Australian Government
Department of Defence
Defence Science and
Technology Organisation

Use of System Dynamics Techniques in the Garrison Health Modelling Tool

Mark Burnett, Kerry Clifford and Graham Durant-Law

Joint Operations Division
Defence Science and Technology Organisation

DSTO-TN-0988

ABSTRACT

This report describes the Garrison Health Modelling Tool, a prototype software package designed to provide decision-support to JHC health officers and managers in a garrison environment. Version 3 is described in detail from a system dynamics modelling and user interface perspective. It includes components representing service demand, medical staffing by GPs, the health dependency of the garrisoned troop, health facilities, costings and budget amounts. Built with the strong involvement of domain experts, the simulation model is applicable to strategic health policy design and operational level analysis of the health care system.

The Garrison Health Modelling Tool needs further development and validation before its utility can be fully tested. Inclusion of health data derived from existing health systems will allow for validation of the underlying model, and also permit the value of the tool to be tested in a real setting. This will allow for an informed decision on whether to look for a Defence project to fully develop the concept as a tool supporting garrison management within Australia.

RELEASE LIMITATION

Approved for public release

Published by

Joint Operations Division
DSTO Defence Science and Technology Organisation
Fairbairn Business Park Department of Defence
Canberra ACT 2600 Australia

Telephone: (02) 6256 6200
Fax: (02) 6128 6332

AR-014-925
November 2010

APPROVED FOR PUBLIC RELEASE

Use of System Dynamics Techniques in the Garrison Health Modelling Tool

Executive Summary

Joint Health Command (JHC) tasked DSTO to develop techniques for modelling Defence health service delivery both in a Garrison environment in Australia and for operations overseas. The background to this request followed a COSC Agendum report (known as the Alexander review of health services[1]) and the standing up of JHC in 2008. The intent was to improve efficacy of health delivery and make command and control of the Defence health system more effective and transparent.

This report presents a system dynamics simulation model for the health management of the Townsville garrison. It includes components representing service demand, medical staffing by GPs, health dependency of the garrisoned troop, health facilities, costings and budget amounts. The simulation model is applicable to strategic health policy design and operational level analysis of the health care system. It has been built with the strong involvement of domain experts who were also engaged in the development of an overarching Garrison Health Support Model (GHSM)—an agreed representation of how Joint Health Command manages its responsibilities for Garrison health care. The tool described here was developed as a concept demonstrator to assist in development of the GHSM and in identification of requirements of tools to support administration of the model.

The system dynamics model of the Townsville Garrison is implemented in software in the Garrison Health Modelling Tool version 3.0. It is designed as a prototype decision-support tool for senior health officers and JHC managers, with an interface that allows easy access to dynamic simulation of various parts of the health system. It is envisaged that it can be used to answer 'what if …' questions regarding health policy and management and to perform sensitivity analyses across the health system.

There are a number of facilities included in the model:

1. Lavarack Eastern Clinic.
2. RAAF Expeditionary Health Squadron Detachment Townsville (1 EHS Det Tvl).
3. Lavarack Barracks Medical Centre (LBMC).
4. Aviation Precinct (used to model an expanded 1 EHS Det Tvl facility).
5. Lavarack Western Clinic
6. 5 Aviation Regiment Regimental Aid Post (RAP).
7. Lavarack Central Clinic (a concept requiring consideration during early development).

[1] Australian Government Department of Defence, COSC Agendum 50/08 – medical issues, 2008

The model includes a number of linked sectors or sub-models that together form the garrison health representation. The main sectors are:

1. A Medical Staffing sector, currently limited to ADF and Civilian GPs.
2. A Dependency Sector, representing troops in various units across the garrison and their posting cycles.
3. A service delivery sector, modelled on a path through the health care system from health centre or RAP visit through to hospitalisation.
4. A service demand sector that takes account of the various medical services provided by staff on the garrison.
5. Costing and budget sectors that include weekly staff, health centre, fee-for-service and pharmaceutical costs.

As described here the Garrison Health Modelling Tool needs further development and validation before its utility can be fully tested. Inclusion of health data derived from existing health systems will allow for validation of the underlying model, and also permit the value of the tool to be tested in a real setting. This will allow for an informed decision on whether to look for a Defence project to fully develop the concept as a tool supporting garrison management within Australia.

Contents

1. Introduction

Joint Health Command (JHC) tasked DSTO to develop techniques for modelling Defence health service delivery both in a Garrison environment in Australia and for operations overseas. The background to this request followed a COSC Agendum report (known as the Alexander review of health services) [1] and the standing up of JHC in 2008. The intent was to improve efficacy of health delivery and make command and control of the Defence health system more effective and transparent. In this regard JHC put in place a set of Service Level Agreements (SLAs) with the three services, and Regional Level Agreements (RLAs) with the Australian health regions, designed to deliver and maintain agreed garrison health services.

Associated with these agreements is the Garrison Health Support Model (GHSM) -- an agreed representation of how JHC manages its responsibilities for Garrison health care. Since the formation of JHC this model has been under development and review within the Defence Health group. It looks to establish a clear command and control chain for technical and corporate governance across the joint garrison environment, and provide clarity of roles and responsibilities for technical governance, capacity development, corporate compliance and performance assurance. This report describes the Garrison Health Modeling Tool (GHMT), a prototype software tool developed in conjunction with the evolving GHSM to provide systems analysis and decision support capabilities.

The main requirements for such a tool were the ability to look at a number of different analyses of health support in a garrison environment including those related to:

- Workforce planning issues. A system that can simulate workforce needs on the basis of a variable health dependency, due for example to operational postings or specific training needs, would be useful.
- Facilities management. There is a need to analyse the effects of distributing the dependency among the health facilities within a garrison precinct.
- Financial planning. Tracking of various lines in the budget associated with garrison health care with regard to predicted cost over-runs.
- Demand for various health services. This includes the need for warning indicators on waiting times for services.

DSTO's role was to help provide a prototype tool that could be used to stimulate discussion, refine requirements and provide the basis for a fully operational system used for assistance in the management of garrison health care arrangements.

A search was conducted for existing systems and approaches that could provide the requirements listed above. The Queensland Government's Health Workforce Unit has produced a toolkit[1] for health workforce planning. This includes tools or documented approaches for Service Planning Analysis, Process Mapping and Analyses of Model of Care. The toolkit is potentially useful in a civilian environment where medical services demand and workforce are relatively constant but less so in a military situation where demand (in particular) is highly variable. These approaches tend to give a snapshot of the health support arrangements at a point in time and do not provide the type of dynamic views of the health system over time that can be used for decision-support purposes.

[1] Last referenced at http://www.nhwt.gov.au/colab.asp, October 2010

2. System Dynamics

The faceted nature of garrison health care with a number of inter-related time dependencies makes it a challenging environment for systems analysis. The systems modeling methodology of system dynamics offers a holistic view of such systems. The approach, developed by Jay W. Forrester in the Mid-1950s and first described at length in the book *Industrial Dynamics* [2], has been used in a number of studies both in the health [3, 4] and the military domains [5, 6].

A precept of system dynamics is that the complex behaviours of organisational and social systems are the result of ongoing growth of stocks—for example of people, material, knowledge or other assets—and both balancing and reinforcing feedback mechanisms that affect the rates of growth of these stocks. System dynamics offers the practical application of the concepts of stocks and flows in the form of computerised models in which various policies and scenarios can be tested in a systematic way that potentially answers both "what if" and "why" questions.

System dynamics model building may be thought of as a series of four stages [7]: conceptualisation (problem definition and system conceptualisation), model formulation, testing (model behaviour and model evaluation) and implementation (policy analysis and use). These are:

1. Conceptualisation. The conceptualisation stage is broadly made up of the following tasks:
   - Define the purpose of the model.
   - Define the model boundary and identify key variables.
   - Describe the behaviour or draw the reference modes of the key variables.
   - Diagram the basic mechanisms and feedback loops of the system.
2. Formulation. The iThink application software, a product of iSee Systems (http://www.iseesystems.com/), was used in this phase. The formulation phase is made up of the following tasks:
   - Modelling of the system in terms of stocks, flows and converters. The software automatically converts these representations into time-dependent equations that can be solved numerically. Built-in functions in the software facilitate mathematical, statistical, and logical operations.
   - Identify relevant measured and experiential data for use in the model.
   - Evans and Peck Pty Ltd were contracted to build the software for this phase.
3. Testing. The test phase is made up of the following tasks:
   - Simulate the model and test the dynamic hypothesis.
   - Test the model's assumptions.
   - Test model behaviour and sensitivity to perturbations.
4. Implementation. The implementation stage is made up of the following tasks:
   - Test the model's response to different policies.
   - Translate study insights to an accessible form.

As discussed in the next section we largely followed this approach with a rapid iterative development technique that allowed the model to be refined as the problem space became clearer and as new requirements were identified.

3. The System Dynamics Simulation Model for the Garrison Health Environment

The main subject matter expertise for this core part of the model comes from LTCOL Kerry Clifford formerly of JHC, now Senior Health Officer Northern Queensland. Notes from LTCOL Clifford on the development of the system have been referenced throughout this report [8].

The model was developed using a rapid iterative development technique that involved subject matter experts working closely with the contractor used to build the model in the iThink software. This involved a process of making apparent the mental models of subject matter experts and is strongly dependent on an understanding of how the different parts of the health system operate and inter-relate. Mental models are the most important sources for model building particularly for the early conceptualisation stage [9]. These elicitation, clarification and representation processes, which can be regarded as a learning development, are an outcome of the work described here.

The current model, known as the GHMT Version 3.0, has not yet been formally validated. Informal verification of structural correspondence to the real world processes involving the main entities and their life-cycle within the health system has taken place, but reproduction of real scenarios derived from observed past behaviour based on real data has not yet occurred. This will be described as part of documenting the next version of the model.

The current model relates to the Townsville garrison. This is a major operational base where variations in demand and health dependency appear through large collective training and deployment cycles. Units of the 3rd Brigade are stationed here along with other units such as 5th Aviation Regiment (5 AVN REGT), 10th Force Support Battalion (10 FSB) and Joint Logistics Unit - North Queensland (JLU-NQ). The garrison includes the Lavarack Barracks Medical Centre - (LBMC) a small hospital within Lavarack Barracks. It has a range of facilities, including operating theatres, wards, outpatients, ambulances etc. It is staffed by Royal Australian Army Medical Corps, Royal Australian Army Nursing Corps and civilian medical personnel. There is also a Dental Centre at Lavarack Barracks, staffed by Royal Australian Army Dental Corps personnel and civilian dental specialists.

There are eight facilities included in the model [9]:

1. Lavarack Eastern Clinic
2. RAAF (1 Expeditionary Health Squadron Detachment Townsville (1 EHS Det Tvl) facility as at May 10)
3. Lavarack Barracks Medical Centre (LBMC) Plus. This is used to model an expanded LBMC as an option to the building of a third Lavarack clinic.
4. Aviation Precinct. This is used to model an expanded 1 EHS Det Tvl facility to hub garrison support to 5 Avn Regt as well as RAAF Townsville dependencies.
5. LBMC (facility as at May 10)
6. Lavarack Western Clinic
7. 5 Aviation Regiment RAP.
8. Lavarack Central Clinic (a concept requiring consideration during early development).

The model includes a number of linked sectors or sub-models that together form the garrison health representation. Figure 1 shows the main sectors and some of the linkages between them.

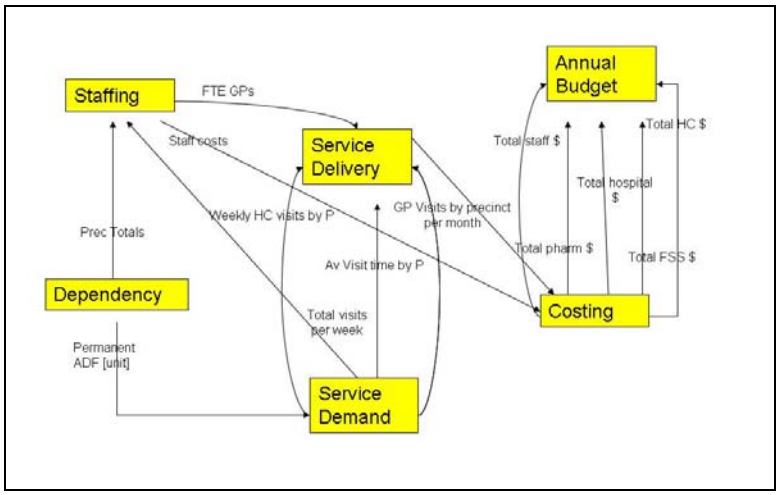

Figure 1: GHMT Sectors

The following sections discuss the sectors in more detail.

3.1 The Medical Staffing Sector

This sector (see Figure 2) represents the number of medical staff (currently limited to GPs) by precinct. Both ADF and Contracted Health Professionals (CHP) GPs are included, with numbers settable from the user interface Health Facility Staffing screen (see section 4.2). Availability of GPs is settable, allowing for example a percentage of ADF GP time to be allocated to non-medical duties.

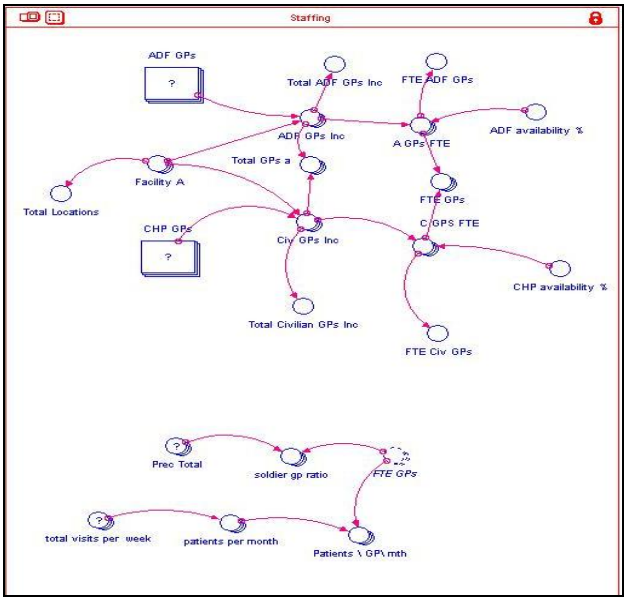

Figure 2: Medical Staffing Sector

3.2 The Dependency Sector

This model (see Figure 3) represents the posting associated with a number of ADF units across the precincts in the garrison, the deployment of staff in those units, and the return back into the system after deployment. Key parameters are the numbers of permanent ADF troops by unit across the garrison, the rate of uptake of ADF personnel involved in training, and the rate at which they are deployed.

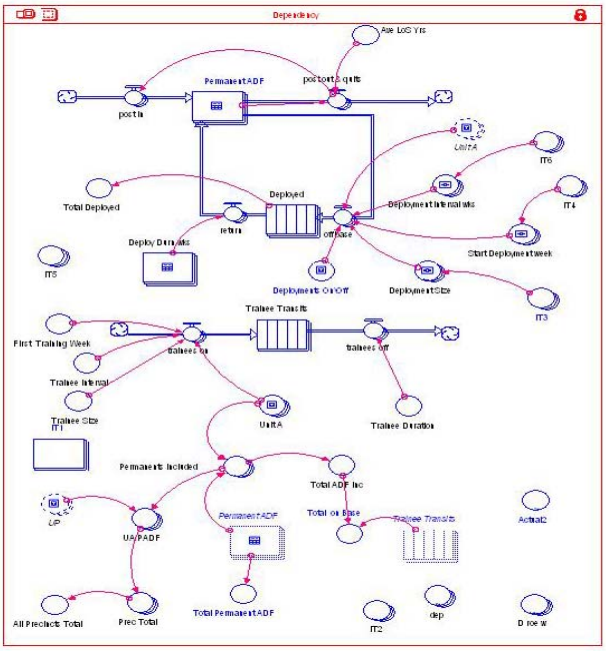

Figure 3: Dependency Sector

3.3 The Service Delivery Sector

The following notes on service delivery are taken from [9]. A simple patient flow pathway was assumed for initial model development (see Figure 4). Patients enter the health service pathway predominantly at a health clinic/centre. This is the initial demand metric. They are triaged by medical assistants in the first instance. From this process, a number will have their care needs met through simple advice, minor treatment and/or non-prescription medication. Once satisfied, a certain number of patients will therefore return to their unit or take limited sick leave, thereby closing the patient event and exiting the system.

An assumption was made that there is a system-wide average rate at which patients require medications at an average cost per event (sufficient for model design in the first instance). This brings pharmaceutical cost into the equation for the first time.

Those remaining in the process stream require referral to a Medical Officer. In a more sophisticated model, an intermediate step of review by a Nursing Officer/RN would be introduced to further filter out patients not requiring MO attention. Patients referred for MO attention represent the next level of waiting time demand within the system. This backlog can only be met by Medical Officers as a process component, with availability, effectiveness, non-patient time and facility efficiency elements impacting on process effectiveness. Once seen, a

number of patients will require further review and therefore enter a feedback loop to re-enter the backlog for service delivery at further time. A number will also progress through to admission to hospital for various reasons.

Hospitalisation was conceptually modelled during the 2009 RLA development analysis at four levels of inpatient bed requirement, being:

1. Self caring inpatient beds for members who cannot recuperate in unsupervised accommodation.
2. Members requiring basic nursing care assistance and regular observation, mostly regionally available in Defence facilities.
3. Members requiring pre- and post-operative nursing care or levels of medical or nursing assistance generally not available in Defence facilities.
4. Intensive or Critical Care admissions generally associated with high levels of clinic management.

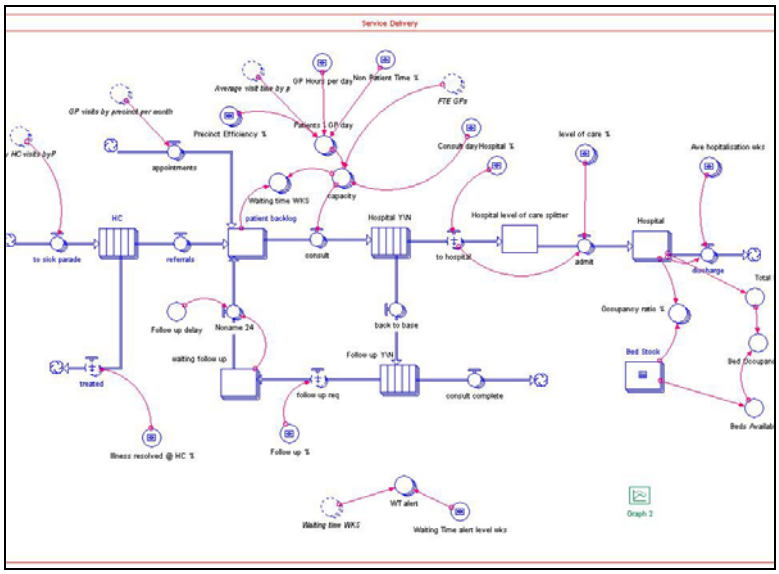

Figure 4: Service Delivery Sector

3.4 The Service Demand Sector

This model (see Figure 5) represents the range of medical services provided by GPs across the precincts including Health Centre referrals, and military-specific tests and examinations such as an Annual Health Exam and the MECR. Key parameters include *daily RAP visits* calculated from presentations both by trainees transiting through the garrison and permanent ADF, and *GP visits* broken down across unit and precinct, to handle health centre referrals and tests and examinations.

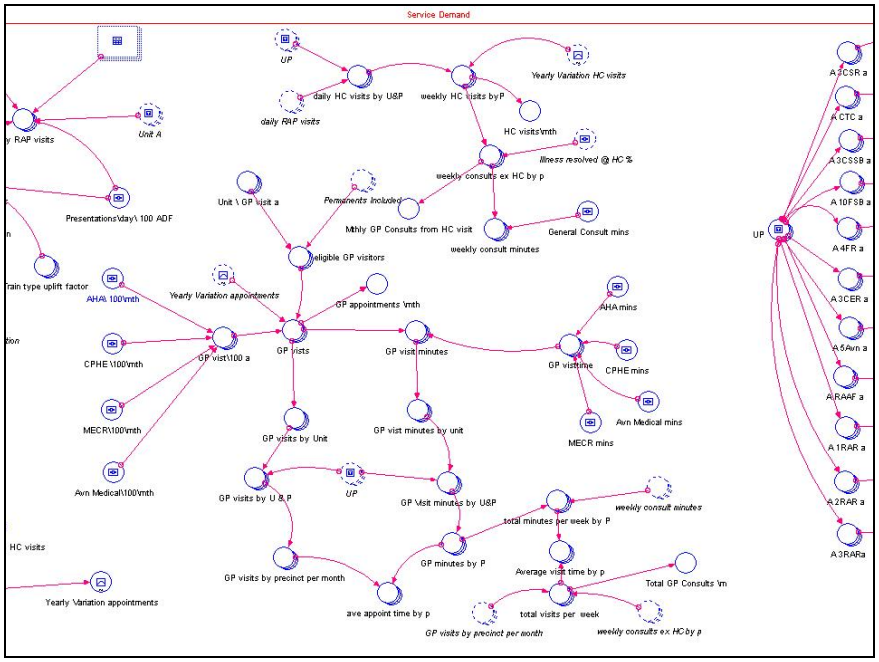

Figure 5: Service Demand

3.5 The Costing Sector

This model (see Figure 6) is made up of five sub-models that go to calculate the *Total Modelled Costs*:

1. A total staff cost made up calculated weekly from ADF and contracted GP FTE (full-time equivalent) numbers;
2. A total hospital cost including bed and admission costs;
3. A pharmaceutical cost;
4. An external fee-for-service (FFS) cost;
5. A total health centre cost based on average cost per presentation and presentation numbers.

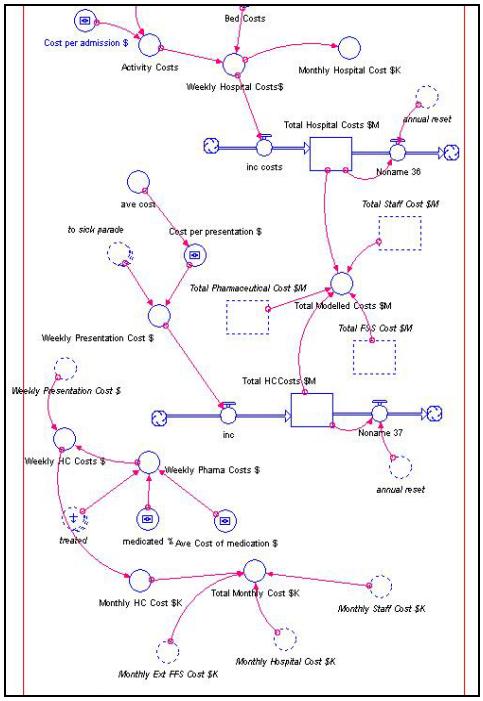

Figure 6: Costing

3.6 The Budget Sector

This is the complement to the Costing Sector in Section 3.5. It models (see Figure 7. the budgets or allocated dollar amounts associated with the five areas of costing outlined in the previous section. A cost alarm is flagged if actual (modelled) costs exceed budgeted amounts.

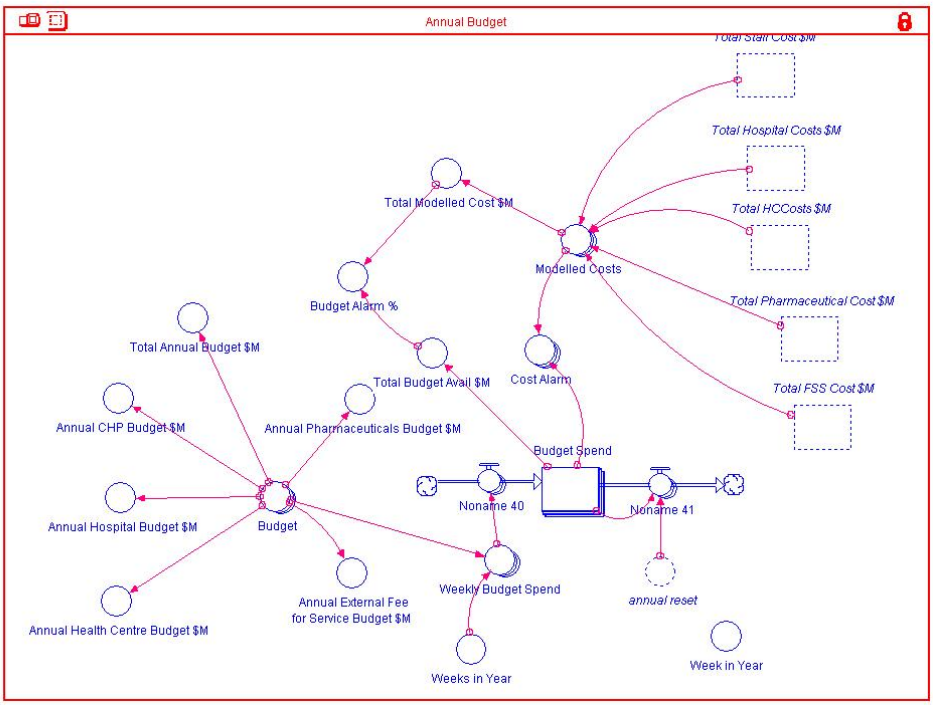

Figure 7: Budget Sector

4. The User Interface to the Garrison Health Modelling Tool

This section describes the main functionality of the user interface to the model. These elements allow user input to a range of underlying data and the display of tables, graphs and so on representing the simulations of the tool. The intent was to give an indication of the types of operations that could be possible with a fully developed tool.

4.1 The Executive Dashboard

As shown in Figure 8, this allows navigation to the various sectors of the tool, an ability to run the system and a display in graphical form of a number of outputs over a period of two years[2]. The values displayed in this way include the variation over time of patient backlog data across the various precincts, total ADF personnel on garrison and total deployed, monthly costs broken down by type (staff, external FFS, pharmaceutical, health centre, etc), numbers of occupied beds across the four levels of care, waiting times by precinct, and total budget and total modelled costs.

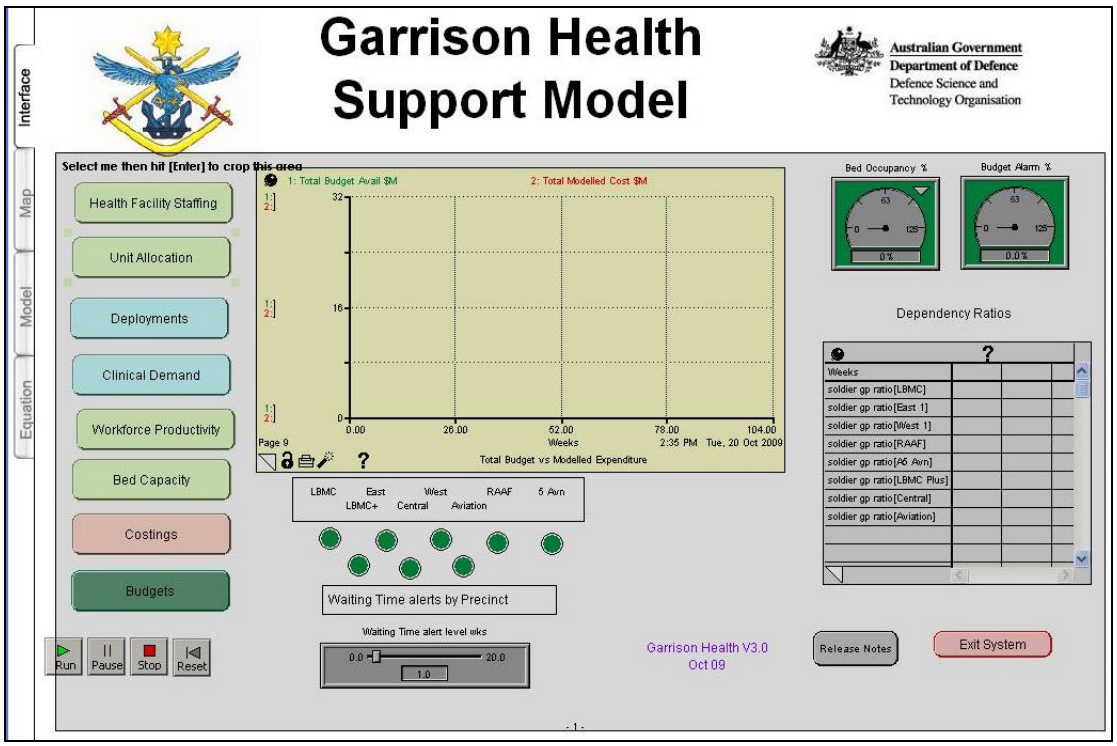

Figure 8: Executive Dashboard

[2] The software allows data to be displayed over periods ranging from months to years. Two years is shown here as a typical period of interest.

4.2 Health Facility Staffing

As shown in Figure 9, this permits the allocation of health dependency across the eight facilities that make up the garrison. Selecting a facility includes the medical staff associated with this facility in the system-wide calculations related to service delivery and costing. Simulating the health system with different facility options is particularly useful as a decision aid when comparing the costs and benefits of amalgamation of health facilities or the creation of new ones.

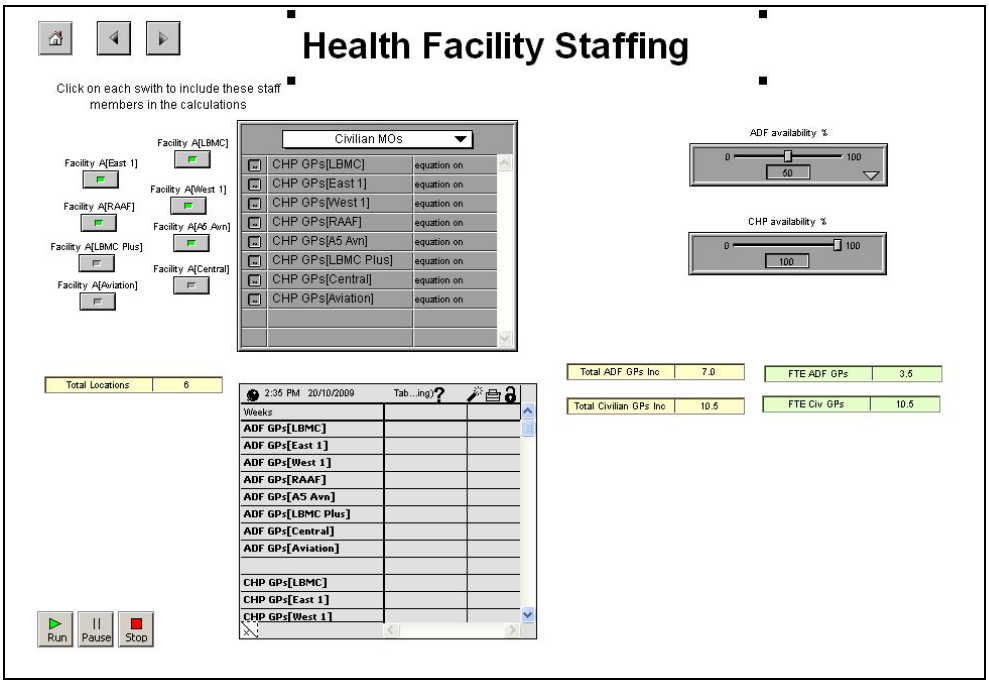

Figure 9: Facility Staffing

4.3 Clinical Demand

See Figure 10. This draws on spreadsheet data denoting ADF numbers by unit and their associated requirements for medical services and examination of various types. The main variables are the staff numbers related to each of the ADF units in the garrison (controlled by buttons). In addition sliders control the number of presentations per day per 100 personnel, the percentage of those presentations that are resolved at the health centre and the demand the various health examinations and tests conducted by GPs. This allows modelling of the effect of including a new unit such as 3RAR on the health system[3].

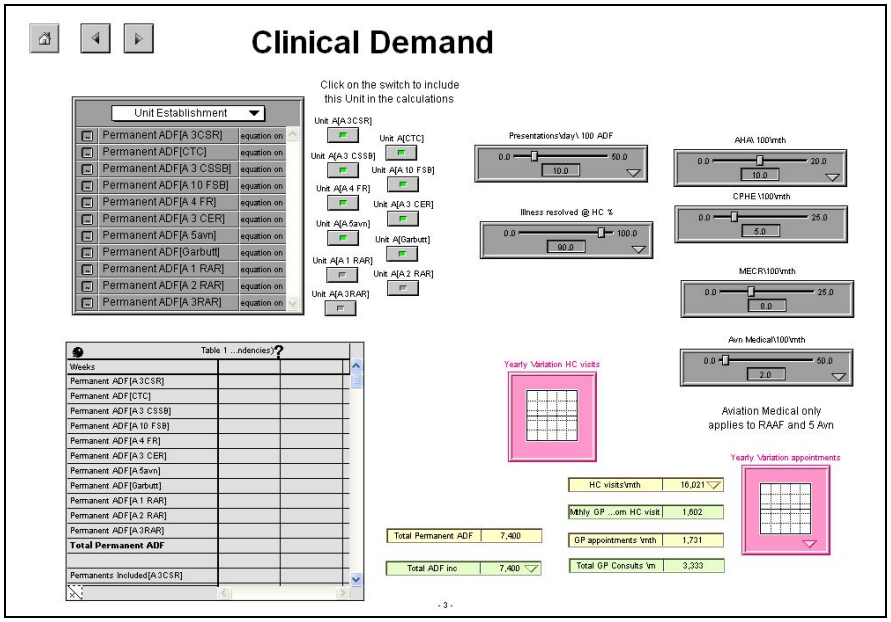

Figure 10: Clinical Demand

[3] 3 RAR will not be fully located within Lavarack Barracks until the second half of 2011

4.4 Unit Allocation

See Figure 11. This matrix permits the distribution of units and their inherent medical dependencies to facility precincts. Spreadsheet data on personnel numbers for each unit are then reflected in cells showing total allocations to each health facility.

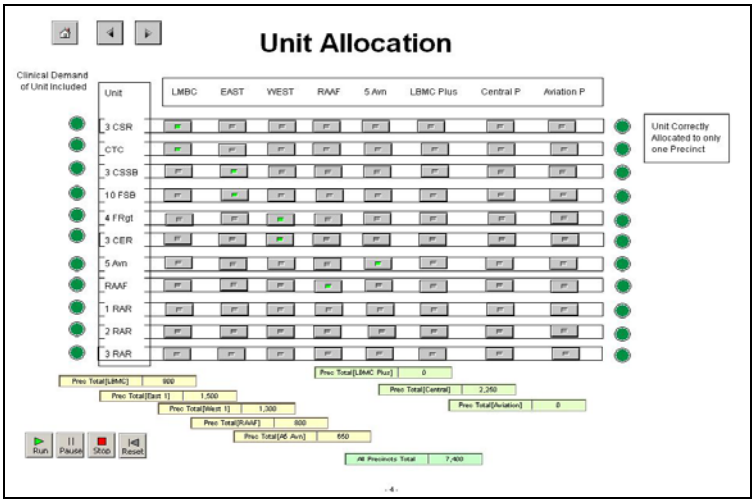

Figure 11: Unit Allocation

4.5 Budget Allocation

See Figure 12. This permits the display over time of actual budget amounts against modelled costs across the five areas outlined in sections 3.5 and 3.6 including salary costs, health centre costs and hospital costs. Traffic lights indicate where there has been a cost over-run in each of these sectors.

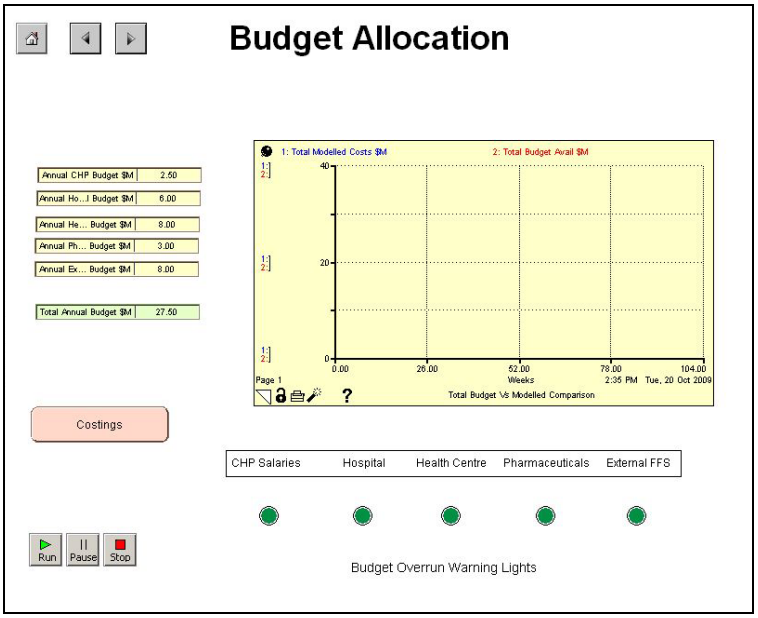

Figure 12: Budget Allocation

4.6 Workforce Productivity

See Figure 13. This permits the modification (by precincts) of the time spent by GPs on a number of activities. The table displays the number of patients being seen per day by GPs across the precincts.

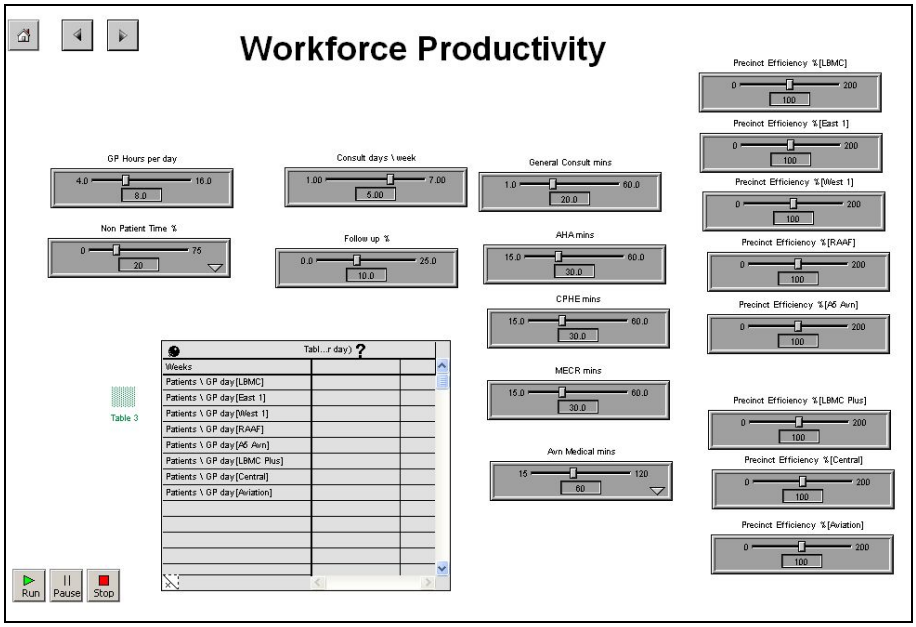

Figure 13: Workforce Productivity

4.7 Garrison Costings

See Figure 14. This allows the modification of costing data across various services including hospital, health centre and fee-for-service (see section 3.5 Costing Sector discussion in previous section.)

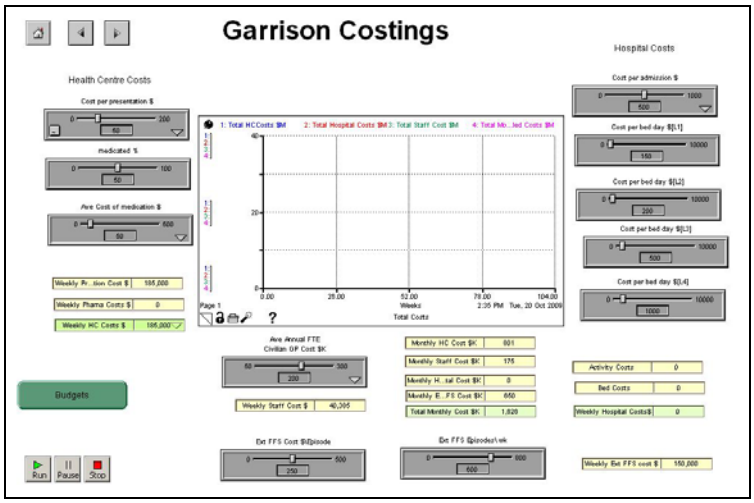

Figure 14: Costings

4.8 Deployments

See Figure 15 and Figure 16. We have assumed that deployable units will enter and leave the garrison environment. These screens model the extent and duration of deployments and reflect that back through dependency and health services figures.

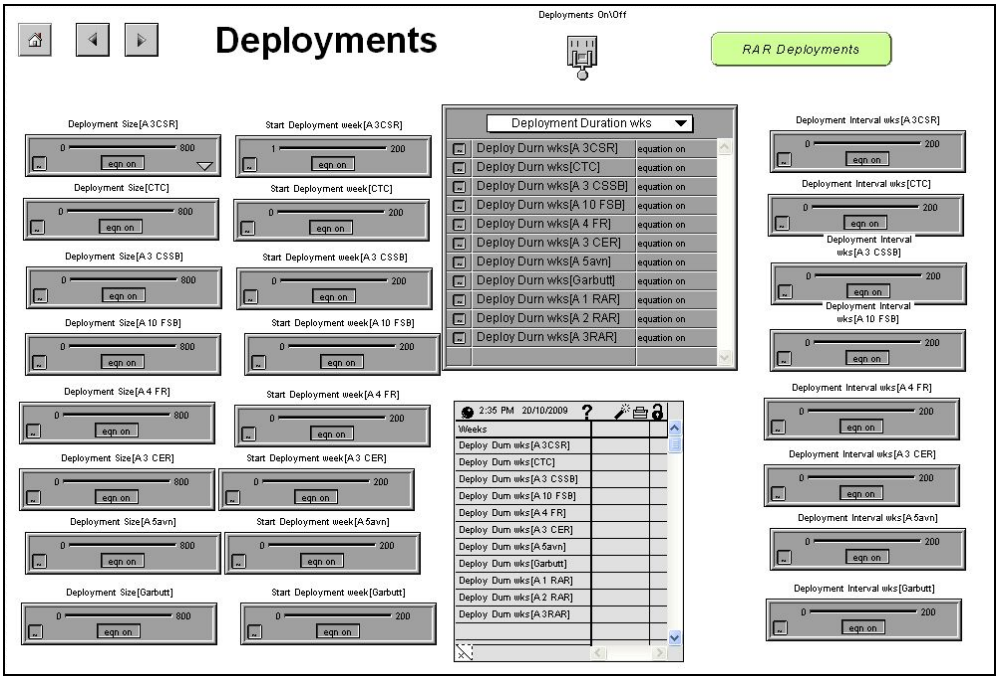

Figure 15: Deployments

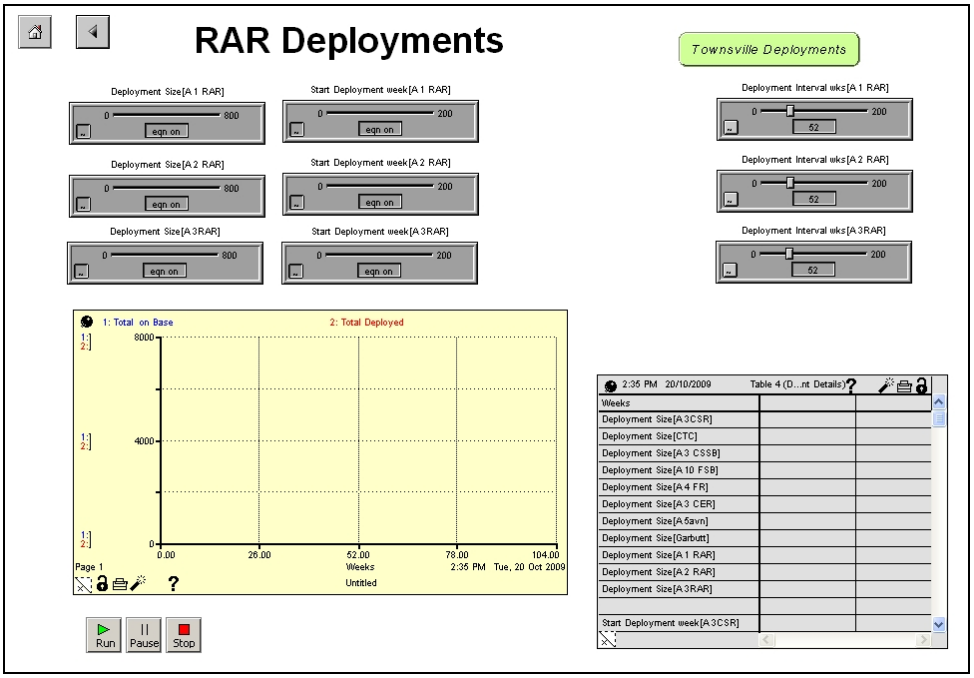

Figure 16: RAR Deployments

5. GHMT Usage Scenarios

Simulation models can occupy varied roles in the planning of health care infrastructure and services. They can be a close replica of the real world used to produce exact answers or a tool in building consensus among stakeholders with different views and objectives. The role a simulation model can have in a decision process is constrained by the degree to which the model and its results are accessible to stakeholders with no or limited experience with modelling, and the degree to which the results are trusted by the stakeholders. The strong client involvement in the present modelling work is seen as essential to create technically accurate models; and is a necessary though not sufficient condition for the use of the models for decision-support purposes involving a number of stakeholders.

As stated it the introduction there are a number of use cases for which the GHMT is applicable including facilities management, financial planning and workforce planning. This section outlines potential scenarios in which the GHMT could be used for a specific purpose. These are not by any means the only circumstances in which the tool could be used. In addition, as discussed above, the full capabilities of the tool either as a device for giving answers or more broadly as a way of achieving consensus between decision-makers need to be tested in a real setting.

5.1 Surge in Training

In this scenario an extra 300 troops from 3 RAR are stationed in Townsville for a one-off training exercise lasting six to eight weeks. It is seen as an early test of the garrison's ability to cope with the re-location of 700 3 RAR personnel plus families from Holsworthy barracks to Townsville planned for 2011. From a health perspective the increase in numbers will place additional strain on health services and resources. The GHMT could be used to estimate what effect the surge might have on overall costings for the garrison in terms of health centre, pharmaceutical, external fee-for-service and hospital costs. It could also be used to look at indicators of health service delivery such as waiting times.

5.2 Response to Outbreak of Dengue Fever

A 2 RAR soldier stationed on base who had been deployed to Timor-Leste is found on return to have contracted the Dengue virus. When an imported case of this type is confirmed as being viraemic a number of response measures are put into place. These include an overall response plan that involves communication with local health authorities, hospital emergency departments and international agencies such as the Centre for Disease Control (CDC). Because of the possibility of transmission to other personnel on the base urgent clinical examinations of all 7,400 ADF employees need to take place either on-site or at local health facilities. This process finds that three other soldiers are infected, escalating the nature of the problem and necessitating the discussion with medical entomologists about vector control measures that are needed in the garrison. In this type of situation the GHMT could be used to estimate the effect of the outbreak on delivery of non-Dengue related, routine health services across the base. The effect on the health budget due to increases in FFS, pharmaceutical and hospital care could also be gauged.

6. Discussion

A full discussion of the efficacy of the techniques used in the GHMT (as outlined in this paper) will need to wait until a more complete evaluation of the system has been completed. However a number of remarks can be made about the adequacy, benefits and shortcomings of the system dynamics approach to modelling health care delivery.

Firstly, in the opinion of subject matter experts (SMEs), the models do closely capture the main lines of operation involved in running a Garrison health care system. There is a strong belief that the tool will be a useful aid in providing decision support to senior health officers who manage the system, mainly as a way of making explicit the complex linkages between different parts of the structure and as a means of simulating the system over time.

Secondly, the benefit of this approach very much depends on the involvement of SMEs. They have the knowledge of how the system works and it is essential to have them involved in the conceptualisation and formalisation stages of the model development cycle. Depending on the level of detail required in the model, this can be time consuming. The time-intensive nature of this involvement is arguably the greatest issue associated with the use of the techniques discussed here.

Thirdly, the system needs a lot of real data for verification purposes. In the health system under investigation this is currently difficult to collect, mainly due to the fact that the data is very diverse and spread around a number of different information systems both electronic and paper based.

7. Conclusion

This report describes the Garrison Health Modelling Tool, a prototype software package designed to provide decision-support to JHC health officers and managers in a garrison environment. Version 3 is described in detail from a system dynamics modelling and user interface perspective.

The underlying modelling assumptions need more detailed verification, and the system also requires testing with senior health officers to gauge its utility. Feedback to date has been very positive and future work aims to address the issues of verification and utility. This will require closer integration of the tool with health information systems and associated data. The approach taken also looks to be applicable to the modelling of the health support to deployed forces.

If the system is successfully tested we would expect the tool to be included in time as part of a project designed to ultimately roll out a commercial version across the ADF garrison environments.

8. References

1. Australian Government Department of Defence, COSC Agendum 50/08 – medical issues, 2008
2. Forrester, Jay W. *Industrial dynamics*. Waltham, MA: Pegasus Communications, 1961
3. Homer, J.B. and Hirsch G. B. (2006), System Dynamics Modeling for Public Health: Background and Opportunities, Vol 96, No. 3 American Journal of Public Health 452-458
4. Dangerfield, B.C. (1999) System Dynamics Applications to European Health Care Issues, The Journal of the Operational Research Society, Vol. 50, No. 4, System Dynamics for Policy, Strategy and Management Education, pp. 345-353
5. Wang, J. (2007) A System Dynamics Simulation Model for a Four-rank Military Workforce, Defence Science and Technology Organisation, DSTO-TR-2037
6. Lofdahl, C. (2009) Implementing Irregular Warfare Policy Using Modeling and simulation, Proceedings of the 27nd International System Dynamics Conference, Albuquerque.
7. Luna-Reyes LF, Andersen DL. (2003). Collecting and analyzing qualitative data for system dynamics: methods and models. System Dynamics Review 19(4): 271–296.
8. Clifford, K. (2010), DSTO Garrison Health Support Modelling Tool, Joint Health Command internal paper.
9. Vennix JAM, Andersen DF, Richardson GP, Rohrbaugh J. (1992). Model-building for group decision support: issues and alternatives in knowledge elicitation. *European Journal of Operational Research* **59**(1): 28–41.

DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION
DOCUMENT CONTROL DATA

1. PRIVACY MARKING/CAVEAT (OF DOCUMENT)

2. TITLE

Use of System Dynamics Techniques in the Garrison Health Modelling Tool

3. SECURITY CLASSIFICATION (FOR UNCLASSIFIED REPORTS THAT ARE LIMITED RELEASE USE (L) NEXT TO DOCUMENT CLASSIFICATION)

Document	(U)
Title	(U)
Abstract	(U)

4. AUTHOR(S)

Mark Burnett, Kerry Clifford and Graham Durant-Law

5. CORPORATE AUTHOR

DSTO Defence Science and Technology Organisation
Fairbairn Business Park Department of Defence
Canberra ACT 2600 Australia

6a. DSTO NUMBER	6b. AR NUMBER	6c. TYPE OF REPORT	7. DOCUMENT DATE
DSTO-TN-0988	AR-014-925	Technical Note	November 2010

8. FILE NUMBER	9. TASK NUMBER	10. TASK SPONSOR	11. NO. OF PAGES	12. NO. OF REFERENCES
2010/1116777	07/269	VCDF	17	9

13. URL on the World Wide Web

http://www.dsto.defence.gov.au/corporate/reports/DSTO-TN-0988.pdf

14. RELEASE AUTHORITY

Chief, Joint Operations Division

15. SECONDARY RELEASE STATEMENT OF THIS DOCUMENT

Approved for public release

OVERSEAS ENQUIRIES OUTSIDE STATED LIMITATIONS SHOULD BE REFERRED THROUGH DOCUMENT EXCHANGE, PO BOX 1500, EDINBURGH, SA 5111

16. DELIBERATE ANNOUNCEMENT

No Limitations

17. CITATION IN OTHER DOCUMENTS Yes

18. DSTO RESEARCH LIBRARY THESAURUS

System dynamics, Health modelling, Garrison health, Joint Health Command

19. ABSTRACT

This report describes the Garrison Health Modelling Tool, a prototype software package designed to provide decision-support to JHC health officers and managers in a garrison environment. Version 3 is described in detail from a system dynamics modelling and user interface perspective. It includes components representing service demand, medical staffing by GPs, the health dependency of the garrisoned troop, health facilities, costings and budget amounts. Built with the strong involvement of domain experts, the simulation model is applicable to strategic health policy design and operational level analysis of the health care system.

The Garrison Health Modelling Tool needs further development and validation before its utility can be fully tested. Inclusion of health data derived from existing health systems will allow for validation of the underlying model, and also permit the value of the tool to be tested in a real setting. This will allow for an informed decision on whether to look for a Defence project to fully develop the concept as a tool supporting garrison management within Australia.