Estimating and projecting subacute care demand: findings from a review of international methods

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Abstract

A review of projection methodologies used to project sub-acute inpatient activity in various international health care jurisdictions was undertaken as part of a project to develop subacute inpatient activity projections for the state with the largest population in Australia. The literature search identified nearly 200 articles and found three main groups of projection methodologies: projections with a focus on subacute care; projections with a focus on acute care, but which often included subacute activity in the overall projections; and projections of specific diseases/conditions influencing the demand for subacute care.

In terms of the examples in the literature specifically regarding subacute care, the most common method of estimating current or future need was the use of normative benchmark ratios of beds to population. This was mainly to provide a policy basis to encourage development of subacute services, but also because of convenience.

In the literature regarding acute activity projection methodologies, many incorporated subacute activity in the overall activity measures of the acute hospital unit. The most common method of acute care activity projection was use of current or trended utilisation rates applied to population projections. It appears that a significant amount of planning and demand projection being undertaken internationally on subacute care takes place within acute care methodologies.

In regard to the potential use of specific diseases/conditions that drive demand for subacute care, such as stroke or cancer, it is suggested that the best use of these disease-specific projections is in reality testing the results of other modelling.

A number of conclusions are made and issues highlighted regarding projections of subacute inpatient activity.

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What is known about the topic?

With ageing of the population, subacute care is growing as an important area requiring specific planning methods to estimate current and future demand. However, internationally there is no consensus about the definition of subacute care or which projection method is more appropriate.

What does this paper add?

The literature review shows there are several methods being used internationally for estimating and projecting subacute care. Both demographic and non-demographic influences, a focus on patient activity rather than beds and scenario modelling were identified as important aspects.

What are the implications for practitioners?

Practitioners can choose from several different methods for estimating future demand for subacute care, depending on the degree of complexity required.

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SUBACUTE CARE comprises palliative care, rehabilitation medicine, maintenance care, psychogeriatrics, and geriatric evaluation and management (GEM).

During 2006, NSW Health undertook a project to develop a projection methodology for subacute care. As part of this project, a review of approaches being used to project demand for subacute care in various health care jurisdictions and in the health services research literature was undertaken.

Methods

The literature review was undertaken during late January/early February 2006 using a variety of database search tools including PubMed which includes Medline citations (National Library of Medicine/National Institute of Health), ScienceDirect, Scopus, Google and Google Scholar. Grey literature was sought from general web-based browsing of key health care and policy organisations such as jurisdictional health departments/ministries and international health-related agencies such as the World Health Organization and the European Observatory on Health Systems and Policies. Articles published since 1990 were included in the review.

Peer reviewed literature regarding projection methods was scanned within the broad topic areas of health service planning, subacute care, demography, health economics, biostatistics/epidemiology, casemix and health management. Search terms identifying subacute care included combinations of the following: subacute care, rehabilitation, palliative care, psychogeriatric care, geriatric evaluation and management and maintenance care. Search terms related to projections methods included: projections, forecasts, modelling, needs assessment, bed planning and future demand. The term workforce was also used to locate any projections related to workforce supply.

As the projections for subacute care reflect underlying epidemiological and demographic trends, additional searches related to projection methods were also made for the following: cancer, dementia, hip replacement, falls, burden of disease, stroke, trauma and brain and spine injury.

In total, nearly 200 articles were identified as being potentially relevant, with nearly 100 being referenced in the project report. The literature included examples of projection methodologies from the United Kingdom and other European countries, a number of states of the USA and Canadian states/provinces and national authorities, Asia, New Zealand and Australia.

Definition of subacute care

Although there is no consensus in the literature on the definition of sub- and non-acute care, there is agreement that sub- and non-acute care in general will play an important and growing role in health systems catering for the demands of an ageing population. Subacute care is also called interim care, intermediate care and post-acute care in the literature, although it is often not well defined.[1] The nature of subacute care is that the predominant treatment goal is enhancement of quality of life and/or functional status. For palliative care this also includes relief of suffering through pain and symptom control.

Subacute care can be provided in either a hospital setting or non-inpatient setting (including in the community/home), often after or instead of acute hospitalisation. In considering the scope of the demand projections for subacute care, it is necessary to consider these definitional issues and boundaries with other forms of care. This is because of the relatively high degree of substitution between these different settings of care reflecting differences in clinical management of patients, differences in administrative processes including type-changing between different episodes of care, and differences in the availability of appropriate treatment settings for each type of care.

Projections with a focus on subacute activity

A major challenge for this project was articulated in a literature review conducted by Gray:[2]

> Because of lack of conformity on definitions and reporting arrangements at State level, there is no routine information available at

> national level on either provision or evidence of demand for subacute services … (p. 142)

For guidance Gray referred to one Australian study of geriatric and rehabilitation services undertaken in 1992 that found a current ratio of 3.2 beds per 1000 population aged over 70 and another study from Ontario that found 40% of all bed-days across 105 hospitals were for subacute care.[3,4]

Our review includes several other studies which attempted to estimate current or projected need for subacute services or its separate components such as rehabilitation or palliative care.

Planning approaches

Young et al clinically reviewed older patients in a hospital who were not ready for discharge and found that 25% of all acute admissions in a district general hospital elderly care department would require post-acute rehabilitation care.[5] McDonagh et al undertook a systematic review of the literature on appropriate use of beds and suggested an overall figure of 20% of older patients may be better suited in alternative care settings such as subacute care.[6] These percentages could be applied to projected acute separations to inform analyses of subacute care needs.

Another simplistic planning approach could be adopted from scenario modelling undertaken for the NHS National Beds Inquiry regarding future reductions in acute length of stay to the year 2019–20.[7] The model was based on work by the University of York and assumed that intermediate (subacute) care days would replace acute care bed-days at the rate of 1.5 intermediate care days for every 1 acute care day.

In Ontario, Canada, a major restructuring of the health system occurred in the late 1990s based on planning ratios determined by the Health Services Restructuring Commission.[8] The planning guidelines recommended 20 rehabilitation beds per 100000 population and 14–19 other subacute beds per 100000 population. In 1998 the benchmarks were revised to 25 rehabilitation beds and 13 subacute beds per 100000 population.[9]

There are examples from the New South Wales health system of projection models for subacute care. One example is the methodology used in the NSW Health resource distribution formula (RDF) which applies statewide age/sex utilisation weights derived from data from the Sub and Non Acute Patient Data Collection to future Area Health Service populations.[10] Additional need indices reflecting variation in need across NSW are applied to the estimated age/sex need, with oncology standardised mortality ratios applied to palliative care and a blended need index comprised of proportion of elderly people living alone, rurality and socioeconomic status being applied to rehabilitation, geriatric evaluation, maintenance care and psychogeriatric care.

For psychogeriatric projections, the NSW mental health planning guidelines deal with planning requirements for acute psychogeriatrics and suggests 20–30 acute beds per 100000 population is required for this group of patients.[11] This estimate is largely influenced by an earlier study in NSW by Snowdon when the average length of stay was 33.5 days.[12]

For palliative care, the approaches used included application of Australian Government benchmarks from the National Palliative Care Policy (50 inpatient beds per 1 million population) or service "capture" rates to estimate the number of patients with certain life-limiting illnesses who should be assessed and managed by a palliative care team.[13] One such capture benchmark was recommended by the NSW Palliative Care Working Party, which recommended 50% of these patients should be managed by a palliative care team.[14] This benchmark was applied to a target population (generally patients with cancer, HIV/AIDS, end-stage organ failure) and multiplied by a trended average length of stay to determine bed-days.

A general estimate from the data supporting these plans was that 20% of palliative care was provided to non-cancer patients. The increasing proportion of non-cancer patients is supported by other reports such as the National Palliative Care Plan Initiative and a WA palliative care study using linked mortality and hospitalisation data.[15,16] These reports noted a sizable percentage of palliative care was being provided to people

with neurological illnesses, HIV/AIDS, COPD and end-stage organ failure.

The New Zeland Palliative Care Strategy projects future demand using 1996 mortality data and an assumption that 84% of people with a life-limiting condition would require palliation.[17] The strategy also refers to a method used by Cox which uses an age period cohort model to estimate the contributions of age, time periods and birth cohort effects to the occurrence of cancer.[18] Reference to a UK benchmark of 5.1 beds per 100000 is made for comparative purposes.

The NZ Ministry of Health developed demand projections for New Zealand to 2021 for health and disability services, which included subacute care in the acute care projections methodology.[19] The study was focused on older people and projected bed-days and separations based on hospitalisation data for selected conditions such as ischaemic heart disease, stroke, cancer, osteoarthritis, dementia, diabetes and COPD. The methodology applied current year utilisation rates per 1000 population for older age groups to population projections.

The Victorian Department of Human Services commissioned a major review of subacute services in Victoria which put forward some recommendations about estimating future subacute care requirements.[20] The study noted the existing benchmarks were based on little foundation and evidence and were overly focused on beds. The existing benchmarks were three rehabilitation beds and 2.5 GEM and respite care beds per 1000 population aged over 70, and 50 palliative care beds per 1 million people.

The Victorian study proposed a new methodology for projecting demand based on age/sex utilisation rates for 5-year age groups being applied to population projections using the metropolitan rates (given the historically low utilisation in rural areas). It was recommended these estimates be adjusted by an index based on access to private hospitals (according to current usage of private hospitals) and a burden of disease index using age standardised rates of years living with disability (YLD) per 1000 population. The study referred to this method as being more equitable than the existing approach. It is not clear if this method has been adopted in Victoria.

Ageing

European studies have shown that a key issue with any approach attempting to estimate future needs is the extent to which future health development (potential compression or expansion of illness and disability) of older people is taken into consideration.[21,22] An earlier review of the subacute care literature by the US Department of Health and Human Services found that ageing was an important factor in explaining increased use of post-acute formal care, although utilisation of home health care and rehabilitation peaked at age 75–79 and then dropped off.[23] The other key points summarised from this review were:

- 10–40% of all acute care patients can be moved to subacute care;
- A study by diagnosis-related group (DRG) showed that between 2% and 65% of patients in different DRGs could be subacute.
- Estimating subacute demand should not be based on historical utilisation rates, rather, disease specific estimates of demand should be used because most subacute units are disease specific.

Palliative care

Palliative Care Australia has produced a planning guide which makes recommendations on how to estimate the target population for palliative care.[24] The approach is based on assumptions about the minimum human resource requirements across 17 staff categories to achieve certain levels of access to palliative care assessment and management by cancer and non-cancer patients in community and acute hospital settings.[25]

This is a normative approach based on expert opinion. The normative approach is also closely aligned with the WHO service-targets approach to projecting overall health system workforce requirements, which has been used by many countries.[26,27] The Palliative Care Australia assumptions are that 90% of cancer patients are referred for palliative care assessment, 70% receive ongoing consultation and 20% ongoing

Recommended capture rates of patients with life-limiting conditions receiving palliation care

NZ Palliative Care Strategy	84%
NSW Palliative Care Working Party	50%
Palliative Care Australia	50%–90%
US Center to Advance Palliative Care	20%–50%
Royal College of Physicians of London	70%
Average	62%

direct care.[24] These assumptions are applied to deaths data per 100000 population to determine the expected number of patients in each category. The benchmarks for various staffing levels are based on communities of 100000 population and acute benchmarks for a 125-bed hospital. Based on occupancy of 85% the number of designated inpatient palliative care beds is recommended to be 6.7 per 100000 population.

A more general estimate of current coverage made by Palliative Care Australia is that half of all deaths in Australia are due to the diagnosed illness (ie, their death could be expected), of which 37.5% are estimated to be receiving specialist palliative care.[28] The US Center to Advance Palliative Care suggests using a 20%–50% capture rate in hospitals for patients who may potentially benefit from palliative care, or a starting point of 5% of all hospital discharges as being in scope for planning a palliative care program.[29] The Royal College of Physicians of London suggests 70% should access specialist palliative care.[30]

The range of estimates about the proportion of patients with life-limiting illnesses that should receive palliation is summarised in the Box.

Workforce models

Using a workforce model as the basis for projecting supply and demand for subacute care has also occurred in the US for projecting demand for physiatrists (physical medicine and rehabilitation). The approach used in a 1995 US study (updated in 1999) based future demand for physiatrists in rehabilitation medicine on a number of approaches.[31,32] One method was based on a consensus panel of physiatrists who were given an initial survey before meeting to discuss issues affecting demand and supply. This information was combined with results from a more analytical approach which involved measuring change in the number of physiatrists between two time periods in a given area. Interestingly, the major factor influencing demand for physiatrists in the US was found to be the penetration rate of managed care, with only 10% of growth due to ageing. This fact highlights the need to understand differences in the underlying market conditions affecting supply-side issues across different jurisdictions.

In 2000, the UK Audit Commission did construct one approach that could be used to estimate requirements for rehabilitation, based on the results of a survey of therapy time (minutes per bed per day) required by qualified physiotherapists, occupational therapists and speech therapists in 16 hospital sites with inpatient rehabilitation wards or combined acute/rehabilitation wards.[33]Another workforce model relative to geriatric care is from the British Geriatrics Society which suggests one consultant in geriatric medicine per 4000 population aged over 75 as a minimum requirement for provision of comprehensive services.[34] The Society also refers to another similar estimate from the literature of six full-time consultant physicians required per 250000 population. The Royal College of Physicians of London suggest a target per 250000 population of one consultant in rehabilitation medicine and 7.05 consultants in geriatric medicine by 2010.[30]

The inclusion or exclusion of private sector demand was not generally made clear in the literature on subacute care, although where it was included (such as in the Victorian subacute services review) the impact on the projections was material. The way private sector demand is included is one area of the projections that should be treated with much caution. There is evidence from the UK that assumptions made during the initial era of the Private Finance Initiative (about reductions in NHS capacity) were too severe and

were in fact overturned by the National Beds Inquiry.[35] The lesson from the UK planning experience is that building in assumptions upfront in the planning model can be problematic in relation to predicting the role of the private sector.

In summary, most of the projections for subacute activity or beds were relatively unsophisticated and relied on methods such as estimated ratios of acute to subacute beds based on clinical review of patients, assumed capture rates for palliative care applied to target inpatient population data, or application of current or trended utilisation rates and average lengths of stay (using linear regression) to population projections to determine growth. Projecting the underlying workforce supply available using linear regression and historical data, or staffing benchmarks based on summary results of surveys of therapy time in a sample of hospitals, were other ways future subacute care requirements could be estimated.

The most common basis for subacute care projections in the specific subacute literature was the use of normative benchmark ratios of beds per 100000 population or per 1000 aged population (eg, 70+ years). These ratios were assumed to represent a desired level of provision and had often been determined via expert clinical consultation.

Projections with a focus on acute activity

While the focus of this study was on projection methodologies for subacute care, a significant number of projection models identified in the literature were in relation to acute activity, with the focus being on projected bed requirements.

Many of these models included subacute care in the overall acute methodology; either projected subacute activity within the acute activity or projected it as a separate clinical group using the same acute care projection methodology. A few jurisdictions excluded subacute activity but did not specify an alternative method for projections.

Projections of factors influencing the demand for subacute care

A useful set of ideas regarding projection methodologies can be obtained from projections of the various diseases and conditions underlying the need for subacute care that are not based on hospitalisation data but on estimates of prevalence and incidence. For rehabilitation, trends in conditions or events such as stroke, hip replacements, falls, brain and spine injury, major trauma and burns might be useful. For palliative care, cancer and HIV/AIDS trends may be relevant, or, alternatively, projections on the number of deaths.

The advantage of basing projections on the underlying conditions or diseases is that the projections, and therefore planning, may more closely align with the way services should ideally be managed to achieve better patient outcomes. For example, compared with rehabilitation in general medical wards, patients treated in stroke units have greater rates of reduction in mortality, up to 10 years after the acute event.[36] Having activity projections that may be more specific and considered enables more targeted planning for future need.

A disadvantage of the disease-specific approach is that, due to data constraints and potential complexity in the model, not all conditions or diseases can be covered.

Conclusions

Based on the review of findings from the current literature review, the main factors distinguishing the better approaches from other approaches appear to be:

- Inclusion of both demographic and non-demographic influences in the projections through use of population data and trended utilisation rates (admission rates and lengths of stay) rather than use of current rates.
- A focus on patient activity rather than beds.
- The ability to perform scenario modelling.

A number of key issues arose from the review of demand projection methods that are relevant to subacute projections. These included:

- The choice of age splits in the older age group to better differentiate the needs within this subgroup.
- Use of trended data over several years to incorporate non-demographic growth in admission rates.

- How estimates for non-inpatient demand are included.
- Assumptions about efforts to avoid hospitalisation and achieve more appropriate discharge practices into home care (ie, potentially conservable days).
- Treatment of patient flows, private sector and other need influences such as socioeconomic status.
- Potential use of a confidence interval or range around the projections.

Implications for policy and future work

Where subacute activity has been incorporated in overall inpatient activity projections, this has been undertaken for several reasons which include simplicity, the belief that the same projection approaches apply equally to acute and subacute care, or lack of episode differentiation from acute to subacute care (type changing) in the data. In the case of the latter, strategies are required to achieve greater application and consistency of type changing to identify this hidden subacute care and thereby improve data quality.

In all planning processes, the need to consider policy and planning frameworks and the service delivery environment is essential. These methodologies cannot be considered in an isolated, formulaic manner.

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Competing interests

The authors declare that they have no competing interests.

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