

# Costing the ambulatory episode: implications of total or partial substitution of hospital care

Stephen F Wilson, Brett Shorten and Rhona MI Marks

## Abstract

The Macarthur Health Service introduced an innovative Acute Ambulatory Care Service (MACS) in 2000. The service was designed to substitute patient care previously provided in hospital beds with care in the patient's home. The financial implications of complete or partial substitution of hospital care were explored using local data sources from the introduction of the service in 2001–2002. These data were analysed using the NSW Department of Health cost of care methodology. This study determined that episodes of care in MACS were less costly than equivalent episodes of inpatient care for selected diagnoses. The Macarthur cost of care data confirmed substantial savings (63%) in cases in certain diagnostic groups (cellulitis, pneumonia) with complete substitution, and lower savings (50%) for partial substitution of care when compared with hospital admission. Savings are likely to be greater as the level of substitution increases and are dependent on the choice of ambulatory sensitive diagnoses.

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THE TERM “AMBULATORY CARE” has been applied to any health care that occurs anywhere other than a hospital bed. The service may range from a

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**Stephen F Wilson**, MB BS, FAFRM (RACP), FRACGP,  
Director of Ambulatory Care  
Executive Unit, Campbelltown Hospital, Campbelltown, NSW.

**Brett Shorten**, BA, MComm, Research Fellow  
Centre for Health Service Development, Faculty of  
Commerce, University of Wollongong, Wollongong, NSW.

**Rhona MI Marks**, BHlthSc(Nurs), Project Officer  
Macarthur Collaboration Research Centre, Macarthur Health  
Service, Sydney, NSW.

Correspondence: Dr Stephen F Wilson, Executive Unit,  
Campbelltown Hospital, Therry Road, Campbelltown, NSW 2560.  
[wilsonstephen@bigpond.com](mailto:wilsonstephen@bigpond.com)

## What is known about the topic?

Moving care from hospital to ambulatory or home settings is generally thought to generate savings in health care costs, although the evidence is mixed. One source of difficulty is the lack of a casemix system for analysing ambulatory care.

## What does this paper add?

Significant cost savings were accrued from substitution in 10 ambulatory sensitive DRGs, with higher savings in those cases where inpatient admission was avoided entirely.

## What are the implications?

There is scope to increase the provision of hospital in the home and other substitution services, in order to reduce costs and ease pressure on inpatient beds. More work is needed to establish valid indicators for hospital admission for patients with ambulatory sensitive conditions and to find the borderline of complexity (both high and low) where cost savings from substitution cease to be achievable.

general practitioner visit or outpatient allied health intervention through to treatment by a multidisciplinary team which provides full or partial substitution of hospital care at home. The latter acute ambulatory episode, delivered in what has been called “hospital in the home”, has been the subject of a number of studies and reviews.<sup>1,2</sup> In spite of mostly positive outcomes for satisfaction and quality there is still some uncertainty regarding resource savings for this type of care.<sup>3</sup>

A number of studies have found that, when patients are carefully selected, outpatient therapy is a cost effective, safe method of administering intravenous antibiotics.<sup>4</sup> Several clinical trials assessing the treatment of geriatric patients at home or in hospital for a variety of conditions demonstrated savings of from 51%<sup>5</sup> to 24%.<sup>6</sup> It is only more recently that studies looking at selected diagnoses such as chronic obstructive

airways disease (COAD) have provided cost comparisons for hospital versus ambulatory treatment.<sup>7</sup> The absence of a casemix classification system for outpatient services based on episodes of care contributes to the difficulty in determining and comparing costs.<sup>8</sup> The current focus on individual outpatient encounters (occasions of service) is not suitable for understanding outreach episodes of care.<sup>9</sup>

The Macarthur Ambulatory Care Service (MACS) model was implemented in 2000 as an alternative means of providing safe, high quality community health care in an environment of relatively low availability of acute hospital beds.<sup>10</sup> During the study period (2001–2002) the bed-to-population ratio for the Macarthur region is estimated, from NSW Health and Australian Bureau of Statistics data, to have been only about 1.2 beds per 1000 compared with a state average of around 2.3 beds per 1000 population. This situation of bed shortage provided an ideal environment to test this alternative model of care. The physical and conceptual design of the “acute” ambulatory care unit was integral to the redevelopment of emergency departments built at Camden and Campbelltown Hospitals during the period 2000–2003.

The *National Health Act 1953* (Cwlth) was amended in 2001 to enable private health insurers to fund acute outreach services in sites other than acute hospital beds.<sup>11</sup> Following this amendment, a system of Commonwealth accreditation of private sector outreach services was established. Macarthur Health Service (MHS) was the first public hospital in New South Wales to be accredited through this process, in March 2004. The Macarthur Health Service, in anticipation of this accreditation, established a virtual ward of 20 beds at Campbelltown Hospital and six beds at Camden Hospital in July 2001. This acute ambulatory outreach service fulfilled all the requirements for acute care of both public and private patients which included 24-hour, 7-days per week medical cover. The admission, treatment and discharge processes are identical to those for other hospital patients, with the addition of a thorough staff and patient community risk assess-

ment. MACS also treats day admissions (eg, infusions and transfusions), and the hospital MACS site is used for outpatient multidisciplinary assessment. There is also support for day surgery with pre- and post-surgical care.

This service provides a unique setting to explore the costs of episodes of care for a number of the most common conditions treated. The virtual ward structure appears equivalent to any other patient admission system with respect to the patient administration systems. These data systems enabled us to examine whether the introduction of ambulatory care to the MHS reduced the health service cost of care for these selected patient groupings.

## Methods

The relevant study populations were all patients treated by MACS in the 2001–2002 financial year as well as all patients treated in MHS hospital wards during the same time period within selected Australian refined diagnosis related groups (AR-DRG, hereafter referred to as DRG). In the first instance potential DRGs for analysis were identified as being “ambulatory sensitive”, defined as conditions commonly treated by MACS, where an infrastructure of treatment and care had been safely provided for patients presenting for acute care of those conditions. From the resulting list, the ten most common DRGs treated by MACS in 2001–02, each of which accounted for more than 20 separations, were chosen for costing analysis. It was hypothesised that the level of cost savings attributable to MACS, if any, would be positively related to the extent to which MACS can be substituted for hospital ward care. Episodes were thus categorised for the chosen DRG conditions, using the South Western Sydney Area Health Service cost-of-care data reports, according to whether they were total substitution (entire episode coded to MACS) or partial substitution between hospital ward and MACS care (episode coded to other ward/s plus MACS). The third category contained those patients in the selected DRGs who were treated totally within a hospital ward.

Additionally, an analysis of emergency department triage data was performed for those of the selected DRGs (four in number) for which relevant data on triage level were available. These data were available for the 2003 calendar year from the Emergency Department Information System (EDIS). This enabled comparisons of triage ratings, as an acuity indicator for patients referred to a hospital ward versus MACS in that year.

The data systems accessed for this study were:

- The Macarthur Ambulatory Project modified Allied Health Information data system (MAP) which is a patient and service register used by the treating team in MACS.
- Emergency department information system (EDIS) which registers the diagnostic codes and triage categories of all emergency department presentations.
- South West Sydney Area Health Service (SWSAHS) cost of care data reports 2001–2002 and using NSW Department of Health methodology.<sup>12</sup> Costs are allocated to individual patients for a range of services provided to inpatients, including ward medical, nursing, operating suite, pathology, imaging, emergency department, intensive care, allied health, pharmacy, and a range of goods and services. This results in estimates of cost of care for each patient, based on DRG.

The objective of the analysis was to identify, for the ten DRGs chosen, the level of cost savings, if any, in the MHS that may plausibly be attributed to MACS. The different groups were analysed to determine the mean difference in cost between total or partial substitution of care and hospital care. All results were analysed using the statistical software package SPSS v 11.5 (Chicago, SPSS Inc.). The groups were compared using a two tailed *t*-test for independent samples to determine the significance of any cost savings.

## Results

Discussion with the nursing staff and reference to the free text definitions of cases in the departmental MAP data system clarified the types of

cases treated. Pulmonary embolus (E61B), deep venous thrombosis (F63B) and COAD with (E65A) or without complications (E65B) are self explanatory. Respiratory infections (E62C) referred to cases of community-acquired pneumonia receiving intravenous antibiotics. The most frequently treated condition was cellulitis (J64B) which comprised cases of cutaneous infection treated with intravenous antibiotics. Kidney and urinary tract disorders (L67C) were predominantly cases of “trial of void” following urinary catheter removal. Red cell disorders (Q61C) referred to blood transfusions, and lymphoma (R61C) referred to platelet infusions. The remaining item (R63Z) comprised bladder infusions of chemotherapeutic agents. The top ten DRGs are listed with their costings in Box 1.

The mean cost of the combined top ten for total substitution was \$1202, which was significantly less than the mean cost for inpatient care of \$3267 (mean difference \$2065; 95% CI, \$1643–\$2485;  $P < 0.01$ ). This equates to an overall saving of 63%. There were significant savings ( $P < 0.05$ ) for most individual DRGs in the total substitution group except for pulmonary embolus (E61B) and COAD with complications (E65A).

The mean cost of the combined top ten for partial substitution was \$1627, which was significantly less than the mean cost of inpatient care of \$3267 (mean difference, \$1640; 95% CI, \$1155–\$2124;  $P < 0.01$ ). This suggests resource savings of the order of 50%. There were savings for all diagnoses, although the level of savings for pulmonary embolus (E61B), respiratory infection (E62C) and COAD with complications (E65A) were not statistically significant.

Box 2 summarises an analysis of triage ratings of selected EDIS-registered diagnoses in the 2003 calendar year. Results indicate a trend for slightly higher mean triage ratings (ie, less acute patients) in the cases referred to MACS compared with those referred for hospital admission. However, the differences appear to be quantitatively modest and were only statistically significant ( $P < 0.01$ ) in the case of cellulitis. This suggests that differences in within-DRG acuity are unlikely to explain much of the substantial cost differences reported in Box 1.

## Discussion and conclusions

These data support our hypothesis that savings are likely to be greater for those cases where total substitution of acute care from hospital to ambulatory care occurs. However, substantial resource

savings appear to be available, whether substitution of care is total or only partial ( $P < 0.01$ ). Substantial savings were demonstrated for all ten diagnoses most commonly treated by MACS, although these savings tended to be somewhat

### I Total and partial substitution cost of care compared with hospital cost of care

Australian refined diagnosis related group (DRG)	Type of care	Number of episodes [n (%)]	Mean episode cost [\$ (SD)]	Mean difference to hospital [\$ (P value)]	Indicative percent saving
Pulmonary embolism (E61B)	MACS Only	10 (23.8)	3034 (1574)	799 (0.53)	21
	Hospital/MACS	10 (23.8)	3206 (997)	627 (0.67)	16
	Hospital Only	22 (52.4)	3833 (2312)		
Respiratory infections (E62C)	MACS Only	26 (8.0)	1662 (423)	1024 (<0.001)	38
	Hospital/MACS	22 (6.8)	2294 (1280)	393 (0.34)	15
	Hospital only	276 (85.2)	2687 (1304)		
COAD with complications (E65A)	MACS only	10 (4.3)	2264 (3674)	2828 (0.19)	56
	Hospital/MACS	16 (6.8)	3695 (3187)	1397 (0.52)	27
	Hospital only	209 (88.9)	5092 (5108)		
COAD w/o complications (E65B)	MACS only	16 (6.6)	2101 (608)	2269 (0.01)	52
	Hospital/MACS	10 (4.1)	3454 (1289)	917 (0.60)	21
	Hospital only	216 (89.3)	4370 (3089)		
Deep venous thrombosis (F63B)	MACS only	24 (33.8)	915 (486)	2521 (0.02)	73
	Hospital/MACS	29 (40.8)	1247 (1135)	2190 (0.04)	64
	Hospital only	18 (25.4)	3437 (5736)		
Cellulitis (J64B)	MACS only	88 (23.2)	894 (881)	1243 (<0.001)	58
	Hospital/MACS	74 (19.5)	965 (571)	1173 (<0.001)	55
	Hospital only	218 (57.4)	2137 (2131)		
Kidney, urinary tract (L67C)	MACS only	17 (32.7)	166 (359)	658 (<0.001)	80
	Hospital/MACS	4 (7.7)	69 (69)	755 (0.01)	92
	Hospital only	31 (59.6)	824 (547)		
Red blood cell disorder (Q61C)	MACS only	13 (14.1)	88 (86)	1183 (<0.001)	93
	Hospital/MACS	8 (8.7)	73 (41)	1198 (0.01)	94
	Hospital only	71 (77.2)	1271 (1176)		
Lymphoma, same day (R61C)	MACS only	22 (73.3)	1716 (122)	642 (<0.001)	27
	Hospital/MACS	3 (10.0)	1743 (107)	616 (<0.001)	26
	Hospital only	5 (16.7)	2358 (551)		
Chemotherapy (R63Z)	MACS only	15 (55.6)	1179 (93)	506 (<0.001)	30
	Hospital/MACS	8 (29.6)	1203 (79)	482 (<0.001)	29
	Hospital only	4 (14.8)	1685 (97)		
<b>Total</b>	MACS only	241 (16.1)	1202 (1196)	2065 (<0.001)	63
	Hospital/MACS	184 (12.3)	1627 (1610)	1640 (<0.001)	50
	Hospital only	1070 (71.6)	3267(3284)		

lower and not always statistically significant for higher intensity and high risk conditions such as pulmonary embolus and COAD with complications. Predictable and low risk conditions such as elective transfusions, infusions, deep venous thrombosis and cellulitis demonstrated significant savings for either partial or total substitution of care and could be considered as ambulatory sensitive diagnoses for most cases presenting for admission to hospital or emergency departments.

The audit of EDIS data, although not contemporaneous with the costing study, indicates only a slight trend for less acute cases to be referred to ambulatory care. Cases were accepted from triage level 2 to 5 with most in the 3 and 4 triage level for both hospital and ambulatory cases. This suggests that other factors may influence referral to ambulatory care. These may include patient or physician choice, lack of awareness of the new service, or time of day of patient presentation. Further consideration and investigation of these factors is required, particularly given the substantial resource savings which this paper has documented when ambulatory care is chosen. In any case, even if sicker or more complex patients were admitted to inpatient care, the savings from not admitting those who would have been admitted before the establishment of MACS are substantial. The challenge that remains is to identify and

validate the factors that genuinely indicate the need for inpatient admission on the grounds of safety, quality or cost.

This study did not investigate “eligibility creep”, that is, whether patients were referred to MACS who previously would have been sent home rather than being admitted. This is a limitation which should be addressed in future studies.

The chronic and complex care of COAD has been identified by the NSW Department of Health as one of the areas that would benefit from improved community services to relieve the pressure on hospital beds.<sup>13</sup> A randomised controlled trial conducted in the Liverpool and MHS region has shown post acute nursing care of patients with COAD has not significantly reduced readmission rates to hospital.<sup>14</sup> This current study has demonstrated that patients with COAD presenting with triage level 2 and 3 have been treated by MACS, and there appear to be significant savings (52%;  $P = 0.01$ ) for total substitution of care in this group (E65B). This suggests that delivery of acute care in an ambulatory setting should be considered for inclusion in chronic and complex programs for patients with exacerbations of COAD without complications.

Debate will always occur regarding the absolute cost of care, and episode costs are subject to the various inaccuracies of inputs of data and histori-

**2 Triage levels for selected Australian refined diagnosis related groups (DRGs) for patients admitted through the emergency department to Macarthur Health Service in 2003**

Triage	Cellulitis*		Chronic obstructive pulmonary disease		Deep vein thrombosis		Pneumonia	
	Hospital episodes [n(%)]	MACS episodes [n(%)]	Hospital episodes [n(%)]	MACS episodes [n(%)]	Hospital episodes [n(%)]	MACS episodes [n(%)]	Hospital episodes [n(%)]	MACS episodes [n(%)]
1	0 (0)	0 (0)	4 (3.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	2 (2.0)	0 (0)	28 (25.7)	3 (18.8)	0 (0)	0 (0)	12 (16.4)	0 (0)
3	48 (48.0)	22 (27.8)	67 (61.5)	12 (75.0)	13 (68.4)	19 (51.4)	55 (75.3)	13 (86.7)
4	47 (47.0)	54 (68.4)	8 (7.3)	0 (0)	6 (31.6)	18 (48.6)	6 (8.2)	2 (13.3)
5	3 (3.0)	3 (3.8)	2 (1.8)	1 (6.3)	0 (0)	0 (0)	0 (0)	0 (0)
Total	100 (100.0)	79 (100.0)	109 (100.0)	16 (100.0)	19 (100.0)	37 (100.0)	73 (100.0)	15 (100.0)
Average	3.51 <sup>†</sup>	3.76 <sup>†</sup>	2.78	2.94	3.32	3.49	2.92	3.13

\* Distributions statistically different at  $P < 0.05$  according to Pearson Chi-Square statistic. † Average triage ratings statistically different at  $P < 0.01$  according to  $t$  test for two independent samples.

cal weightings. The strength of this study is that the same cost-of-care methodology has been used for all groups studied and, irrespective of whether inaccuracies exist in the assessment of absolute costs, the magnitude of potential savings indicates that further development (and evaluation) of substitution services is warranted. The evidence presented in this paper suggests a compelling case for identifying the full range of hospital inpatient activities which could be treated more cost-effectively by ambulatory models of care, and implementing the structural changes required to realise the available resource savings.

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## Competing interests

None identified.

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