

Is capital investment in Australian hospitals effectively funding patient access to efficient public hospital care?

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Abstract

Objective. This study asks ‘Is capital investment in Australian public hospitals effectively funding patient access to efficient hospital care?’

Methods. The study drew information from semistructured interviews with senior health infrastructure officials, literature reviews and World Health Organization (WHO) reports. To identify which systems most effectively fund patient access to efficient hospitals, capital allocation systems for 17 Organisation for Economic Cooperation and Development (OECD) countries were assessed.

Results. Australian government objectives (equitable access to clinically appropriate, efficient, sustainable, innovative, patient-based) for acute health services are not directly addressed within Australian capital allocation systems for hospitals. Instead, Australia retains a prioritised hospital investment system for institutionally based asset replacement and capital planning, aligned with budgetary and political priorities. Australian systems of capital allocation for public hospitals were found not to match health system objectives for allocative, productive and dynamic efficiency. Australia scored below average in funding patient access to efficient hospitals. The OECD countries most effectively funding patient access to efficient hospital care have transitioned to diagnosis-related group (DRG) aligned capital funding. Measures of effective capital allocation for hospitals, patient access and efficiency found mixed government–private–public partnerships performed poorly with inferior access to capital than DRG-aligned systems, with the worst performing systems based on private finance.

Conclusion. Australian capital allocation systems for hospitals do not meet Australian government standards for the health system. Transition to a diagnosis-based system of capital allocation would align capital allocation with government standards and has been found to improve patient access to efficient hospital care.

What is known about the topic? Very little is known about the effectiveness of Australian capital allocation for public hospitals. In Australia, capital is rarely discussed in the context of efficiency, although poor built capital and inappropriate technologies are acknowledged as limitations to improving efficiency. Capital allocated for public hospitals by state and territory is no longer reported by Australian Institute of Health and Welfare due to problems with data reliability. International comparative reviews of capital funding for hospitals have not included Australia. Most comparative efficiency reviews for health avoid considering capital allocation. The national review of hospitals found capital allocation information makes it difficult to determine ‘if we have it right’ in terms of investment for health services. Problems with capital allocation systems for public hospitals have been identified within state-based reviews of health service delivery. The Productivity Commission was unable to identify the cost of capital used in treating patients in Australian public hospitals. Instead, building and equipment depreciation plus the user cost of capital (or the cost of using the money invested in the asset) are used to estimate the cost of capital required for patient care, despite concerns about accuracy and comparability.

What does this paper add? This is the first study to review capital allocation systems for Australian public hospitals, to evaluate those systems against the contemporary objectives of the health systems and to assess whether prevailing Australian allocation systems deliver funds to facilitate patient access to efficient hospital care. This is the first study to evaluate Australian hospital capital allocation and efficiency. It compares the objectives of the Australian public hospitals system (for universal access to patient-centred, efficient and effective health care) against a range of capital funding mechanisms used in comparable health systems. It is also the first comparative review of international capital funding systems to include Australia.

What are the implications for practitioners? Clinical quality and operational efficiency in hospitals require access for all patients to technologically appropriate hospitals. Funding for appropriate public hospital facilities, medical equipment and information and communications technology is not connected to activity-based funding in Australia. This

study examines how capital can most effectively be allocated to provide patient access to efficient hospital care for Australian public hospitals. Capital investment for hospitals that is patient based, rather than institutionally focused, aligns with higher efficiency.

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Introduction

Commonwealth government funding requires hospitals to deliver improvements in quality of care at the efficient price with limited growth in activity-based funding.¹ Yet patient numbers increase, clinical practice evolves and technological advances and replacement costs for medical equipment increasingly challenge hospitals.

Resolving this dilemma involves the key concepts of appropriate, sustainable and effective healthcare and three significant efficiency instruments. In this study these terms are understood to be:

- ‘Appropriate’ acute health facilities are suitable or fitting for their purpose.² Appropriate care derives from government agreements and Australian evidence-based standards.^{3–5} National standards affirm that all Australians are entitled to access safe, high-quality health care that is responsive to the needs of individuals.^{4,6–8} Appropriate health facilities provide access for individuals to contemporary standards of care.
- ‘Sustainable’ has two meanings in the health context: (1) financial sustainability for governments and health services; and (2) environmental sustainability. Financial sustainability within the health sector identifies the ‘desirable composition of the capital stock to bequeath to future generations.’⁹ Manageable and predictable levels of expenditure are determined by maximising efficiency.^{10,11}
- ‘Effectiveness’ identifies whether the outputs of the service achieve the stated objectives of that service⁶ in terms of equity of access, appropriateness and quality.⁶
- ‘Efficiency’ has three elements, namely allocative, productive (or technical efficiency) and dynamic efficiency.¹² Efficiency in hospitals considers the quality of health services, access to care and cost.¹³
- ‘Allocative efficiency’ optimises the distribution of assets to achieve the greatest community well-being or outcomes at a point in time.¹² In health, allocative efficiency involves priority setting for the distribution of resources between elements of the health system.¹⁴ Allocative efficiency is the optimal choice of input proportions, given their respective prices, according to their cost-effectiveness.¹⁵ Productive efficiency and allocative efficiencies together provide the concept of economic efficiency.
- ‘Productive or technical efficiency’ maximises outputs for a given level of inputs so that achieving an additional output requires additional inputs.¹⁶ Productive efficiency can be measured as a ratio of outputs to inputs.⁶
- ‘Dynamic efficiency’ is the allocation of resources to achieve the greatest possible community well-being or outcomes over time.¹² Dynamic efficiency examines how effectively capital distribution systems respond to emerging risks for public hospitals, including sustainability, patient demand, technological change and increased acuity.^{17–19}

An effective system of capital allocation for public hospitals would provide equity of access for patients, be appropriate, efficient and would fund quality services.²⁰ So the aim of the present study was to ask the question, is the system of capital funding for Australian hospitals effectively funding patient access to efficient public hospital care?

Hospitals achieving productive efficiency have been found to require access to capital that is timely, flexible, affordable and fairly distributed.^{21,22} Allocative efficiency of capital in public hospitals requires capital resources to be optimised for maximum social benefit, which, in the case of public hospitals, is described as patient access to appropriate treatment. In considering assessing which systems most effectively fund patient access to efficient public hospital care, comparative measures of the access of hospitals to capital, patient access to hospital services and productive efficiency have been identified in Fig. 1, which illustrates the relationship between the qualities sought for Australian hospitals and the measures used in this study to assess the ability of hospitals to fund patient access to efficient care.

Methods

To investigate whether the capital funding of Australian hospitals effectively funds patient access to efficient public hospital care, we addressed the following questions: (1) how is capital allocated for acute care to public hospitals in Australia; and (2) what is international best practice for allocating capital to hospital infrastructure for acute care? To understand Australian processes and priority setting for hospital capital funding, 10 senior health officials,²³ experienced in the process of capital allocations to hospitals, were interviewed about capital decision making across three domains: (1) the process of capital allocation for public hospitals; (2) decision making about funding levels; and (3) health system objectives, including clinical appropriateness, sustainability, approach to innovation and evidence-based change, patient-centred care, clinical pathways and evidence-based design. This study was granted ethics approval (SPH-86-2013) by Curtin University. Semistructured interviews were conducted over a 12-month period with the senior health officials sharing responsibility for capital funding systems covering 84% of Australian public hospitals.²³ Officials from two states and one territory declined invitations to participate in the study.

In addition to interviews, a literature review was conducted to identify publications addressing Australian and overseas capital allocation systems with the following objectives: (1) to determine the methods for allocating capital for public hospitals in Organisation for Economic Cooperation and Development (OECD) health systems; (2) to assess the ability of public hospitals to fund access to efficient care; and (3) to identify the attributes of an effective system of investment for public hospitals.

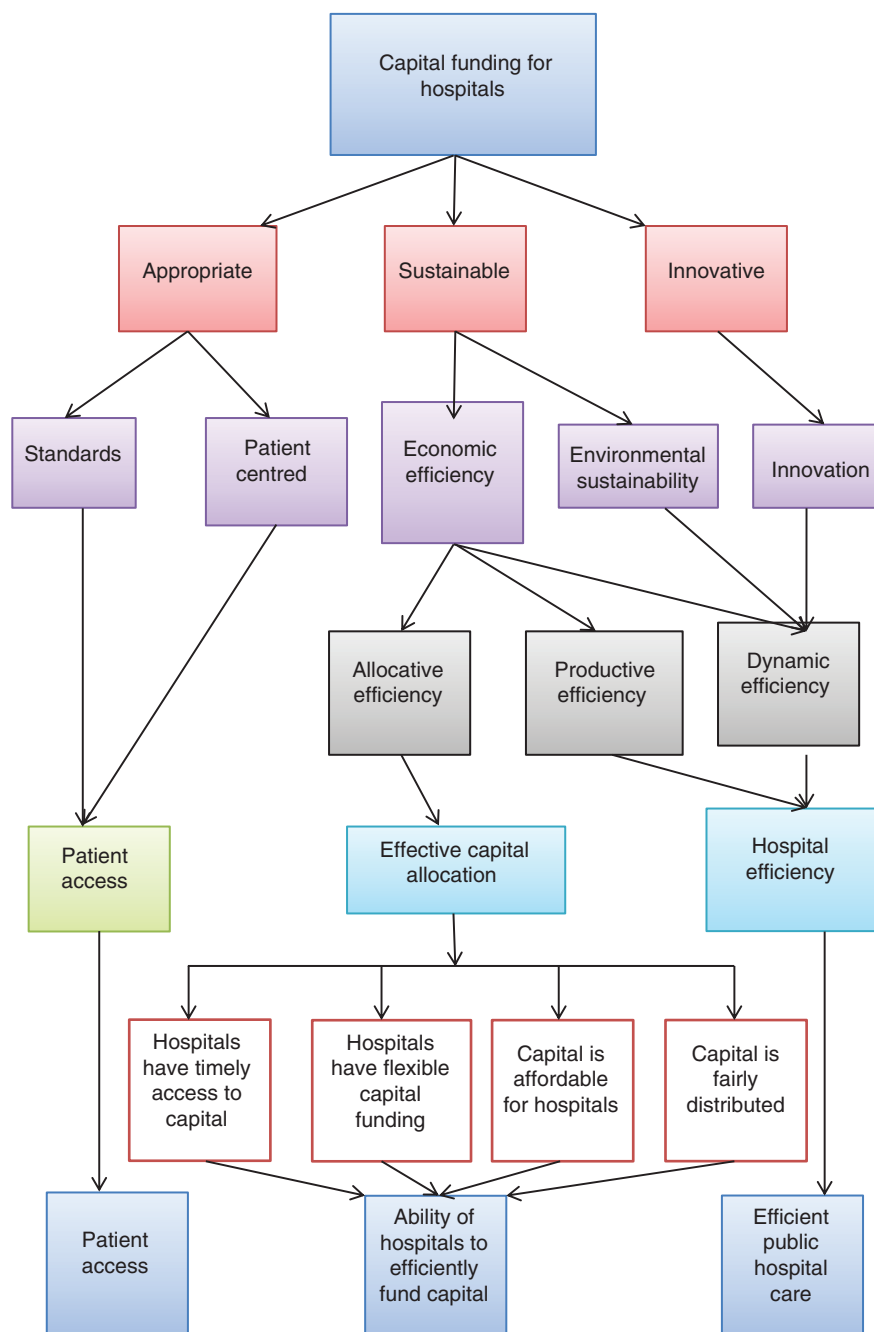


Fig. 1. Funding patient access to efficient hospitals, qualities and measures.

Inclusion criteria for the literature review were articles or reports published after 2000 in the English-language peer-reviewed literature on system-wide approaches to capital funding. Articles were identified using the search terms 'capital allocat*' with 'hospital*', 'patient access' and 'public hospital investment process' and variants thereof for OECD countries in the electronic databases Emerald, Informit and Medline. Items were reviewed based on title and abstract and excluded if only one hospital was discussed, references were for social or intellectual capital or the studies were focused on portfolio investment strategies. Well-known comparative health efficiency

studies were excluded because they did not include capital.^{24–28} Three relevant Australian references were identified^{12,13,29} in addition to 58 reports and articles for the international comparisons.^{15,22,30–85}

Searching Australian government and university websites using the same criteria as for the peer-reviewed literature identified 56 relevant documents^{5,86–140} that were used to verify the results of the Australian interviews. International grey literature information sources and websites included the World Health Organization (WHO), relevant European, US and UK official websites, the OECD, the Commonwealth Fund and

university health economic sites (McMaster, University of York, Imperial College London, London School of Economics, London School of Hygiene and Tropical Medicine). The literature review provided sufficient data on national capital allocation systems for the 17 OECD countries. The WHO Health in Transition (HiT) studies^{31–38,40–46,48–50,53,58,59,67,73} for those nations provided a common source.⁵¹ National systems for capital allocation for public hospitals were identified from the HiT studies and categorised into five groups, namely diagnosis-related group (DRG)-type systems, government subsidy, government project grants, mixed government–private–public partnership (PPP) or private funding (Table 1).

Health systems in Australia identify efficiency, sustainability, innovation and patient-centred care as system objectives.^{141–144} Three aspects of economic efficiency were examined: (1) productive efficiency, analysed from econometric reports on efficiency;^{10,12,13,15,22,52,145} (2) allocative efficiency measures, which, in the present study, are based on systems for priority setting for public hospital capital allocation and patient access; and (3) dynamic efficiency, assessed by examining systems for environmental sustainability, responsiveness to innovation and patient-centred care.¹⁷

Productive efficiency was scored from three studies ranking WHO member countries for health service allocative and productive efficiency.^{15,22,52} These three studies ranked 191 countries using frontier production function model and data envelope analysis, and were reviewed by an international scientific committee^{146–148} and by the European Commission study of health system efficiency.¹⁴⁵ Each study had a different emphasis and measures providing different, but comparable, national rankings. Conversion of rankings to graduated scores within the range 0–3 was based on relative rankings between the

17 OECD countries and Australia such that the highest-ranking nation (of the designated group) for each study scored 3, the second scored 2.83 and the lowest-ranked countries scored 0.17 for each study. The scores for each nation across the three studies were then averaged to provide one national score for productive efficiency.

To compare the measures for capital from national and international sources, a common scoring scheme was developed across the measures to be tested: hospital access to capital and patient access to hospital to match the measure for productive efficiency. Together, these measures were used to assess which systems most effectively fund patient access to efficient hospital care (Fig. 1).

‘Patient access to hospital’ and ‘hospital access to capital’ were assessed by three scorers (RK, DVH, Rachel Moorin) using the 0–3 scoring system (with 3 the highest score, 2 indicating satisfactory, 1 indicating poor or inadequate and 0 indicating a very poor standard). Scores were based on extracts from Section 4.1 of each HiT study and other peer-reviewed studies.^{10,12,31–51,53–74,81–85,149–159}

Using the same scoring system, scoring for ‘hospital access to capital’ per country was for each of the four domains (timely access to capital, flexibility of funding, affordable capital and fairness of distribution); these domain scores were averaged to provide a single score for ‘hospital access to capital’ within the 0–3 range for each country. ‘Patient access to hospital’ was scored directly for each country. Then, the scores for each country, as assessed by the three scorers, were averaged to provide a final score in the range 0–3 for ‘patient access to hospital’ and ‘hospital access to capital’.

Scoring was compared between scorers using weighted Cohen’s kappa analysis.¹⁶⁰ Scoring of these measures reflected

Table 1. Source of capital funds for hospitals in Australia and 17 Organisation for Economic Cooperation and Development countries

Data from World Health Organization (WHO) Health Systems in Transition by nation and other peer-reviewed literature. PPP, private–public partnerships; DRG, diagnosis-related group

	DRG-type	Government subsidy	Capital funding Government project grant	Mixed government–PPP	Private funding
Australia ^{10,12,74}			✓	✓	
Austria ^{31,32}	✓	✓			
Belgium ^{33,59}		✓	✓		✓
Canada ^{34,82}			✓		✓
Denmark ^{35,36,66}		✓	✓		
Finland ^{37,83,158}	✓				
France ^{38,40}	✓		✓		
Germany ^{41,61,84}		✓			
Italy ^{42,159}	✓				
Japan ⁴³				✓	✓
Netherlands ^{44,67}	✓				
Norway ⁴⁵	✓		✓		
Portugal ^{46,157}			✓	✓	
Spain ^{58,73}			✓	✓	
Sweden ⁴⁸	✓				
Switzerland ⁵³	✓				
UK ^{49,85}				✓	
USA ^{50,57}	✓				✓
Total	9	4	8	5	4

Table 2. Mean scores for access to capital, patient access to hospital and efficiency in Australia and 17 Organisation for Economic Cooperation and Development nations

Data from World Health Organization (WHO) Health in Transition reviews, other peer-reviewed literature and the scoring of Evans¹⁵, Murray²² and Tandon⁵²

Country	Hospital access to capital	Patient access to hospital	Economic efficiency	Total
France ^{38,40}	2.8	3	3	8.8
Netherlands ^{44,67}	2.8	3	3	8.8
Switzerland ⁵³	2.7	3	3	8.7
Austria ^{31,32}	2.7	2.3	3	8
Germany ^{41,61,84}	2.3	3	2.3	7.6
Norway ⁴⁵	2.8	1.7	2.7	7.2
Japan ⁴³	0.8	3	3	6.8
Average	1.64	1.8	2.7	6.14
Australia ^{10,12,74}	1.75	2	2.3	6.05
Finland ^{37,83,158}	2.2	1.3	2.3	5.8
Belgium ^{33,59}	1.6	1.3	2.7	5.6
Italy ^{42,159}	1.3	1.3	3	5.6
Sweden ⁴⁸	1.1	1.3	3	5.4
UK ^{49,85}	0.5	1.7	3	5.2
Portugal ^{46,157}	0.8	1.3	3	5.1
Denmark ^{35,36,66}	1.3	1.3	2	4.6
Spain ^{58,73}	0.8	1	2.7	4.5
Canada ^{34,82}	0.9	1	2.3	4.2
USA ^{50,57}	0.6	0.3	2	2.9

Table 3. Mean scores for access to capital, patient access to hospital and efficiency by capital allocation systems
CaDRG, capital aligned to the diagnosis-related group

System	Access to capital	Patient access	Efficiency	Total
CaDRG minus US	2.1	2.1	2.0	6.2
CaDRG including US	2.3	1.9	1.8	6.0
Government subsidy	2.0	2.0	1.2	5.1
Government project grants	1.6	1.6	1.5	4.7
Private-public partnerships	0.7	1.8	1.9	4.4
Predominantly private	1.0	1.4	1.4	3.8

fair to moderate agreement or better, with no levels of poor agreement.

Scores for hospital access to capital, patient access to hospital and efficiency were summed (Table 2) to assess how effectively hospitals fund patient access to efficient hospitals for each country. Finally, in Table 3, countries were grouped by their system of capital allocation (Table 1) for the qualities of hospital access to capital, patient access to hospital and efficiency (Table 2) to assess which funding system most effectively funds patient access to efficient care. Because the US scored considerably lower than most other countries, the funding categories were expanded to include DRGs without the US to aid comparison.

Results and discussion

Capital allocation systems in Australia

Interviews with senior officials identified that all Australian states have similar systems for annual capital allocations for

public hospitals. Regional health authorities compile prioritised project investment lists that are amalgamated and prioritised centrally for funding. Decision making on capital for public hospitals was identified by 43% of senior officials to take place in the state departments of health, whereas 29% indicated that decision making was at ministerial level and 29% identified cabinet or treasury level. The amount allocated for public hospital facilities and medical equipment was recognised as part of a planned replacement process or a similar amount annually by 50% of officials, and was stated to be dependent on the state budget by 20% of officials.

Clinical alignment

In the process for capital allocation, clinical views were universally sought in the planning process at the beginning of the capital allocation process, but were half as likely to be included at each further step in the planning process. Only 50% of officials used evidence-based clinical standards or clinical guidelines. This result aligns with the findings of system-wide reviews and commentators.^{86–88,141,161–165} Clinical pathways were always referenced in planning, but not used in the capital allocation process.

Clinical service planning at the beginning of the capital allocation process was found to be hospital and region based in 80% of cases, with only one state using patient-centred planning as the foundation of capital allocation.

Allocative efficiency

Allocative efficiency is promoted under activity-based funding because all patients treated within the same DRG are funded to have access to comparable recurrent resources.¹⁶⁶ Similarly, an effective system of capital allocation would promote allocative efficiency when capital for hospitals was sufficient to fund equitable patient access to appropriate quality care that is efficient.²⁰

However, all Australian jurisdictions use a similar system that compares and prioritises capital allocation options within the health system. Prioritisations draw from asset-replacement strategies based on lifespans for buildings of up to 50 years, and up to 20 years for some technologies.^{29,167} Twenty per cent of officials saw capital as an asset with a 20- or 50-year lifespan, with another 20% of officials, from different states, identifying elections as significant in setting priorities for capital allocation. Fifty per cent of officials reported working from a defined plan for allocations or used asset-specific replacement as a determinant of capital allocations. Prioritised systems are also used for medical equipment investment, with new builds and redevelopments receiving the majority of funds for medical equipment, and the replacement and improvement of older medical equipment receiving a lower priority. Similarly, investment in information and communications technology (ICT) was recognised as associated with major hospital developments by 92% of officials.

Productive efficiency

Productive efficiency in public hospitals is dependent on optimal combinations of skilled labour and capital so desired outputs are achieved within resources.^{10,168} Australian public

hospitals were found to be operating at an estimated 90% efficiency in the most detailed study of hospitals, but the value of capital cost per patient could only be estimated.^{6,12}

Dynamic efficiency

Innovations in clinical services are less clearly supported in the capital funding system, with no national or state-wide systems to support capital for evidence-based clinical innovation; commonly, funding to facilitate innovation was sought at the project or hospital level (60%).

Sustainability is a significant issue for acute health care, with high energy costs and carbon emission particularly in ward areas and surgical services.¹⁶⁹ Up to 60% of public sector energy costs in Victoria were estimated to have been generated by hospitals.¹⁷⁰ Several states have trialled projects to monitor the use of energy in existing hospitals, but officials could not reference a state-wide system of energy or carbon management. The prevailing approach to improving energy consumption was redevelopment of the hospital (60%) or was a matter for individual hospitals (40%).

Patient access to appropriate hospital care is a national measure of equity.¹⁷¹ Patient-centred care is an aspiration of most health systems, but only 20% of officials reported patient-centred, rather than hospital-based, clinical service planning within the capital allocation system.

Funding patient access to efficient hospital care: the international experience

Hospital investment systems of 17 countries were examined to assess which systems most effectively fund patient access to efficient public hospital care. Examining the system of capital funding (Table 1) found that although many countries have mixed systems, most countries reviewed have transitioned to capital aligned with the DRG-type payment (CaDRG). Fewer nations use traditional government project grants (Table 1). Centralised government funding was less common than funding closer to the clinical level (CaDRG, mixed government–PPP and private funding).

Table 2 provides results for the three elements of the research question: capital funding for hospitals, patient access to hospitals and economic efficiency.

Access to capital for hospitals identified the UK and the US to have the lowest scores (Table 2). Australia ranked eighth for access to capital, whereas the best-performing national systems were France, the Netherlands and Norway.^{12,27,30,33,34,37,46,47,49,50,59,70,73,151,158,172–176}

Considering patient access to hospitals, the US again scored lowest, with the best patient access in Germany, the Netherlands, Switzerland, France and Japan.^{25,31,35–38,45,48,50,57,64,67,151,158,175,177–180}

Evaluating the relative economic efficiency of health systems found that the US and Denmark ranked lower than the average efficiency figure for the 18 countries studied.^{15,22,52}

Bringing the three measures of access to capital, patient access and economic efficiency together (Table 2), France and the Netherlands funded the best access to efficient hospital care for patients, followed by Switzerland, Austria, Germany and Norway. The international comparative studies echo Productivity Commission reports that Australia ranked below the

18-nation average for patient access to efficient care.^{10,12,74,181} The US scored lowest at funding patient access to efficient care, with a score equivalent to 33% of the top scoring nations.

Does the capital funding system influence how well nations fund patient access to efficient hospital services? Table 3 aggregates nations by capital funding system (from Table 1), for hospital access to capital, patient access and efficiency (Table 2). CaDRG systems gained the highest scores for (timely, flexible, affordable and fairly distributed) capital allocations for hospitals. Government subsidies were ranked as the next most appropriate capital funding method. Private funding scored below average. The least effective system for funding patient access to efficient hospital care was mixed government–PPP funding.

Patient access to public hospitals was best provided by CaDRG (when the US was excluded) and government subsidy systems, narrowly ahead of CaDRG capital allocation systems that included the US. Private and mixed government–PPP funding again scored below average (Table 3).

For efficiency, countries using DRG-type funding were 70% of the top 10 rated countries.^{15,22,25,52} So when nations were aggregated by funding system for efficiency, DRG-based funding ranked highest regardless of inclusion of the US (Table 3).

Overall, DRG-based capital funding systems (with or without the US) scored highest for funding patient access to efficient hospital care. Government subsidies ranked above average. Market-based funding systems did not provide better access to capital for hospitals than government-funded systems. Predominantly private capital funding and mixed government–PPP systems provided one-third or less access to capital afforded by the CaDRG and government subsidy systems, scoring lowest for funding patient access to efficient care (Table 3).

Conclusions

Australian capital allocation systems are generally not patient centred or focused on clinical standards. Instead, Australia has a prioritised hospital investment system based on hospital asset replacement, institutionally based capital planning, budgetary and political priorities.

Because Australian systems for capital allocation for acute care were also found not to demonstrate allocative, productive or dynamic efficiency, the fundamental question was asked, which capital allocation method most effectively funds patient access to efficient hospitals?

The present study identified that the OECD countries most effectively funding acute care have transitioned to DRG alignment for capital funding for hospitals. Measures of effective capital allocation for hospitals, patient access and efficiency found DRG-based capital allocation superior to government subsidies, with the worst performing systems based on private finance. Of the 18 health systems assessed, France, the Netherlands and Norway provided the best access to effective capital funding for hospitals.

Numerous reviews of health service delivery across Australia have found that a prioritised capital allocation system does not comprehensively provide appropriate access to capital resources for all patients and clinicians.^{29,86–88,141,161–163,182,183} Australian systems of capital allocation for public hospitals were not found

to match health system objectives for promoting allocative, productive¹⁰ or dynamic efficiency within the national study or in comparison with 17 OECD nations.

The present study is the first to review capital allocation systems for Australian hospitals, to evaluate those systems against the contemporary objectives of the health systems, and to assess whether prevailing Australian allocation systems deliver funds to facilitate patient access to efficient hospitals. Commonly, hospital efficiency and access are considered by type of ownership or bed numbers rather than system of funding. The present study is the first to evaluate hospital capital allocation and efficiency. It is also the first to analyse the effectiveness of a range of capital funding systems to facilitate access for patients to efficient hospital care across a range of OECD countries. Similarly, it is the first time capital allocation for Australian hospitals has been included in an international review.

Although the measures used to quantify capital allocation, patient access and efficiency have been used with care, all measures have their limitations. Information has been drawn from various sources, themselves containing limitations. A wider search over 12 additional languages may have found further information on patient access, innovation, clinical standards and access to capital. Patient access to hospital services relies on a wide range of factors, including recurrent funding of hospitals, staffing and access to primary care. The efficiency measure is a generalised measure because comparative efficiency studies are challenged by method,¹⁴⁸ data and specificity,¹⁸⁴ defining outputs or outcomes¹⁸⁵ and because inputs rarely include measures of capital investment other than hospital beds.^{13,25} The studies scored for efficiency date from the turn of the century and do not include later changes made in health systems.

Allocative efficiency for capital in Australia, in an activity-based funding context, invites capital to be linked to patient care, clinical standards and efficiency, and to be equitably distributed between hospitals for patients in similar DRGs. The international evidence identified that an allocation system that provides hospitals with access to capital that is timely, flexible in use, affordable and fairly distributed improves efficiency. The evidence indicates that DRG-aligned capital allocation in Australia can provide the equitable, patient-centred distribution required for allocative, productive and dynamic efficiency in acute care.

Competing interests

The authors declare no conflicts of interest.

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