Economic modelling of telehealth substitution of face-to-face specialist outpatient consultations for Queensland correctional facilities

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Abstract

Objective. The provision of healthcare services to inmates in correctional facilities is costly and resource-intensive. This study aimed to estimate the costs of transporting prisoners from 11 Queensland correctional facilities to the Princess Alexandra Hospital Secure Unit (PAHSU) in Brisbane for non-urgent specialist outpatient consultations and identify the cost consequences that would result from the substitution of face-to-face visits with telehealth consultations.

Methods. A 12-month retrospective review of patient activity at the PAHSU was conducted to obtain the number of transfers per correctional facility. The total cost of transfers was calculated with estimates for transport vehicle costs and correctional staff escort wages, per diem and accommodation costs. A cost model was developed to estimate the potential cost savings from substituting face-to-face consultations with telehealth consultations. A sensitivity analysis on the cost variables was conducted. Costs are reported from a government funding perspective and presented in 2016 Australian dollars (A$).

Results. There were 3539 inmate appointments from July 2015 to June 2016 at the PAHSU, primarily for imaging, general practice, and orthopaedics. Telehealth may result in cost savings from negligible to A$969 731, depending on the proportion, and travel distance, of face-to-face consultations substituted by telehealth. Wages of correctional staff were found to be the most sensitive variable.

Conclusions. Under the modelled conditions, telehealth may reduce the cost of providing specialist outpatient consultations to prisoners in Queensland correctional facilities. Telehealth may improve the timeliness of services to a traditionally underserved population.

What is known about the topic? Specialist medical services are located in only a few metropolitan centres across Australia, which requires some populations to travel long distances to attend appointments. Some face-to-face specialist outpatient consultations can be substituted by telehealth.

What does this paper add? Prisoners from correctional facilities represent one specific population that requires complex travel arrangements for specialist medical appointments. Transportation of prisoners for specialist health appointments represents a substantial cost to the government. This paper quantifies the annual cost in Queensland for transporting prisoners, taking into account fuel and vehicle costs, staff wages, per diem rates, and accommodation. In addition, it quantifies the costs of substituting face-to-face consultations with telehealth consultations.

What are the implications for practitioners? This research encourages practitioners to consider using telehealth services for prisoners, as well providing an argument for tertiary centres to include telehealth as a model of care for this population. Telehealth can result in major cost savings and state and federal governments should consider implementation especially in Australia where correctional facilities and specialist services are separated by great geographic distances.

Received 5 June 2017, accepted 4 October 2017, published online 28 November 2017
Introduction

Healthcare in Australian correctional facilities currently operates under a nurse-led clinical pathway where some health services are provided within the institution. When required, referrals are made to tertiary health centres for emergency or specialist care. These referrals require transport of prisoners via secure on-road vehicle transportation with accompanying security personnel. This makes providing specialist care logistically difficult and expensive. In Australia, prisoners consistently exhibit high-to-extreme rates of psychiatric conditions, infectious disease and high-risk behaviours, compared with the general population. Hence, there is a high demand for specialist care among prisoners. As such, the cost of providing specialist healthcare to Australian prisoners is invariably high due to a complex health profile, distance and security issues.

As the prison population continues to grow, a cost-efficient solution needs to be found. Ideally, the need to refer to a specialist clinician is considered in respect to medical requirements, distance, cost and security issues. If care cannot be delivered locally by the prison clinic nurse, referral to tertiary specialist care is the alternative option. As a result, over 700 acute and non-acute transfers of prisoners to tertiary care are made across Australia every fortnight. The cost of these transfers is not explicitly known.

Outside of Australia, telehealth (the provision of health services over distances using information and communications technology) has successfully been used to address the problem of high costs for the provision of healthcare to prisoners. The US has led this initiative by implementing telehealth prison programs since the 1990s. The earliest telehealth prison program, based in Texas, found the cost of providing telehealth services was significantly less than the cost of prisoner transfer. Since then, most studies agree that telehealth is a viable option for many types of consultations, generating significant cost savings due to reduced travel requirements. Furthermore, telehealth prison programs also improve timely access to specialist care, without compromising patient and provider satisfaction.

In Australia, the potential cost savings associated with telehealth usage in correctional facilities is not clearly understood. The aim of the present study was to model the cost consequences of using telehealth as an alternative to transporting prisoners for specialist outpatient consultations.

Methods

Setting

In 2016 there were 14 correctional centres operating in Queensland, Australia containing 7752 adult prisoners. Correctional facilities accommodated 25 to 1000 prisoners each, with security requirements ranging from minimum to maximum security. The Princess Alexandra Hospital (PAH) is a public tertiary hospital located in Brisbane, Queensland. Within the hospital is the PAH Secure Unit (PAHSU). The PAHSU is the principal secure unit for all correctional facility inmates in Queensland. However, northern Queensland correctional facilities may elect to transfer their inmates to a secure unit in the Cairns and Hinterland Hospital and Health Service. Each correctional facility, as well as the PAHSU, has video conferencing capabilities, however, there has been little uptake of telehealth. The location of correctional facilities in Queensland, along with the number of transfers to PAHSU in the 2015–16 financial year, is shown in Fig. 1.

Study design

Using a case-study approach, we modelled the cost consequence resulting from the substitution of prisoner transfer to PAH for face-to-face consultations with telehealth (video) consultations. This required estimating the costs for face-to-face consultations (current practice) and the costs expected if these consultations were undertaken using telehealth. Costs were reported from a government cost perspective as Queensland Corrective Services and the PAHSU are publically funded. Costs are reported in 2016 Australian dollars and rounded to the nearest dollar ($1 = US$0.73 or €0.69 or £0.59).

Assumptions

Medical staff costs for face-to-face consultations and telehealth consultations were assumed to be equal as clinician time is the same for both modes of consultation. It was also assumed that the nursing staff costs required to carry out a telehealth consultation are comparable to the nursing staff effort required for a face-to-face appointment. Start-up and infrastructure costs related to operation of telehealth were excluded as videoconference capabilities were already available within the correctional facilities and at the PAH. The cost per consultation was assumed constant throughout the study period.

Patient transport

Inmates must be referred to PAHSU by Queensland Health to receive specialty care. These referrals require transfer by a secure on-road vehicle. Typically, a group of prisoners will be transported at one time and the same transport vehicle will be used to transfer prisoners to the judicial courts and to the PAHSU. Prisoners are transferred using a hub-and-spoke scenario where prisoners are first transported from their respective correctional facility to the correctional facilities at Wacol (~20 km from PAHSU) where they transfer into vehicles and continue on to the courts and PAHSU. The maximum number of prisoners that can be transported at any one time is 10, however, the Escort and Security Branch of Queensland Corrective Services estimates the average number is three. The amount of security measures and personnel depends on the security level of the prisoner. The minimum requirement is two security guards per vehicle with maximum-security prisoners requiring up to six escort staff. Overnight accommodation and per diem allowances are paid to the correctional staff that accompany prisoners to the Wacol facilities. For the purpose of our study, the costs per trip allowed for three minimum-security prisoners and two guards.

Prisoner patient activity

The actual number of consultations conducted at the PAHSU for the 2015–16 financial year was used in our modelling. The number and type of medical speciality of consultations conducted were extracted from the outpatient activity records of the unit. Scheduled consultations that patients did not attend were excluded. Consultations for patients from an unknown facility were also excluded, as were those appointments that did not involve a transfer such as telephone or chart reviews.
Transport cost

The cost of transporting an inmate from their correctional facility to the PAHSU was calculated as the sum of secure van operating costs, security staff costs and accommodation costs for staff. Total vehicle operating costs include many components such as fuel, oil, tyres, repairs, and depreciation. The per-kilometre vehicle cost was estimated to be A$1.85/km as calculated using the State of Queensland Department of Transport and Main Roads guidelines for cost–benefit analysis. Prices from the formula were converted to 2016 costs using the ABS Consumer Price Inflation Index Calculator, where necessary. The most direct round trip route between the correctional facility and Wacol facility where the escort vehicles are kept was

![Map of Queensland correctional facilities and the number of prisoner transfers to Princess Alexandra Hospital Secure Unit (2015–16).](image)
Economics of telehealth in correctional facilities

Results

Patient Activity

Over a 12-month period, 3539 completed consultations were provided at PAHSU for Queensland correctional facility inmates. In addition to the completed consultations, there were 528 scheduled consultations where the patient did not attend and a further 575 scheduled consultations where the patient refused to attend (23.8% of scheduled appointments). These non-completed consultations were excluded from our analysis. Facilities that did not transfer patients to the PAHSU were also excluded from this investigation. The breakdown of consultation numbers by facility is shown in Fig. 2. The majority of referrals came from correctional facilities in the outer Brisbane region. Two consultations were from an unknown facility. This resulted in a total of 3537 consultations included in our analysis. It should be noted that one centre, the Borallon Training and Correctional Centre, re-opened in April 2016, therefore within the study period transfers to PAHSU from this particular facility reflect May and June 2016 activity only.

Cost per consultation

The cost of transporting inmates for specialist consultation per facility is shown in Table 1. The type of consultation by speciality is shown in Fig. 3.

Scenario analysis

Scenario analyses were undertaken by modelling different rates of substitution of face-to-face consultations with telehealth at 10% increments from 0% to 100%. At each point, expected cost savings were calculated. The modelling amalgamated costs for all of Queensland’s correctional facilities.

Ethics

This research was approved by Metro South Health Human Research Ethics Committee (reference number HREC/15/QPAH/1) and by Queensland Corrective Services.
Sensitivity analysis

Staff wages had the greatest effect on the transport cost per consultation, however, a 5% change in wage only resulted in a less than 3% change in transport cost per consultation. The extent to which the cost per consultation was affected by a 5% change in variable costs is shown in Table 2.

Discussion

Our modelling indicates that using telehealth within correctional facilities could potentially result in cost savings from a government perspective. In a 12-month period, the cost of transporting inmates from Queensland correctional facilities to the PAHSU was A$969,731. By substituting a proportion of face-to-face consultations with telehealth consultations, cost savings are realised with reduced costs associated with transportation of prisoners. The greatest cost savings came from those facilities that were furthest away and required overnight accommodation for staff.

The literature has consistently reported that telehealth reduces the cost of providing specialist outpatient health services in a correctional setting. Our economic analysis demonstrated greater potential savings than operational telehealth services in these previous studies. Previous studies have considered the infrastructure cost of implementing telehealth into correctional facilities.

Table 1. Cost of transporting inmates per facility over 1 year (2015–16)

<table>
<thead>
<tr>
<th>Correctional facility (see legend)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
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<tbody>
<tr>
<td>Travel</td>
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<tr>
<td>Round-trip distance (km)</td>
<td>35</td>
<td>96.8</td>
<td>35.4</td>
<td>39</td>
<td>131</td>
<td>594</td>
<td>242</td>
<td>256</td>
<td>192.8</td>
<td>39</td>
<td>226</td>
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<tr>
<td>Shift hours (per security escort)</td>
<td>7.6</td>
<td>7.6</td>
<td>7.6</td>
<td>7.6</td>
<td>38.0</td>
<td>22.8</td>
<td>11.4</td>
<td>11.4</td>
<td>11.4</td>
<td>7.6</td>
<td>11.4</td>
</tr>
<tr>
<td>Per diem days (two security escorts)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Required nights (two security escorts)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Cost per trip</td>
<td></td>
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<tr>
<td>Vehicle cost (A$)</td>
<td>65</td>
<td>179</td>
<td>65</td>
<td>72</td>
<td>2424</td>
<td>1099</td>
<td>448</td>
<td>474</td>
<td>357</td>
<td>72</td>
<td>418</td>
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<td>Security escort wages (A$)</td>
<td>368</td>
<td>368</td>
<td>368</td>
<td>368</td>
<td>1842</td>
<td>1105</td>
<td>553</td>
<td>553</td>
<td>553</td>
<td>368</td>
<td>552</td>
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<tr>
<td>Per diem allowances (A$)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1235</td>
<td>741</td>
<td>247</td>
<td>247</td>
<td>247</td>
<td>0</td>
<td>247</td>
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<tr>
<td>Accommodation (A$)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1640</td>
<td>820</td>
<td>410</td>
<td>410</td>
<td>410</td>
<td>0</td>
<td>410</td>
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<tr>
<td>Total transport cost per trip (A$)</td>
<td>433</td>
<td>548</td>
<td>434</td>
<td>441</td>
<td>140</td>
<td>3765</td>
<td>1657</td>
<td>1683</td>
<td>1566</td>
<td>441</td>
<td>1628</td>
</tr>
<tr>
<td>Number of consultations</td>
<td>571</td>
<td>30</td>
<td>439</td>
<td>500</td>
<td>43</td>
<td>59</td>
<td>68</td>
<td>14</td>
<td>321</td>
<td>1170</td>
<td>322</td>
</tr>
<tr>
<td>Trips required (3 prisoners per trip)</td>
<td>191</td>
<td>10</td>
<td>147</td>
<td>167</td>
<td>15</td>
<td>20</td>
<td>23</td>
<td>5</td>
<td>107</td>
<td>390</td>
<td>108</td>
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<tr>
<td>Total transport cost per facility (A$)</td>
<td>82,741</td>
<td>5475</td>
<td>63,789</td>
<td>73,580</td>
<td>107,104</td>
<td>75,299</td>
<td>38,117</td>
<td>84,816</td>
<td>167,589</td>
<td>171,833</td>
<td>175,789</td>
</tr>
<tr>
<td>Transport cost per consultation (A$)</td>
<td>145</td>
<td>183</td>
<td>145</td>
<td>147</td>
<td>2491</td>
<td>1276</td>
<td>561</td>
<td>601</td>
<td>522</td>
<td>147</td>
<td>546</td>
</tr>
</tbody>
</table>

Table 2. Change in cost per consultation resulting from 5% change in variable costs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Base case values A$</th>
<th>Change in cost per consultation A$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security escort wages</td>
<td>274.17</td>
<td>7.30 (2.66)</td>
</tr>
<tr>
<td>Vehicle costs</td>
<td>274.17</td>
<td>3.00 (1.09)</td>
</tr>
<tr>
<td>Accommodation</td>
<td>274.17</td>
<td>1.99 (0.73)</td>
</tr>
<tr>
<td>Per diem allowances</td>
<td>274.17</td>
<td>1.32 (0.48)</td>
</tr>
</tbody>
</table>

Fig. 3. Princess Alexandra Hospital Secure Unit consultations by speciality (n = 3537).

Fig. 4. Potential annual cost savings based on telehealth substitution rate (%).
facilities, whereas our analysis excluded capital costs, since the video-conferencing infrastructure was already in place. In our modelling, telehealth ultimately acts to negate the cost of transport and outcomes are assumed to be equivalent for telehealth and face-to-face consultations.

Given that the degree of economic benefit from telehealth is dependent on degree of utilisation, this is an important consideration. From our analysis, medical imaging accounts for 30% of prisoner transfers and procedural appointments a further 3%. Imaging and procedural consultations are not appropriate for telehealth substitution. The proportion of specialist outpatient consultations that can be substituted with telehealth is specialty-dependent. Low substitution rates have been observed in cardiology (4%) and neurology (5%), whereas higher substitution rates have been observed in endocrinology (49%) and rheumatology (42%).

In the context of correctional facilities, a well-utilised and cost-effective telehealth program was run by the Texas Department of Criminal Justice, which included similar specialties to what we have identified in the present analysis, such as general medicine, orthopaedics, and gastroenterology. This example from Texas provides some evidence that telehealth could be substituted for a proportion of face-to-face consultations in certain medical specialties. Within Australia, nurse-led hepatitis C programs with specialist supervision via telehealth have successfully treated inmates in NSW correctional facilities. Orthopaedic telehealth consultations have also reduced the need for transfer and cost and were satisfactory to patients but had mixed levels of acceptability to surgeons. Telehealth in maxillofacial trauma was also useful for assessment and significantly reduced the need to transfer. Furthermore, in Western Australia prison medical officers and nurses were trained to operate portable ophthalmic imaging instruments so that an ophthalmologist could provide a diagnosis via telehealth.

Larsen et al. found that only half of US prisons operate telehealth programs despite clear evidence of effectiveness. They cited start-up cost, resistance from medical providers, lack of technical expertise, and coordination as common barriers to its implementation. Similarly in Greece, a prison telehealth program was unsuccessful and was terminated due to lack of support from prison and hospital staff, despite having training being provided. Communication and involvement of key staff increases the likelihood of a new telehealth program being accepted.

Limitations

Inmates who cancelled or refused to attend their appointment were excluded from this analysis. Although previous research has identified that there are costs associated with rescheduling unattended appointments, in the current study these would have been minor administrative costs and no cost to the clinician as their time was used for other clinical duties. Anecdotally, many inmates refuse to leave the prison for medical appointments due to resultant instability in their accommodation. One of the ancillary benefits of telehealth may be to increase access to medical care for this patient group. Other factors not included in this analysis are the benefits associated with safety of people involved in the transportation of prisoners, the safety of the general public as transporting prisoners can present a risk of escape, and the increase in timeliness of specialist care.

The range of transport costs is highly variable because it is difficult to account for variations in distance, total patients per trip and security level of patients. Hence, this study may be limited by crude estimates. In addition, specialist appointments that did not require transportation were not considered in this study. Mental health consultations are currently provided inside correctional facilities via an outreach service model. Mental health is an important issue in Australian prisoner health and correctional facilities may still benefit from the use of telepsychiatry.

One potential barrier to the uptake of telehealth in correctional facilities is that the savings are not realised by the organisation which implements the change. In this scenario, Queensland Health would need to create the change in practice, whereas Queensland Corrective Services would see the savings in reduced patient transport costs. Cost-shifting across government departments and between different levels of government are not uncommon. Queensland Health may have the motivation to enact the change in practice to realise other benefits outside of cost savings, such as safety of hospital staff and patients.

Conclusion

In the context of Queensland correctional facilities, our modelling shows that substitution of face-to-face consultations with telehealth consultations can potentially result in cost savings from a government perspective. Savings result primarily from avoided patient transfers and become greater as the proportion of telehealth substitution increases. There appears to be strong evidence of successful telehealth programs within correctional facilities. Further investigation of the barriers to implementation is warranted. Expansion of telehealth within Queensland correctional facilities seems to be a promising opportunity, not only in regard to cost savings, but also for improving access to health services for inmates detained in prison.

Competing interests

The authors have no competing interests.

Acknowledgements

The authors would like to acknowledge assistance on this project provided by Molly Zhang. They would also like to thank the Escort Services Branch of Queensland Corrective Services and the staff of PAHSU for the information they provided.

References


