

# Variations in utilisation of colorectal cancer services in South Australia indicated by MBS/PBS benefits: a benefit incidence analysis

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Colorectal cancer (CRC) is the third most common cancer globally, with Australia having one of the highest incidence rates.<sup>1</sup> Differences exist across populations in incidence and survival from CRC both internationally and in Australia.<sup>2</sup> Australians living in the most socioeconomically disadvantaged areas have a higher incidence of CRC compared to those in the most advantaged areas (63 versus 53 per 100,000) and a lower five-year relative survival (56% versus 63%).<sup>3</sup> Differences in mortality rates for CRC are also observed by geographic area of remoteness potentially reflecting differences in access to services. A higher incidence of some CRC sub-types is also evident in people living in rural areas compared to those living in major cities. For example, the incidence of rectal cancer in males in the Lower South East Region was found to be 30% higher than age-sex adjusted South Australian rates and corresponding non-significant elevations were evident in 13 of the 14 other country regions in a 23-year study.<sup>4</sup> Differences in accessing palliative care in Australia are also evident across socioeconomic groups<sup>5</sup> and by remoteness of residential areas.<sup>6</sup> Findings from a South Australian study of patients diagnosed with CRC in 2003–2008 were consistent in showing lower survival in more remote residential areas and among residents of the more socioeconomically disadvantaged areas.<sup>7</sup>

Aims of government cancer strategies in Australia include equity of access to cancer

## Abstract

**Objective:** This study investigated variations in healthcare expenditure for colorectal cancer (CRC) patients in South Australia by socioeconomic position (SEP) and remoteness area.

**Methods:** Benefits incidence analysis (BIA) was used to examine healthcare expenditure and utilisation in relation to CRC patients by SEP and remoteness areas. Utilisation data was obtained for patients diagnosed with CRC in 2003–2013 from a dataset linked to a population-based cancer registry, Medicare Benefits Scheme (MBS), Pharmaceutical Benefits Scheme (PBS), hospital and death data. Concentration indices estimated the distribution of health expenditure on MBS, MBS palliative care, PBS and general practitioners. Costs of claims data and length of stay in hospital were used as indicators of healthcare utilisation.

**Results:** The results indicated that MBS palliative healthcare services utilisation favoured the more advantaged groups for both SEP and remoteness area (Concentration index (CI)= 0.1681, t-value=54.42 (SEP) and CI=0.1546, t-value=41.64). MBS expenditure was also favourable to the more advantaged groups (CI: 0.0785 and 0.0493). PBS and MBS general practitioner expenditure were equal (-0.0093 to 0.0250).

**Conclusion:** Overall MBS and PBS healthcare expenditure for CRC patients was close to equality, however utilisation of MBS-funded palliative healthcare services was less concentrated in low SEP and more remote areas.

**Implications for public health:** Whether the differences in palliative healthcare utilisation supplied by private providers are offset by other services requires investigation to determine if there is a need for initiatives to improve equality and give greater support to those who choose to die at home.

**Key words:** Equity, healthcare utilisation, healthcare access, benefits incidence analysis, colorectal cancer

services by socioeconomic position (SEP) and rural and remote place of residence.<sup>8,9</sup> In the health economics literature, 'equity' is often conceptualised as 'horizontal' or 'vertical'.<sup>10,11</sup> Horizontal refers to members of the population with equal needs receiving equal care (regardless of socioeconomic factors or geographic location) and vertical equity refers to those with different needs

receiving appropriately different amounts of health resources.<sup>12</sup> Universal access to services is a key aim of Australia's health system,<sup>13</sup> in alignment with SA's cancer strategies and should be reflected in the equity of government expenditure across the healthcare system.

Australia has a publicly funded, universal healthcare system Medicare, which includes

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Submitted: May 2021; Revision requested: October 2021; Accepted: November 2021

The authors have stated they have no conflicts of interest.

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Aust NZ J Public Health. 2022; 46:237-42; doi: 10.1111/1753-6405.13197

funding of government-provided community and hospital care plus subsidisation of care provided by private health care providers (e.g. private hospitals, specialists and General Practitioners). Private healthcare subsidies are set according to published fee schedules for services (Medicare Benefits Scheme (MBS)) and pharmaceuticals (Pharmaceutical Benefits Scheme (PBS)). Concession card holders have access to bulk billing of certain services, whereby the Medicare benefit is the full payment for their service with no out-of-pocket costs. Bulk billing can cover GPs and specialists that choose to bulk bill as well as some tests and scans. Patients who are not bulk billed contribute up to 15% of schedule fee (MBS) and up to \$40 per prescription (PBS) if they are not concession card holders, plus any additional fees charged by private providers above schedule fees. Higher subsidies are provided to concessional status patients, including low-income groups, children and the elderly. Privately funded hospital services such as those delivered by specialists, including palliative medicine, come under the MBS scheme.

The distribution of healthcare to members of society is influenced by both the supply and demand of the health system. On the supply side, access to health care outside major city areas may be restrained by limitations in locally available services and infrastructure.<sup>14</sup> Australia's population density is 3.2 people per sq km, but this varies greatly across the country with approximately 30% of the population living outside major city areas, often in sparsely populated areas.<sup>15</sup> In rural and remote South Australia, local cancer services are affiliated with comprehensive cancer centres to achieve equitable access, however, highly specialised services, for example, radiotherapy, remain localised to metropolitan centres. On the demand side, healthcare services' use is influenced by differences in factors such as levels of health literacy and healthcare need. People with low health literacy (i.e. a low capacity to obtain, process, understand and use health information) often have lower rates of health service use and poorer health outcomes.<sup>16</sup> Low SEP and particularly educational attainment can be considered the most important determinant of health literacy.<sup>17</sup> Healthcare need is demonstrated not only in incidence or prevalence levels of disease but also by severity. Rates of CRC screening are lower in more disadvantaged groups,<sup>18,19</sup> leading to detection at later stages of disease.

Out-of-pocket (OOP) costs will also influence demand for services. The required co-payments for services from private providers contribute to Australia's relatively high OOP costs. OECD data show Australia has high OOP at 20%, compared to countries with similar health systems such as the United Kingdom (10%), New Zealand (13%) and Canada (14%). This is an ongoing concern for improving equity of access to health care. General practitioners charging out of pocket costs can be a barrier to accessing their services. Across Australia, the number of people who delay or do not see a GP for cost reasons is higher in regional areas and lowest in major cities.<sup>20</sup> For those suffering from chronic illnesses such as cancer, the fee-for-service payment system in Australia means that OOP costs can rapidly build up to unaffordable annual amounts. The impact is felt most by those on low incomes, in rural and remote areas and who have a poorer health status.<sup>21</sup>

Benefit Incidence Analysis (BIA) has been used previously to estimate the equity of healthcare benefits accrued to individuals across socioeconomic groups. Middle and low-income countries have been the main users of the technique to estimate utilisation of publicly funded healthcare benefits acquired by individuals across SEP groups.<sup>22,23</sup> Concentration indexes have been used previously in Australia for analysing how different socioeconomic groups benefit from government healthcare expenditure,<sup>24,25</sup> however, expenditure focused on cancer patients has not been previously analysed.

The focus of this study was on healthcare expenditure for privately funded hospital attendances as well as the MBS items for private providers outside of hospital attendances. Our aim was to investigate by socioeconomic groups and geographic area of remoteness hospital utilisation by CRC patients and MBS and PBS expenditure. Based on the supply and demand side issues mentioned, we hypothesised that MBS expenditure would be pro-advantaged groups, whereas hospitalisations would be pro-disadvantaged groups and PBS expenditure would be equal.

## Methods

Benefit incidence analysis describes the distribution of benefits, in monetary terms, inferred from the utilisation of health services across SEP groups. Benefits are calculated

by multiplying the number of times each health service is used by their unit cost. To analyse distribution differences, we have used a concentration index and estimated the proportion of services utilised by each subgroup.

## Data sources

Cancers in Australia are registered at state level by population cancer registries (except for non-melanoma skin cancers). For this study we used data for South Australia, which represents seven per cent of the national population.<sup>26</sup> A linked data platform was developed for all patients diagnosed with CRC (ICD10 18–20) between 1 January 2003 and 31 December 2013 as recorded by the South Australian Cancer Registry (SACR). The broad purpose of the data was to explore differences in cancer stage, patterns of care, service utilisation and survival. Cancer registry, hospital inpatient records, health insurance claims (MBS and PBS data) were linked, using recommended gold standard privacy-protecting protocols.<sup>27</sup> From 2003 to 2013 SACR data were also linked to official State death registrations and the National Death Index. Deaths were coded by ICD10-AM and classified as caused by CRC or another cause. See Supporting Information Table 1 for a description of linked data and data items used for this analysis.

## Socioeconomic and geographic groups

Patients' residential postcodes were used to assign area socioeconomic disadvantage using the Socioeconomic Index for Areas (SEIFA) Index of Relative Socioeconomic Disadvantage (IRSD) and geographic remoteness using the Accessibility and Remoteness Index of Australia (ARIA) from the Australian Bureau of Statistics (ABS), the national statistical agency.<sup>28</sup> The SEIFA quintiles represent groups of individuals who live in similarly ranked areas, based on information such as the income, qualifications and occupation skills of the residents.<sup>28</sup> Socioeconomic advantage and disadvantage is defined by the ABS in terms of people's access to material and social resources, and their ability to participate in society.<sup>29</sup> SEIFA scores were categorised into quintiles for analysis, where quintile 1 referred to the most socioeconomically disadvantaged areas. ARIA was classified as 'major city areas', 'inner regional', 'outer regional and remote/very remote' areas.<sup>30</sup>

**Defining the variables**

*Healthcare utilisation*

Publicly available costs to government for each subsidised MBS and PBS item for the period 2008 to 2013 were merged with PBS and MBS item codes of individual patients.<sup>31,32</sup> Item numbers were matched with their costs using historical records of costs from the MBS and PBS. 2013 was used as the base year for costs to control for inflation.

In Australia, there are additional subsidies available to concession card holders. However, as we did not have data on concession cardholder status, we assumed for the purposes of this study that there were no concessions.

Discounting was not undertaken as the analysis does not seek to compare alternative future streams of costs that differ in the timing over which these costs were incurred. Costs were used to indicate health service utilisation. The costs for the last six months of life were excluded from this analysis to avoid effects on raised end-of-life health-service utilisation.<sup>33</sup>

*Palliative healthcare utilisation*

We conducted a separate analysis specifically for palliative care utilisation as inferred from MBS-subsidised palliative medicine specialist services item codes from Group A24 that cover all Medicare funded palliative medicine attendances at hospitals and at home and case conferences items. Details of the MBS item numbers can be found in Supplementary File 1. PBS expenditure was not included in this analysis. Data from 2003 to 2013 were used.

*General Practitioner utilisation*

Separate analyses were conducted for visits to General Practitioners. This included professional attendances and after-hours attendances at a consulting room hospital, institution, or home residential aged care facility. Details of the MBS items numbers are in Supplementary File 1.

**Healthcare benefits**

In this analysis 'benefits' are the government expenditure on health services (MBS) and medicines (PBS). For each person, this was calculated by multiplying the number of times a health service was utilised by the government rebate. As hospital costs were not available, 'benefits' for hospitalisations were measured by the number of days spent

in hospital. We excluded non-palliative care expenditure six months prior to death because not all deaths were CRC related.

**Healthcare need**

To estimate relative need for healthcare in each subgroup, we used the number of patients diagnosed with CRC from 2008 to 2013. To estimate need for palliative healthcare, we used the number of individuals who died during the period 2003–2013. It was necessary to expand the period for this variable to avoid small cell sizes that could potentially increase the risk of identifying patients.

**Benefit incidence analysis**

Concentration indices were used to measure variations in the distribution of MBS claims data.<sup>34</sup> These indices quantified the degree of socioeconomic variation in MBS healthcare utilisation. Concentration indices were calculated for mean total MBS, PBS expenditure and palliative care MBS expenditure to indicate the extent to which utilisation varied by area socioeconomic status and remoteness. We used the SEIFA IRSD and ARIA groups for the calculations:  $u_t=(t=1, \dots, T)$  is the mean expenditure of the  $t$ th IRSD or ARIA group and  $f_t$  its population share.

The concentration index was calculated for each category of healthcare using the formula<sup>35</sup>

$$C = \frac{2}{u} \sum_{t=1}^T f_t u_t R_t - 1$$

where  $R_t$  is the relative rank of  $t$ th IRSD or ARIA group, indicating the cumulative proportion of the population up to the midpoint of each group interval. The index ranges from -1 to +1 and takes on a negative value when expenditure is greater amongst

the more disadvantaged and a positive value when expenditure is greater amongst the less disadvantaged. T- values were calculated to test the significance in the difference of the concentration index with zero.

Comparisons between the distributions of health service expenditure in relation to need (CRC illness and deaths) were also conducted using proportions across socioeconomic and geographic remoteness groups.

All analyses were undertaken in Stata 16.0 and Microsoft Excel. All data were stored in de-identified form and analysed by an approved analyst (EB) in the Secure Unified Research Environment.

**Results**

In 2008 there were 981 patients diagnosed with CRC. The mean length of follow-up of patients was four years and two months (SD 3 years and 3.5 months). In the period 2003–2013 there were 2,393 deaths from CRC and 935 non-CRC related deaths. Deaths in each year can be found in Supplementary Table 2.

General practitioner visits were the most frequently claimed MBS item. Beta blockers (to reduce blood pressure) were the most frequently claimed PBS item and hospital or surgery visits were the most frequently claimed palliative care MBS item. Further details of the most frequently claimed MBS, PBS and palliative care items are in Supplementary Table 3.

Of the four categories of expenditure, MBS palliative healthcare had the highest positive concentration index for socioeconomic groups of 0.1681 (t-value=54.42) (Table 1), indicating that this type of healthcare utilisation was higher for the more advantaged socioeconomic groups. MBS-funded palliative healthcare expenditure was also significantly higher in residents of

**Table 1 : Concentration Indices of MBS, PBS and MBS palliative care expenditure.**

	MBS all items	PBS	MBS Palliative care	MBS General Practitioner items	Hospital days*
SEP groups (95%CI),	0.0785	0.0250	0.1681	-0.0093	-0.0795
t-test	(0.0481–0.1088)	(-0.0132–0.631)	(0.1621–0.1742)	(-0.0282–0.0097)	(-0.1240– -0.0350)
	5.07	1.28	54.42	-0.96	-3.50
	p<0.05	p>0.05	p<0.05	p>0.05	p<0.05
Geographic remoteness (95%CI),	0.0493	0.0031	0.1546	-0.0032	-0.0735
t-test	(0.0282–0.0704)	(-0.0411–0.0473)	(0.1473–0.1619)	(-0.0179–0.0116)	(-0.1177– -0.0293)
	4.59	0.14	41.64	-0.42	-3.26
	p<0.05	p>0.05	p<0.05	p>0.05	p<0.05

Notes:

MBS=Medicare Benefits Schedule, PBS=Pharmaceutical Benefits Schedule, \*controlled for death by subtracting admissions in calendar year of death

major city areas, with a concentration index of 0.1546 ( $t$ -value=41.64). The concentration indices for total MBS expenditure were positive but lower (0.0785 by socioeconomic group and 0.0493 by area of remoteness ( $t$ -values 4.59 and 5.07)) and those for total PBS and for MBS General practitioner expenditure were close to equality (-0.0093 to 0.0250; not statistically significantly different from zero). In contrast, hospital days had significant negative concentration indices for both socioeconomic and geographic remoteness groups, indicating that hospital days were higher for those in more disadvantaged groups.

The distribution of MBS and PBS claims (benefits) in relation to need are presented in Figures 1 and 2. Comparing healthcare need across socioeconomic quintiles, PBS expenditure more closely matched the distribution of CRC by socioeconomic status than MBS expenditure (Figure 1). Expenditure indicates that healthcare utilisation funded by the MBS and PBS is unevenly allocated across SEP groups, with lower utilisation in the lowest quintiles. For example, Quintile 1 has 27% of CRC cases but only 22% of MBS and 23% of PBS expenditure on service utilisation.

MBS claims by area of remoteness indicates that 24% of funded utilisation related to CRC cases living outside major city areas, whereas registry data indicate that 29% of CRC cases lived in these areas (Figure 1).

Large differences in the proportion of benefits from MBS palliative care expenditure compared to numbers of CRC related deaths can be seen in the comparison of geographic

remoteness groups and socioeconomic quintiles (Figure 2). Deaths outside of the metropolitan area account for 28% of CRC deaths compared with 13% of MBS expenditure. For socioeconomic groups, quintile 1 had 28% of CRC deaths but only 16% of MBS Palliative care expenditure. Quintile 5 had 13% of CRC deaths and 23% of MBS Palliative care expenditure.

### Discussion

Our study of CRC patients in South Australia indicated that MBS funded palliative healthcare and overall MBS claims were greater for residents of higher socioeconomic areas and metropolitan areas compared with lower socioeconomic areas and those outside the major city. In contrast, more days in hospital were indicated for disadvantaged groups, both socioeconomically and by area of remoteness. MBS general practitioner visits and PBS healthcare benefits were closer to equal across socioeconomic and geographic groups.

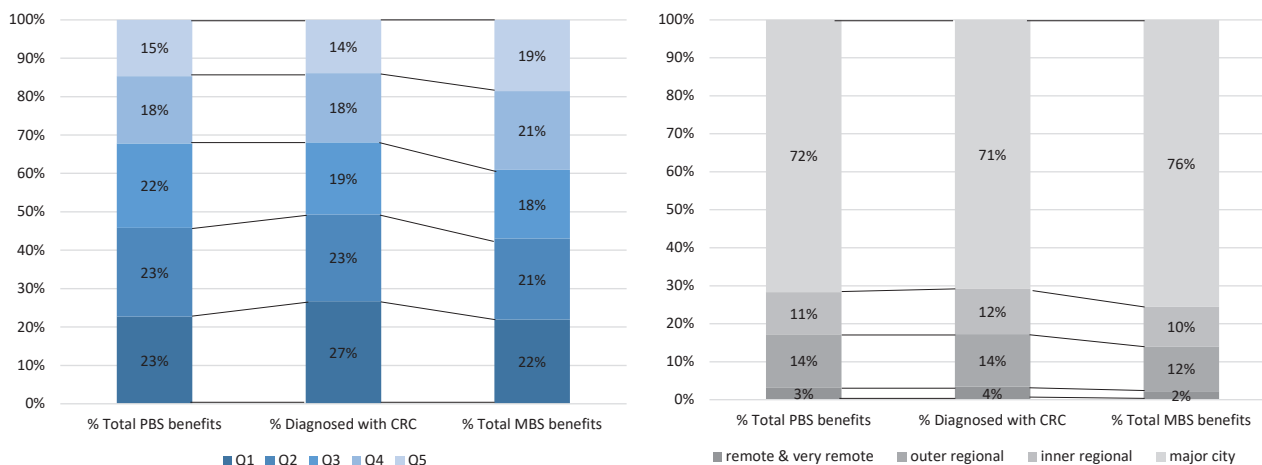
The health service needs of individuals with cancer are not equal and this is a limitation of our analysis. Patient healthcare needs vary due to cancer stage and comorbidities and this was not considered in our analysis. However, previous Australian studies have shown that the more socioeconomically disadvantaged quintiles had higher percentages of later stage cancers when compared to more advantaged quintiles,<sup>36,37</sup> which are more costly to treat. We did not have access to hospital

costs data but this may explain the greater hospitalisation utilisation amongst the more socioeconomically disadvantaged. The evidence of differences in stage of diagnosis between CRC patients from metropolitan and non-metropolitan in Australia is inconclusive, however, non-metropolitan have lower five-year survival from CRC.<sup>38</sup>

Palliative care received specifically for CRC patients by socioeconomic position or area of remoteness has not been examined previously in Australia. Our findings, of MBS palliative healthcare favouring advantaged groups, are consistent with a recent review of the impact of SEP on end-of-life costs, which found greater expenditure for higher SEP patients, even within countries providing universal healthcare.<sup>33</sup> There are caveats around Medicare data being used to establish the extent of palliative care services provided. Currently, there is no nationally consistent routinely collected primary care data that enables reporting of palliative care by GPs.<sup>5</sup> Also, the MBS palliative care items refer to services delivered by private palliative medicine specialists. These data indicate that disadvantaged groups are not utilising MBS-funded private palliative medicine specialists to the extent undertaken by more advantaged groups. This could reflect their ability to pay extra costs for specialist services, and the OOP expenses, or that they experience limited access to these services. Palliative hospices are usually located in major cities.<sup>39</sup>

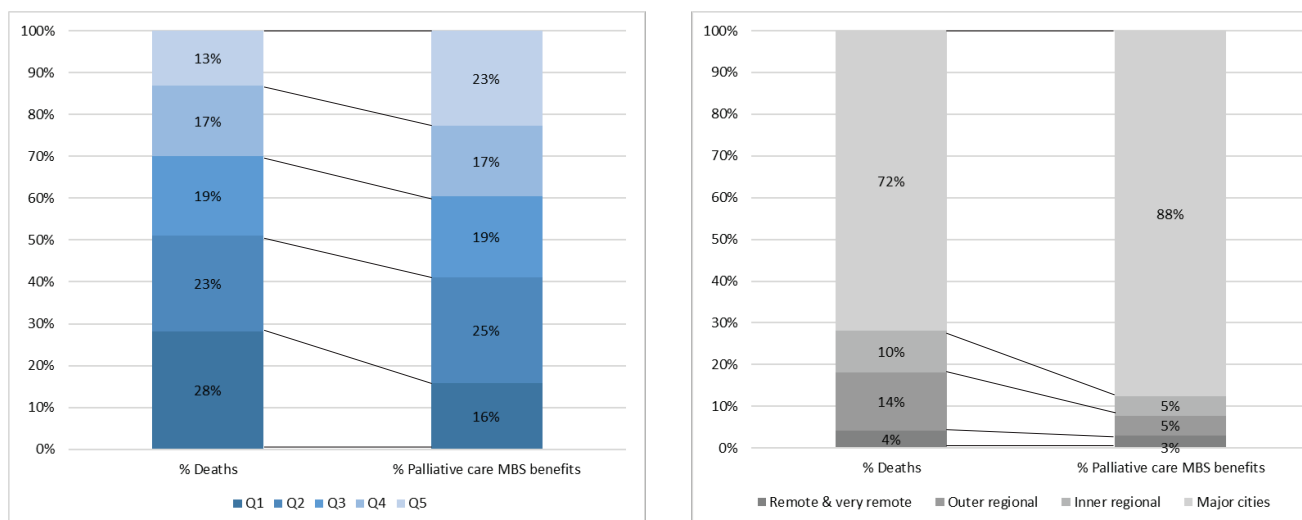
We were unable to analyse MBS-funded inpatient and community palliative care in South Australia. But in Australia, the overall

Figure 1: Distribution of CRC diagnoses and MBS and PBS expenditure across socioeconomic quintiles and ARIA groups.



Notes: Q1=most disadvantaged socioeconomic group; MBS= Medicare Benefits Schedule; PBS=Pharmaceutical Benefits Schedule.

Figure 2: Distribution of deaths and MBS palliative care expenditure across SEIFA quintiles and ARIA groups.



## Notes:

Q1=most disadvantaged socioeconomic group; MBS= Medicare Benefits Schedule; PBS=Pharmaceutical Benefits Schedule.

percentage of total MBS-funded inpatient and community palliative care is almost double for the least disadvantaged groups (29.3%) compared to the most disadvantaged (15.9%).<sup>5</sup> CRC is the fifth most frequently recorded diagnosis for accessing palliative care in hospitals<sup>5</sup> and palliative care related hospitalisations in public hospitals are twice as high for the most disadvantaged group than the least disadvantaged, reflecting a greater tendency to die in hospital than at home for more disadvantaged groups.<sup>5</sup> It has been estimated that 60–70% of people would prefer to die at home but only about 14% do so.<sup>40,41</sup> A report commissioned by the Australian Government Department of Health indicated that the healthcare system was not providing equal access to community based palliative care for disadvantaged groups, implying that the services are available but are being under-accessed.<sup>42</sup>

A limitation of the pharmaceutical expenditure data used in this study is that we used estimates rather than actual costs to government. In Australia, the government provides additional subsidies for those on low incomes, of up to \$36.10 (in 2013) per prescription. As we did not have records of concession card holder patients, this was not accounted for and the government expenditure is therefore likely to be underestimated for lower socioeconomic groups. The PBS expenditure estimates may therefore be more pro-disadvantaged than reported.

## Conclusions

Our findings indicate that MBS palliative healthcare services were least utilised by CRC patients living in the more socioeconomically disadvantaged areas and those residing outside major city areas. Reducing variations in access to cancer care is an aim in most Australian national cancer control plans.<sup>9,43</sup> Many high-income countries similarly aim to reduce these variations and 'benefit incidence analysis' appears useful for investigating the distribution of healthcare utilisation. The extent to which these differences in healthcare utilisation supplied by private providers are offset by use of public hospital services requires investigation to determine whether net imbalances exist and, if so, whether there is a need for initiatives to improve equality in palliative care utilisation and to provide greater support to those who choose to die at home.

## Availability of data and materials

The data that support the findings of this study are available from SA Department of Health and Wellbeing and the Australian Institute of Health and Welfare but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of SA Department of Health and Wellbeing and the Australian Institute of Health and Welfare.

## Ethics approval and consent to participate

Approval from Australian Institute for Health and Welfare Human Research Ethics Committee (reference no EO2016/4/317) and the SA Department of Health and Wellbeing HREC (HREC/16/SAH/6) was provided for this project.

## Funding

A.L. is funded by a Dean's Postdoctoral Research Fellowship, Deakin University. N.M. is partly funded by the Cancer Council Victoria. This study received financial support from the Australian National Data Service for data linkage and project activities. D.R. receives support from Cancer Council's Beat Cancer Project on behalf of its donors.

## References

1. Globocan. *Cancer Fact Sheet: Colorectum and Anus*. Lyon (FRA): International Agency for Research on Cancer; 2018.
2. Aarts MJ, Lemmens VE, Louwman MW, Kunst AE, Coebergh JW. Socioeconomic status and changing inequalities in colorectal cancer? A review of the associations with risk, treatment and outcome. *Eur J Cancer*. 2010;46:15.
3. Australian Institute of Health and Welfare. *Cancer in Australia 2019*. Cancer Series No. 119. Canberra (AUST): AIHW; 2019.
4. South Australian Cancer Registry. *Incidence, Mortality and Survival 1977 to 2000*. Adelaide (AUST): South Australian Department of Human Services Epidemiology Branch; 2001.
5. Australian Institute of Health and Welfare. *Palliative Care Services in Australia*. Canberra (AUST): AIHW; 2019.
6. Urbis. *Evaluation of the National Palliative Care Strategy 2010 Final Report*. Canberra (AUST): Australian Government Department of Health; 2016.

7. Beckmann KR, Bennett A, Young GP, Cole SR, Joshi R, Adams J, et al. Sociodemographic disparities in survival from colorectal cancer in South Australia: A population-wide data linkage study. *BMC Health Serv Res.* 2016;16:24.
8. The Cancer Council South Australia. *Statewide Cancer Control Plan 2006 – 2009*. Adelaide (AUST): South Australia Department of Health; 2006.
9. The Cancer Council South Australia, SA Department of Health. *Statewide Cancer Control Plan 2011–2015*. Adelaide (AUST): South Australia Department of Health; 2011.
10. Wagstaff A. Equity in Health Care Finance and Delivery. In: Culyer A, editor. *Handbook of Health Economics*. Amsterdam (NLD): Elsevier; 2000.
11. Mooney G. Inequity in Australian health care: How do we progress from here? *Aust N Z J Public Health.* 2003;27:3.
12. Mooney G, Jan S. Vertical equity: Weighting outcomes? Or establishing procedures? *Health Policy.* 1997;39(1):79-87.
13. Department of Health. *Medicare* [Internet]. Canberra (AUST): Government of Australia; 2021 [cited 2021 Oct 4]. Available from: <https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-medicarebenefits-healthpro>
14. Thomas SL, Wakeman J, Humphreys JS. Ensuring equity of access to primary health care in rural and remote Australia - what core services should be locally available? *Int J Equity Health.* 2015;14:111.
15. Australian Bureau of Statistics. *3218.0 - Regional Population Growth, Australia, 2018-19*. Canberra (AUST): ABS; 2020.
16. Batterham RW, Hawkins M, Collins PA, Buchbinder R, Osborne RH. Health literacy: Applying current concepts to improve health services and reduce health inequalities. *Public Health.* 2016;132:3-12.
17. Stormacq C, Van den Broucke S, Wosinski J. Does health literacy mediate the relationship between socioeconomic status and health disparities? Integrative review. *Health Promot Int.* 2018;34:5.
18. Australian Institute of Health and Welfare. *National Bowel Cancer Screening Program Monitoring Report 2020*. Cancer Series No.:126. Canberra (AUST): AIHW; 2020.
19. Martini A, Javanparast S, Ward PR, Baratiny G, Gill T, Cole S, et al. Colorectal cancer screening in rural and remote areas: Analysis of the National Bowel Cancer Screening Program data for South Australia. *Rural Remote Health.* 2011;11:2.
20. Australian Institute for Health and Welfare. *Patients' Out-of-pocket Spending on Medicare Services, 2016–17*. Canberra (AUST): AIHW; 2018.
21. Duckett S, Breadon P, Farmer J. *Out of Pocket Costs: Hitting the Most Vulnerable Hardest*. Melbourne (AUST): Grattan Institute; 2014.
22. Bowser D, Patenaude B, Bhawalkar M, Duran D, Berman P. Benefit incidence analysis in public health facilities in India: Utilization and benefits at the national and state levels. *Int J Equity Health.* 2019;18:1.
23. Khan JA, Ahmed S, MacLennan M, Sarker AR, Sultana M, Rahman H. Benefit incidence analysis of healthcare in Bangladesh - equity matters for universal health coverage. *Health Policy Plan.* 2017;32:3.
24. Dalziel KM, Huang L, Hiscock H, Clarke PM. Born equal? The distribution of government Medicare spending for children. *Soc Sci Med.* 2018;208:50-4.
25. Knott RJ, Cass A, Heeley EL, Chalmers JP, Peiris DP, Clarke PM. How fair is Medicare? The income-related distribution of Medicare benefits with special focus on chronic care items. *Med J Aust.* 2012;197:11.
26. Australian Bureau of Statistics. *3101.0 - Australian Demographic Statistics*. Canberra (AUST): ABS; 2019.
27. National Statistical Service. *A Guide for Data Integration Projects Involving Commonwealth Data for Statistical and Research Purposes* [Internet]. Canberra (AUST): Government of Australia; 2017 [cited 2021 Oct 1]. Available from: <https://statistical-data-integration.govspace.gov.au/>
28. Australian Bureau of Statistics. *Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia*. Canberra (AUST): ABS; 2018.
29. Australian Bureau of Statistics. *2033.0.55.001 - Advantage & Disadvantage: The Concepts* [Internet]. Canberra (AUST): ABS; 2018 [cited 2021 Apr 19]. Available from: <https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~Advantage%20&%20Disadvantage:%20The%20Concepts~9>
30. Australian Bureau of Statistics. *The Australian Statistical Geography Standard Remoteness Structure* [Internet]. Canberra (AUST): ABS; 2018 [cited 2020 Jun 5]. Available from: <https://www.abs.gov.au/websitedbs/D3310114.nsf/home/remoteness+structure>
31. Australian Government Department of Health. *PBS Publications Archive*. Canberra (AUST): Government of Australia; 2020.
32. Australian Government Department of Health. *MBS Online Downloads* [Internet]. Canberra (AUST): Government of Australia; 2020 [cited 2020 Feb 10]. Available from: <http://www.mbsonline.gov.au/internet/mbsonline/publishing.nsf/Content/downloads>
33. Yu CW, Alavinia SM, Alter DA. Impact of socioeconomic status on end-of-life costs: A systematic review and meta-analysis. *BMC Palliat Care.* 2020;19:1.
34. Love-Koh J, Griffin S, Kataika E, Revill P, Sibandze S, Walker S. *Incorporating Concerns for Equity into Health Resource Allocation: A Guide for Practitioners*. York (UK): University of York Centre for Health Economics; 2019.
35. Kakwani N, Wagstaff A, van Doorslaer E. Socioeconomic inequalities in health: Measurement, computation, and statistical inference. *J Econom.* 1997;77:1.
36. Stanbury JF, Baade PD, Yu Y, Yu XQ. Cancer survival in New South Wales, Australia: Socioeconomic disparities remain despite overall improvements. *BMC Cancer.* 2016;16:1.
37. Luke C, Nguyen AM, Priest K, Roder D. Female breast cancers are getting smaller, but socio-demographic differences remain. *Aust N Z J Public Health.* 2004;28:4.
38. Crawford-Williams F, March S, Goodwin BC, Ireland MJ, Chambers SK, Aitken JF, et al. Geographic variations in stage at diagnosis and survival for colorectal cancer in Australia: A systematic review. *Eur J Cancer Care (Engl).* 2019;28:3.
39. Gordon R, Eagar K, Currow D, Green J. Current funding and financing issues in the Australian hospice and palliative care sector. *J Pain Symptom Manage.* 2009;38:1.
40. Swerissen H, Duckett S. *Dying Well*. Melbourne (AUST): Grattan Institute; 2014.
41. McCaffrey N, Agar M, Harlum J, Karnon J, Currow D, Eckermann S. Is home-based palliative care cost-effective? An economic evaluation of the Palliative Care Extended Packages at Home (PEACH) pilot. *BMJ Support Palliat Care.* 2013;3:4.
42. Australian Healthcare Associates. *Exploratory Analysis of Barriers to Palliative Care*. Canberra (AUST): Australian Government Department of Health; 2019.
43. Cancer Australia. *Cancer Australia Strategic Plan 2014–2019*. Sydney (AUST): Cancer Australia; 2014.

## Supporting Information

Additional supporting information may be found in the online version of this article:

**Supplementary Table 1:** Table 1: linked datasets used for investigating utilization of MBS and PBS funded services.

**Supplementary Table 2:** CRC deaths 2003–2013.

**Supplementary Table 3:** Top 5 most frequently claimed PBS, MBS and MBS palliative care items.