

Sustaining long term care for the elderly during dynamic national population structure changes

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Abstract – *Changes in the population structure and illness and disability profile in many countries are creating pressures to improve the provision of community, hospital and long-term care of the elderly. A system dynamics model of current and future population ageing, patient flows and formal and informal services provision was constructed with domain experts and calibrated using national Australian data. Policy options and funding arrangements were assessed according to key performance measures of cost, unmet care needs and waiting for care in the wrong place. The model was adjusted to include behavioral responses to*

service pressures including acute hospital admissions and “queue-jumping” via hospital to enter residential aged care. The findings for Australia were also applied to the current and future population of Hong Kong to test the generic use of the model. An extension to the model, which considers geographic mal-distribution of supply and demand for health and long term care of the elderly, is being constructed using combined agent based and system dynamics methodologies.

Keywords: demographics, aged care, long term care, service provision, health system dynamics.

1 Introduction

Rapid increases in life expectancy and reduction in the birth rate in many developed and non-African countries are producing significant changes in the age structure of the population. Some of these changes are driven by rapid, temporary increases in fertility rate around the 1950s and 1960s and are also modified by international migration patterns of the past and future decades. Additional changes in family caring roles related to increased female workforce participation have resulted in non-parents caring for young children, and non-children caring for elderly parents, including informal and formal care, either paid or provided by the state.

These significant demographic and social

changes affect the provision of health and long term care for the elderly in a mix of community hospital and residential care settings. This topic has been the subject of a number of economic and strategic modeling studies, particularly in OECD countries [1-3]. Related SD work includes human service delivery in the US, intermediate care in the UK, and long term care modeling in Scandanavia and New York [4-15]. In Australia, a project was funded to apply system dynamics modeling to the interface between acute hospital care and longer term residential aged care. This interface is complicated by the funding responsibilities being split between two levels of Government,

with states (provinces) funding public hospitals and the national government funding residential care.

2 Model Description

A population ageing chain stock and flow structure includes gender and age specific mortality rates, life expectancy increases, fertility and migration rates; an explicit 50to64 age stock captures the current population asymmetry caused by the 1940s to 1960s baby boomers. Aged personal care needs are based on the incidence and prevalence by age and gender of severe and profound disability of people aged 70 years or more. Provision of acute health and formal and informal personal care services in the community, in acute hospitals and in aged care residences is also modeled based on planning ratios for service per population aged 70 plus. Patient flows are tracked through assessment and waiting lists for acute and long term care. Long term care types include respite, high and low permanent residential care (RAC) and community packages. Costings and other key performance scorecard variables complete the model. Policy experiments are performed and graphical and numeric outputs displayed through an interactive user control interface.

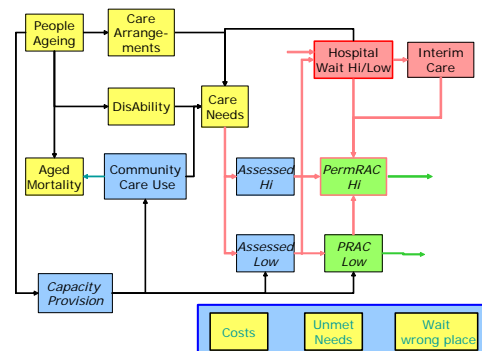


Fig.1 Model overview

See the supplementary zip file for a copy of the itthink simplified model.

3 Model Calibration

Initialised at 2001, the model reproduced the observed historical pattern from 2001 to 2006. Multiple datasets from various sectors were compiled to calibrate initial stock values, transition flows and other parameters using the national health statistics body, the AIHW as a project partner.

4 Key Policy Experiments

Key Performance Indicators

A key performance variable is the number of people waiting in hospital for RAC places and the average wait time. Other key dimensions of policy performance include overall cost to the governments and to individuals and the unmet demand for formal personal care.

Provisioning

The impact of various feasible provisioning and pricing policies for increasing aged care services and hospital multi-day beds according to growth in the aged population were tested over the next four decades.

Hong Kong Population

In order to generalize the model to other contexts, the Hong Kong population structure and projections were substituted in the demand sector of the model.

readmission rates (“rework”). Secondly, people waiting too long in the community for residential aged care will queue-jump by presenting at the acute hospital for placement in long term care. This tendency is exacerbated by giving priority to patients waiting in hospital for long term care places over direct placement from the community.

Rationing vs pricing

The impact of pricing policies on demand for long term care was explored in the model. Although an effective way to manage short term demand pressures, the over-use of this mechanism has two main dangers. There is a large unmet care burden placed on poorer families in the community, which results in increased inequity of care access and political pressure. Care of these marginally coping people in the community can also increase their use of community and acute hospital services. Explicit geographical rationing of government subsidized residential care places has the capacity to slow the growth in inequities of access to affordable long term care.

Medium term problem only

There is a tendency to equate the problem of aged care provision with increasing life expectancy. However the main challenge faced in the next 3 decades is the “downstream” effect of the rapid increase in the birth rate during the 1950s and 1960s. The initial effect is a reduction in workforce numbers (including both taxpayers and health care workers) followed by a large increase in elderly patients. For the Australian population, this one off “baby boomers” effect subsides by around 2040.

6 Further Work

Managing the ongoing interaction between the demand for aged care and the supply of services in the community sector, the hospital sector and in aged care residences is a complex ongoing task. In addition to longer term strategic national policy models there is a need to model the local regional operating conditions over a shorter time frame. There are also significant differences in the constraints on supply of services between urban and rural settings, some of which can be provided with newer remote technologies.

While the current model focuses on the supply of accommodation capacity, the aged care workforce will be a significant limiting resource for the next two decades as baby boomer retirements increase. We are currently modeling the overall and regional distributions of the health workforce for Australia.

To improve the usefulness of our health systems simulations we are developing more intuitive, compelling and engaging visualizations. We are also combining system dynamics, agent based and network analysis methods using newer multi-method tools [16]. These enable a wide range of users to perform virtual experiments through ubiquitous web browsers [17].

Finally there is a need to better integrate ongoing data collections with simulation models. Significant key data gaps have been recognized during this project and are being rectified in current data reporting.

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