hospitalisations	0	204	0.0
Emergency Department Presentation	7	121	5.8
Pressure Injury	4	243	1.6
Number of facilities with multiple indicators above 95%CI			
National Cohort (2551 facilities) - 5 indicators			
0	1684		66.0
1	664		26.0
2	164		6.4
3	37		1.5
4	2		0.1
South Australian Cohort (243 facilities) - 12 indicators			
0	162		66.7
1	57		23.5
2	20		8.2
3	4		1.6

Discussion

A pragmatic quality and safety reporting system for aged care was developed using ROSA, a resource that leverages **existing aged care and health care data in Australia**. The twelve indicators were selected because of the significant body of evidence surrounding each measure, validated by an expert advisory committee for their potential to inform practice in the aged care sector, and low reporting burden. Examination of the indicator set using data from 2016, found high prevalence of medication-related indicators, with two-thirds (67.5%) exposed to antibiotics, almost half had a high sedative load (48.1%) and approximately one in four residents were exposed to chronic opioid use (26.8%) or an antipsychotic (23.5%). Further, approximately 20% of residents had an emergency department presentation within 30 days of being discharged from hospital, one in ten had at least one fall requiring medical attention and 2.3% of those with dementia had a hospitalisation for dementia and/or delirium. Variation at the facility level, ranges from 0-15% of facilities falling outside the expected upper range of the national averages depending on indicator.

Several countries have active population-based surveillance systems to monitor the safety and quality of aged care based on data collections from surveys (e.g. Sweden, Netherlands),^{21,23} registries(e.g. Sweden)²³ or assessments by providers, such as the Resident Assessment Instrument Minimum Data Set (e.g. Canada, New Zealand).^{11,22,24,28} Indicators developed from administrative data have also been included in the USA for key outcomes such as hospitalisations and emergency department visits.²⁵ It has been argued that use of outcome measures such as those derived from administrative data, be prioritised over process measures of care, given the poor correlation observed with

improvements in process measures and outcomes.²⁹ The utilisation of administrative claims data for routine quality and safety monitoring, such as those included in the *ROSA Outcome Monitoring System*, provide a broad-coverage of key domains in aged care with minimal data collection burden.

Currently, three indicators for aged care have been implemented as of July 2019 by the ACQSC National Aged Care Mandatory Quality Indicator Program.¹³ Public reporting at the provider level is not available yet and the viability and effectiveness of these indicators within the current program is uncertain.³⁰ Further, reporting does not adjust for facilities' case mix differences, nor allows examination of performance related to multiple indicators, and its utility for benchmarking remains unclear. Victoria has also developed the Public Sector Residential Aged Care Services (PSRACS) quality indicators.³¹ These include pressure injuries, falls and fractures, physical restraint, use of polypharmacy and unplanned weight loss. All PSRACS facilities are required to collect, record and report on these indicators to the Victorian Government quarterly. While this only includes public facilities, each receives a summary, comparison with state and reference target ranges.³¹ While there is some overlap between these two Australian-based quality indicators programs, comparisons between their estimates and the *ROSA Outcome Monitoring System* overlapping indicators (namely pressure injury, weight loss, or falls and fall-related fractures) are difficult. These challenges in comparison are due to a lack of publicly available data for the Victorian indicators and differences in reporting systems, including data sources, definitions, reporting measures, periods, and risk adjustment approaches. For illustration purposes, in attempt to compare the ROSA data on pressure injuries, to the employed federal indicators, we estimated that the pressure injury incidence for 90-days with the ROSA data was 0.6/1000 resident-days

(95%CI 0.5-0.7), which is comparable to the national rate (0.76/1000),³⁰ and within range of a study of 426 facilities (0, 95%CI 0-0.8/1000 occupied bed-days) using a private benchmarking company software,³² but lower than from 60 facilities using one management system (1.33/1000 resident-days).³³ These differences in estimates highlight how the definitions and data sources influence the estimates provided for each of the indicators employed by reporting systems. Key strengths of the *ROSA Outcome Monitoring System* include the utilisation of existing data from the Australian aged care and health care sectors, no reliance on providers for reporting, and the indicator specific risk adjustment for the measures developed. Also, while we focused on yearly reporting periods, shorter periods could be employed.

While we believe that this reporting system is a starting point to examine variation in practices and outcomes of the care provided to older Australians, we recognise several limitations. Because public hospital records and subsidised health encounters were used to ascertain some indicators there is likely under-reporting of conditions such as malnutrition/weight loss, pressure injuries, and falls where only more severe cases are likely recorded (or cause) during hospitalisations. Additionally, the use of the PBS records does not capture private prescriptions, medications not PBS-subsidised or indications for their use. While we may be under ascertaining these indicators, this is unlikely to be differential by facilities and therefore the relative differences are likely consistent. Importantly, the prevalence of several indicators is high and variation is present, important information that must be understood for the sector. Seven of the indicators presented were examined only for South Australia, due to current data access restrictions. Once data access is granted all indicators will be examined in other states. Timeliness of data access is also a limitation. The

delay in access is due to availability and multiple ethics, governance, and linkage approvals necessary to create the datasets for such a report. This limitation is not unique to aged care data in Australia nor is insurmountable and could be addressed by national data access policies changes. Our funnel plots did not include 5% of the facilities nationally where the number of residents was deemed too small to examine. An approach to examine variation that accounts for the large uncertainty around estimates from small facilities is still required for this type of reporting. Our reporting of facility level variation is limited to expected random variation. Variation because of facility (e.g. staffing levels and education, care models) or individual differences not captured in our models may still exist.²⁷ Furthermore, the performance of home care providers or appropriate levels of performance for facilities (or home care providers) were not examined. More work is required to capture the whole population accessing long term care and understanding acceptable levels of these indicators.

Our indicators do not examine important domains of care quality, namely accessibility and delivery of person-centred care. Delivery of person-centred care, or individuals' quality of life assessments, are unavailable in the datasets employed. This unfortunately is an area without adequate population level data nationally and requires investment and development.³⁴ The accessibility of care also needs addressing, although we decided not to examine measures that could be ascertained within our data (e.g. timeliness of access) because it was deemed to be outside of the scope of this first set of indicators by our Expert Advisory Committee. Further work on our indicators is also needed to refine, address limitations, and expand their potential impact. This work includes ascertaining the appropriateness of indications for medication use or hospitalisations, enhancing and

validating indicators with clinician or individuals' input, and examining the impact they have on care and outcomes.

In conclusion, twelve indicators to monitor the quality and safety of aged care in Australia based on the synthesis of existing literature and expert advisory validation have been developed. These indicators rely on existing data within the Australian aged care and health care sectors, therefore creating a pragmatic, efficient, and low burden tool to examine quality and unwarranted variation in care. The implementation of these indicators, or potentially a set of these indicators, will provide a starting point to efficiently monitor the quality and safety of aged care and support the development of evidence-based quality improvement initiatives to improve health outcomes and quality of care for older Australians.

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Figure legends:

Figure 1. Crude (a) and Adjusted (b) Antipsychotic Use in Residents of Residential Aged Care in 2527 Facilities in Australia, 2016

Figure 2. Crude (a) and Adjusted (b) Falls in Residents of Residential Aged Care in 243 Facilities in South Australia, 2016