

Use of Simulation Modelling to Guide Mental Health Planning – A pilot study in the ACT

Phase 1: Proof-of-Concept Final Report

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Executive Summary

Use of simulation modelling to guide Mental Health Planning: A pilot study in ACT Phase 1: Proof of concept trialing of the AI-enabled toolkit using historical local

data from 2016. (ANU Ref: SPH40019) 1 August 2019 - 31 January 2021

The analysis of the efficiency of the mental health system has been identified as a major priority in Australia by the 2020 Productivity Commission Report. This project has tested a proof-of-concept model of a decision support tool that will be applied in a second phase to modelling the relative technical efficiency of mental health care in one Australian jurisdiction, the Australian Capital Territory (ACT). This ACT demonstration of the proof-of-concept will eventually help local and regional mental health planning right across Australia. The project draws on real data regarding mental health service care in local systems. This project brings world's best practice in mental healthcare improvement by using an Artificial Intelligence-enabled "decision support system" devised by an international consortium led by Professor Luis Salvador-Carulla. The project combines social and demographic data, and health service provision data with secondary analysis of aggregated and deidentified data on utilisation of mental health services and outcomes. This proof-of-concept project has analysed metadata sets on service provision and resource utilization, using a series of visualization and modelling tools. This package of tools will then be used in Phase 2 of the project to identify the optimal combination for modelling technical efficiency in ACT.

Metadata Sets: Three metadata sets have been analysed in this proof-of-context study:

- > ACT (Australia): a) Atlas of MH Metadata Set
 - Service provision from the Atlas of Mental Health Care in ACT -2016,
 - ACT Health pseudonomised database on service use 2017
 - b) Service provision from the Atlas of Mental Health Care in ACT -2020,
 - c) Other national databases
- > ENGLAND (UK): a) QUIRC Metadata Set
- BASQUE COUNTRY (Spain)
 - a) Service provision from the Atlas of MH care in the Basque Country
 - Atlas of Mental Health Care in Bizkaia 2015
 - Atlas of Mental Health Care in Gipuzkoa 2015
 - b) Pseudonomised database of service use in the Basque Country 2017

Decision Support Tools: Five visualization and decision support tools have already been tested in a series of case examples (ACT, Basque Country, and England) on the metadata sets described above, to appraise their feasibility for the efficiency analysis of the mental health system in ACT in 2021:

- > Interactive Parallel Coordinates to visualize complex data of local mental health systems
- > Dendograms and spider graphs of a hierarchical cluster
- Geographical Information Systems based on the information provided by the Atlases of MH care
- Self-Organising Map Network (SOMNet) and Hierarchical clustering based on Machine Learning
- > Efficient Decision Support Mental Health (EDeS-MH)

Method

In order to analyse the feasibility of the resulting method we followed a multistep process of consensus formation using the "Expert-based Cooperative Analysis" (EbCA). This approach combines data analytics and expert knowledge to provide answers to complex questions in health system research. The EbCA process has involved the iterative analysis of the above-mentioned metadata sets and tools, and the collaboration of experts from all the public agencies on mental health in ACT: the Office of Mental Health and Wellbeing, ACT Health, Canberra Health Services, and Capital Health Network (PHN). The ACT Mental Health Community Coalition (MHCC), the main organisation in community care and community engagement in the region, has also participated in the study. We also incorporated feedback from two major organisations of professionals from the Royal Australian and New Zealand College of Psychiatry - ACT Branch, and Australian College of Mental Health Nurses (ACMHN), as well as the contribution of an international expert panel. The iterative process to guide consensus formation entailed five face-to-face and online international seminars and discussions, and a feasibility survey with five decision makers of planning agencies and systems research.

Results

The feasibility survey indicated the potential for the toolkit to be used as an information source for supporting decision making both in the ACT region and in their respective organisations. It also underscored the need for such a tool and the importance of using information from the Atlas with improved visualization tools. The agreement on the relevance of the suggested indicator dataset of service use and the GIS for the efficiency analysis was moderate to high, but lower than for other domains of the feasibility analysis. The panel identified the EDeS-MH as the best alternative to model the efficiency of mental health services in the region, and the importance of combining this tool with the Dynamic System Modelling of Suicidal Behaviour. The panel judged that the proposed model would be acceptable and practical both for ACT planning at regional level as well as for supporting planning and management in specific organisations (planning agencies and NGOs), as well as for the consumers in this region. The major problems were identified in relation to the interpretation of the potential results, the need for training in the use of the tool, and the need for external support to use the system. Finally, the experts considered that the efficiency and the overall value of the tool would be high for future planning of mental health in the region.

Taking into account the results of the EbCA process and the survey, the decision support tool proposed for the analysis of technical efficiency of the mental health system in the ACT region was considered feasible with a series of amendments to its main components, as follows:

Components of the final decision support system:

- > The model for the evaluation of mental health systems
- > The Atlas of MH in the ACT Region 2020
- > A revised version of the GIS (Interactive mapping) including service utilisation
- > The Efficient Decision Support Mental Health (EDeS-MH)

In addition, a series of actions have been taken at the completion of phase 1 and amendments to the original design of Phase 2:

Actions incorporated to improve Phase 2

- Reinforcement of the collaboration with other key research centres working on other modelling tools for mental health planning such as the Dynamic System Modelling of Suicidal Behaviour (University of Sydney) and the NMHSPF (University of Queensland) within the new research reference network "Regional Mental Health Planning in Australia" funded by the Department of Health
- *Reinforcement* of the role of ACT Mental Health Community Coalition (MHCC) in the design of Phase 2 to increase community engagement and participation
- *Incorporation* of a new partner within the core research group to produce an interactive GIS mapping of the Atlas of MH in the ACT Region 2020 (A/Prof Amir Aryani, SoDA, Swinburne University of Technology)
- Incorporation of an on-line training module for planners within the Phase 2 proposal
- Incorporation of a sustainability plan and impact analysis module within the Phase 2 proposal

Lessons learned

Modelling the efficiency of local mental health care, their services and interventions is a major priority at every level of the mental health system: macro (national, states, regions), meso (small catchment areas), micro (individual services) and nano (consumers and professionals). The absence of such systems has been noted by repeated reports and inquiries as a major factor impeding accountability, effective planning and systemic quality improvement in mental health. The design of a decision support tool for modelling the efficiency of mental health systems is a low-intensity but highly complex organizational intervention.

This project was originally intended as a single project including the proof-of-concept phase and the implementation of the tool in a region in Australia. Splitting the project in two separate phases with this focus on the Proof-of-Concept in Phase 1 has been an unusual approach that has proven enriching and necessary. It has allowed the team to reinforce collaboration with the key stakeholders in the region, to identify strengths

and weaknesses in the previous design and to produce a workable version, as well as to improve the collaboration with the different partners and refine the design of Phase 2. Despite the challenges imposed by COVID-19, all the objectives have been accomplished. The full engagement of ACT public agencies and the participation of key leaders from professionals and community organisations constitutes a unique achievement in the Australian mental health system. Four scientific papers have been produced from this study. Two have been submitted and are under peer-review. Two other papers are undergoing final revision by the partnership and contributing stakeholders including the analysis of equality of care provision using modelling tools.

It is our strong belief that the Proof-of-Concept findings justify continuation of the project into Phase 2 in which the decision-support tool is practically applied here in the ACT, working with local decision-makers.

Introduction

Recent public reports such as the National Productivity Commission and the Victoria Royal Commission report have confirmed that the mental health care system in Australia is in crisis, characterized by fragmentation, inefficiency and a lack of accountability. Though these problems were identified nearly a decade ago and widely cited in reports such as "Obsessive Hope Disorder" (2013), repeated calls for change by major stakeholders and organisations have not elicited change. Instead, often, the same alternatives have been funded and tried unsuccessfully in a seemingly endless loop.

The National Productivity Commission (Productivity Commission, 2020) has identified six major priority areas to fundamentally shift this situation and drive systemic reform:

- 1. Examine the effect of supporting mental health on economic and social participation, productivity and the Australian economy;
- 2. Examine how sectors beyond health, including education, employment, social services, housing and justice, can contribute to improving mental health and economic participation and productivity;
- Examine the effectiveness of current programs and initiatives across all jurisdictions to improve mental health, suicide prevention and participation, including by governments, employers and professional groups;
- 4. Assess whether the current investment in mental health is delivering value for money and the best outcomes for individuals, their families, society and the economy;
- 5. Draw on domestic and international policies and experience, where appropriate; and
- 6. Develop a framework to measure and report the outcomes of mental health policies and investment on participation, productivity and economic growth over the long term.

This in-depth analysis should be aimed at leading a reform towards a person-centred mental health system which, among other priorities, should incorporate the "measurement and transparent reporting of all service outcomes, as perceived by the people using services, would be used to enhance ongoing improvement in both the **effectiveness and efficiency of services**, and to facilitate individual choices." (Productivity Commission, 2020).

The achievement of this goal is hampered by a series of major challenges and gaps. First, the connection between medical, social and other types of care is very weak in Australia. While health service providers understand the relevance of a multisectoral approach to mental health care, current academic research is not providing the required evidence to guide planning in this direction. Second, there is a significant waste of available data. As stated at the Productivity Commission report, the mental health system in Australia "is data rich and information poor: there is limited use of data to either improve people's choices, experiences and outcomes, or inform improvements in service delivery and effectiveness.

For example, data on specialised mental health services collected by State and Territory Governments, data on services commissioned by PHNs, and data in the National Outcomes and Casemix Collection are all

underutilised." (Productivity Commission, 2020). Third the data on service availability that should be fed into a modelling system to assess systemic efficiency is missing. Australia's mental health system lacks a standard description of service provision that could serve as a baseline for monitoring improvement (Fernandez et al, 2017). This has been confirmed by the information gathered in the 13 PHNs Atlases of Mental Health produced since 2015 by the ANU team as part of the "Glocal Project" (https://rsph.anu.edu.au/research/projects/atlas-mental-health-care); the comparative analysis of the and the semantic interoperability between the National Mental Health Service Planning Framework (NMHSPF), the national classification of services in Australia, and the "Description and Evaluation of Services and DirectoriEs" (DESDE), the most widely used classification system for international comparisons of mental health systems in the world (Romero et al, 2019). The analyses conducted to this date (Salvador-Carulla et al, 2018; Rosen et al, 2020), indicate that, when used alone, the NMHSPF cannot perform an accurate analysis of the "effectiveness of current programs and initiatives across all jurisdictions" (priority 3 of the Productivity Commission Report), and to draw on "international policies and experience" (priority 5 of the Productivity Commission Report). Finally, Australia lags behind other OECD countries in applying systems thinking and modelling techniques to health planning. This is particularly relevant in mental health which is a major cause of global disease burden and with associated high societal costs.

This study assesses the usability of a healthcare ecosystems approach to mental health planning, based on systems thinking and the use of modelling, to guide local evidence-informed planning. It applies an Alenabled simulation modelling technique to local ACT mental health data from 2016 and other databases in Europe, including the analysis of a supported accommodation program in England and systemic modelling of mental healthcare from the Basque Country (Spain). The proposed Decision Support Toolkit arising from this work will replace ad hoc, untested and previously unsuccessful efforts to guide local mental health reform to better inform the planning process.

Method

This is a proof-of-concept study of a prototype toolkit designed to support decision making and guide mental healthcare planning (Decision Support System – DSS). It follows the Technology Readiness Level (TRL) framework used in the assessment of computer assisted and IT tools in healthcare (Commission E. Horizon 2020; Chung et al, 2018). In software development, the term "proof of concept" characterizes the processes to establish whether a prototype system satisfies a series of pre-defined characteristics or goals – can it really do what it promises?

Procedure

The information gathered in this project combines secondary analysis of data packages on mental health systems, visualisation tools, scenarios and modelling. A representation of these different components and how they are combined to generate meaningful information for evidence-informed planning is at Figure 1 (Furst et al, 2020).

Figure 1. Conceptual framework (summary for policymakers of the methodological assessment of scenarios and models of systems of mental health care delivery) (Furst et al, 2020)



Use of Co-design and Expert-based Collaborative Analysis for developing the Knowledge base

The development of the necessary knowledge base follows the Expert-based Collaborative Analysis approach (EbCA) (Gibert et al, 2010, Chung et al, 2018) (Figures 2 and 3 below). EbCA is a tested procedure to incorporate expert knowledge into the data analytic process beyond generation of the prior knowledge base and the interpretation of the final results. The different types of knowledge and the phases of the EbCA process are shown in Figure 3. The EbCA approach involves different types of domain "experts": a) experiencer cares and consumers; b) expert developers involved in the mid-processing of data (data mining) and c) expert end-users (planners, managers and other decision makers) that participate in the pre-processing and post-processing of the information. The development of the Decision Support Toolkit starts from the "Prior Knowledge Base" (PKB), the formal knowledge the experts already have that is structured in the pre-processing phase of decision analysis and incorporated into the mid-processing to generate new information. The information provided in the secondary analysis of the datasets and its representation in visual tools is presented to an expert panel to elicit their tacit knowledge and to identify and interpret complex patterns of care provision to provide tentative improvements of the toolkit (e.g., by providing adjusted values of the indicators of resource use) (Figure 3).

The EbCA process allows refinement of the different components of the decision support tool, as well as the indicators that should be incorporated into the scenarios used in the simulation modelling based on best evidence and data adjusted by expert judgement in a second phase. The PKB included in the simulation model synthesizes the following information and data:

- Description of the context and provision of the local system of MH care following a multisectoral approach including health, social, education, employment, housing and justice.
- Description of the target population and the workforce
- Analysis of the use of resources and local available outcomes
- Performance and systems indicators derived from the above

Figure 2. Expert-based Collaborative Analysis for incorporating formal rules, ranges for indicators and external validation of the components of the proof-of-concept prototype.





Figure 3 – Phases of the EbCA process and three types of knowledge compiled in the project

In this proof-of-concept study, the expert panel was made of 12 experts on mental health planning, including representatives from carers and consumers organizations. These experts on the local mental health care system contribute all along the differences phases of the model development and testing, using a nominal group approach. Two preparatory meetings were followed by two nominal group meeting (December 2019 and December 2020). A further meeting was held in March 2020 to discuss a case study focusing on analysis of a model of supported accommodation services in the UK and the discussion focused on its tentative applicability in ACT.

The panel of experts provided information to each of these meetings, guided by the visual graphs to develop appropriately tailored, locally relevant indicators, for example rate of psychiatrists in community outpatient care, readmission rates, length of stay, etc). This work set the Prior Knowledge Base of the model (PKB) (Fig. 2). The group also provided feedback on the feasibility of the use of the model for mental health planning in the region. The final panel meeting was conducted on 10 December 2020 to provide the final results of the proof of concept and a summary of the conclusions relevant to the next phase of the project. This final panel was followed by a survey on the feasibility of the decision support tool. In addition, zoom meetings have been conducted on a monthly basis with members of expert panel and the international advisors (Prof. H. Killaspy and Prof. Carlos Garcia-Alonso).

The EbCA process was also used to identify other key data sources to be considered in the analysis of phase 2 apart from the ACT Metadata Set (see below).

Metadata Sets - Overview

Three data packages of metadata on healthcare systems (pre-made set of databases that fed the model) have been used to test the usability of the proof-of-concept model. Apart from the target metadata set (ACT-Mental Health), we conducted an in-depth analysis of the components of the model in the QuIRC Metadata set (Support Accommodation in England- 2016) and the Metadata set "Mental Healthcare in the Basque Country – 2015". Both datasets collected information using the DESDE coding for its directory of services. DESDE (service provision) and QuIRC (service quality) databases are characterised by extensive previous data cleaning, external validity testing and a relevant publication record in peer review journals. Both are open access and are highly complementary, as the Basque Country (DESDE) focuses on service provision in local systems, and QuIRC provides a detailed description of the quality of different types of services. This allows for a better analysis of the main components and characteristics of the model.

a) Metadata Set "Mental Health Atlas ACT"

This metadata set comprises three databases:

i) The database of the Integrated Atlas of Mental Healthcare in ACT 2016 contains information about the main social and demographic indicators of the ACT region, the availability of mental health services, its placement capacity (number of beds and places), workforce and variability of types of care available in ACT in the whole system for mental health: health, social, employment, education and justice. The Atlas is already published on an open access repository (2016 Atlas of MH in ACT - <u>https://rsph.anu.edu.au/files/ACT.pdf</u>) (https://rsph.anu.edu.au/research/projects/atlas-mental-health-care).

ii) ACT Health pseudonymized database on service use 2017. This second database comprises information on resource use and outcomes of consumers treated by the ACT mental health system in the period 2017-2018. Data on resource utilisation and outcomes on MH are available from a pseudonymized historic database (2016-2017) managed by ACT Health (co-partner of this project together with the Primary Health Network (CHN) and Canberra Health Services). These two databases have been merged in a metadata set and this information has been used to provide relevant bottom-up key performance and system's indicators of mental health care in the ACT region.

iii) The database of the Integrated Atlas of Mental Healthcare in ACT 2020. This database contains information from the second survey of the mental healthcare provision in ACT after 5 years of the completion of the first Atlas. It includes a revision of the social and demographic indicators of the ACT region, the availability of mental health services, its placement capacity (number of beds and places), workforce and variability of types of care available in ACT in the whole system for mental health: health, social, employment, education and justice. It also compares the evolution of the service delivery system just before the NDIS was implemented and its evolution after 5 years.

b) QuIRC Metadata set (Support Accommodation in England- 2016)

This data package includes information from the QuEST-QuIRC study (Quality assessment of care for complex and comorbid severe mental illness). It provides information on the support accommodation system for severe mental health conditions in England. This data base incorporates indicators of service use and quality of care based on the Quality Indicator for Rehabilitative Care (QuIRC) (Killaspy et al, 2016). This is a staff-rated, international toolkit that assesses quality of care in longer term hospital and community based mental health facilities. The QuIRC was developed from review of the international literature, an international Delphi exercise with over 400 service users, practitioners, carers and advocates from ten European countries at different stages of deinstitutionalisation. It evaluates 6 domains of quality in rehabilitation care:

- Living environment (LE)
- Therapeutic environment (TE)
- Treatments and interventions (TI)
- Self-management and autonomy (SMA)
- Social interface (SI)
- Human rights (HR)
- Recovery based practice (RBP)

QuIRC has undergone extensive validation and adaptation within the European QuEST Study: "QUality and Effectiveness of Supported Tenancies for people with mental health problems" and proved its usability in quality assessment of supported accommodation in England and Portugal. A typology of residential mental healthcare has been developed in Australia based on this system (Fletcher et al, 2019). The original study reached the following conclusions (Killaspy et al, 2016):

- Standardised quality assessment tools for inpatient and community-based rehabilitation services
- Results highlight tension between promoting autonomy vs providing care
- Recovery based practice and human rights promotion are predictors of successful progression towards more independence
- Supported accommodation staff already doing some recovery orientated practice
- Two-year length of stay is unrealistic (and not evidence based)
- Trials comparing models were not feasible in England
- Heterogeneity in provision and systems for deciding who goes where

c) Metadata set "Mental Health Basque Country - 2015.

This data package includes information from the 2015 Atlases of MH services in two provinces of the Basque Country: Gipuzkoa (Gutierrez-Colosia et al, 2021) and Bizcay (Gutierrez-Colosia et al, 2021). These two provinces comprise nearly 2 million inhabitants. Mental health services were classified using the DESDE-LTC codification system (residential, day and outpatient care). The 2015 public health service utilisation databases of mental healthcare in the two provinces were used in this study. The information from metadata set includes 57 variables for describing the structure of the MH system in these two provinces.

Proof of Concept (Modules of the Prototype of the Decision Support Tool)

Following the definition of the PKB, and the contributions made by the expert panel in the nominal groups and the survey, the core group analysed and presented the different components of the modular tool decision support system to the expert panel in the final nominal group meeting. This was followed by a feasibility survey. The information gathered in the nominal groups and the survey were taken into account to design the tool that will be used in Phase 2 to analyse the mental health care system in ACT.

Evaluation

The evaluation team led by A/Prof J Gillespie (Menzies Centre for Health Policy, University of Sydney) supported by ANU members (Sue Lukersmith and Hossein Tabatabaei) has conducted a baseline analysis of the feasibility of the decision support tool to be applied in ACT at Phase 2. This process has involved the participation of an evaluation team member as an observer at all panels, as well as in the other project meetings, and the analysis of the minutes and reports produced in these meetings. This information was used to establish challenges, gaps and tentative inefficiencies in the local system identified and discussed in the panel meetings within ACT MH care. As the project has a core focus on system level change, the evaluation in Phase 2 will monitor progress against the key project milestones attained in Phase 1 (Table 1), to determine how the deployment of the tools could influence the system level. The process evaluation in Phase 2 will determine WHY and HOW, key project milestones are being met as well as the Experience, Sustainability and Acceptability of the project for the local stakeholders.

MILESTONES	Definition	Results
1	The local integrated model of what the ACT mental health system looks like a baseline has been completed.	Presentations to the expert panel
2	Challenges, gaps and inefficiencies in the local system have been identified using the integrated model and acknowledged by local planners / in planning meetings.	Results from the panel meetings (minutes and reports)
3	All relevant stakeholders have had input into the development of the Decision Support Tool and panels have been conducted.	Results from the panel meetings (minutes and reports)
4	The components of Decision Support Tool Prototype have been localised using the metadata sets and is ready to be applied in Phase 2.	Proof of concept report Key indicators Visual tools Modelling

Table 1. Milestones for the evaluation of feasibility (Phase 1)

The final evaluation has included a feasibility survey to collect data on the following domains of the feasibility checklist to evaluate the tool adequacy for use in practice: relevance, acceptability, applicability, practicality, efficiency and value. This checklist has been adapted from previous questionnaires used to assess the feasibility of modelling tools such as SOMNet (Chung et al, 2018) and the classification instrument used in the atlases of mental health care (Salvador-Carulla et al, 2013).

After the completion of the phase 1, the phase 2 will consist of the production of the decision support tool and its demonstration in a relevant real-world environment (ACT) for the analysis of technical efficiency of mental health systems (Figure 4).

Figure 4. Use of a Decision Support Tool to Guide Mental Health Planning – A pilot study in the ACT. Phases 1 and 2 and procedure of the proof of concept and the demonstration study



Contract agreements and ethical approval.

The update of the Atlas to inform the decision support tool that will be incorporated into the modelling in phase 2 was planned between year 1 and 2 in the original proposal submitted to BUPA. The funding of the proof of concept in 2019-2020, required a revision of the collaboration with Capital Health Network to ensure the funding of this component of the project in 2020, which goes beyond the timeframe of Phase 1 (the proof-of-concept phase). CHN and the ANU contract office revised the agreement and updated it to facilitate the use of the information in the BUPA Foundation project. The contract amendment was approved and extended to 2021.

The signature of the contract agreement between ANU and University of Sydney to run the qualitative analysis of the project was completed on 13 December 2019. The project provides an analysis of two metadata sets fully pseudonymised and ethically approved in their jurisdictions: "Mental Health Basque Country-2015", and "QuEST-QuIRC (England)- 2016". The data package of the ACT Atlas 2016 has been approved by the ACT Health Human Research Ethics Committee (Ref. ETHLR.16.094). In addition, we requested approval for the new ACT Atlas 2020 that will be used for running the final version of the model in the phase 2 of the project in 2021 (ANU Human Ethics Committee: Ref. 2019/964 Integrated Atlas of Mental Health Care in ACT 2020).

Results

The proof of concept and feasibility analysis has allowed us to refine the tool and the key performance indicators that will be incorporated into the knowledge-to-action model in Phase 2 and to add other relevant prior expert knowledge into this model.

A new Model for the Evaluation of Mental Health Care

Key frameworks and models

We have adopted a healthcare ecosystem perspective. Mental health ecosystems research is an emerging discipline which takes a systems approach to mental healthcare, facilitating analysis of the complex environment and context of mental health systems, and translation of this knowledge into policy and practice (Furst et al, 2020). Under this framework we take into account changes at different levels of the healthcare ecosystem: micro (individual services), meso (small catchment areas such as a community mental health centre), and macro (health district, region or country) (Figure 5).

Figure 5. The healthcare ecosystem approach applied to the analysis of mental health care planning (Rosen et al 2020)



In order to develop of a real-world "Action Model" of MH care comprising all factors necessary to understand how priorities are set and resources are allocated in a system, we revised the Thornicroft and Tansella Mental Healthcare Matrix, to establish a balance of care beyond the equilibrium between hospital and community mental health care (Table 2). This will provide guidance to regional planners, such as Capital Health Network, Office of Mental Health and Wellbeing, Canberra Health Services and ACT Health better information to optimise their funding and services around the prevention of mental illness and hospital avoidance. The new matrix that defines the geographical levels of healthcare related to the process of care (input, throughput and output) includes an additional row for differentiating indicators related to the service level (micro level) and "nano" or individual level (consumers, carers and professionals) (Figure 4). This is complemented by the organisational levels of healthcare that include a "mega" level (governmental agencies) (Frow et al, 2016) (Figure 6).

Table 2. Geographical levels of Healthcare: A Modified version of the Thornicroft and Tansella Mental Healthcare Matrix

	Input (A)	Throughput (B)	Output (C)
Macro Country/region (1)	1A	1B	1C
Meso Local area (2)	2A ^a	2B	2C
Micro Service (3)	3A	3B	3C
Nano Individual (4)	4A	4B	4C

Figure 6. Organisational levels of Healthcare: A modified version of the Frow's Model (2016)



Expert panels: Co-creation approach and engagement with the public partners

While implementing the original co-design approach we have further incorporated a co-creation framework to better engage additional stakeholders. Co-creation takes the ecosystem approach and incorporates multiple actors' experiences and insights to adapt and refine our model, reinforcing the engagement and building trust with our partners. As part of this process we have recruited a world-leading co-creation expert to our team (A/Prof Tom Chen). The co-design approach has been extremely productive for gathering information on the local system and has improved our capacity to elicit tacit knowledge using the Expert-based Collaborative Approach (EbCA) explained in our original proposal to BUPA (see attached <u>Appendix 6</u>). World leading international experts on community models of MH care and its assessment (Prof H. Killaspy), and on modelling and development of Decision Support Systems for MH care planning (Prof C. Garcia-Alonso), have participated in the meetings.

A series of two preparatory meetings with the stakeholders were held in October and November 2019 to elicit an open discussion on the key components of the proof-of-concept model. These informative meetings were followed by a nominal group meeting hold in December 2019. The full information on these meetings is available in Appendix 2. This approach has been extremely successful, and it has produced a very fruitful discussion on the main characteristics and the complexity of the ACT mental health system. The full list of participants (working group, stakeholders and observers) is available in Appendix 1. The Office of Mental Health and Wellbeing (OMHW) has played a major role in the co-creation strategy, including the joint coordination of the case example meeting scheduled in March 2020 (Modelling efficiency of supported accommodation in England with Prof H Killaspy). The Office has provided major support to prepare this case example meeting, as well as the final meeting and facilitated engagement with public agencies not directly involved in mental health care (primary care, hospital care, social care, education and housing). Due to the conditions imposed by COVID-19 the final meeting was re-scheduled to 10 December 2020 and it was organised via zoom. The last nominal meeting included the presentation of the different tools that could be incorporated into the decision support toolkit. It was followed by an on-line feasibility survey.

Adaptation of the model used in Europe to ACT

The preparatory meetings provided a wealth of information on the requirements to adapt the model developed and used in Europe to ACT and Australia. This information has been analysed and revised in a meeting with the model developers in Seville (Spain) to adapt the model to our context last February 2020. This has included a different approach to the analysis of jurisdictions, the incorporation of nested systems (i.e., Calvary Hospital), new systems indicators, and the possibility of incorporating a new interactive approach to visualisation (interactive mapping). Following recommendations from the previous meetings Dr Amir Aryani (from Social Data Analytics Lab, Swinburne University) joined the team to develop a module prototype of an interactive dashboard mapping tool to the DSS.

Visual Tools

Use of Interactive Parallel Coordinates

The use of interactive parallel coordinates of the metadata set of ACT allowed a quick identification of problems in the definition of geographical areas of MH care in Canberra, as well as relevant issues in the current key performance indicators used in the system. These findings are discussed below.

Use of hierarchical clustering

Data on hierarchical clustering could not be provided due to the low number of catchment areas in ACT.

ACT as a Mental healthcare system: boundaries and partitioning

We revised the general characteristics of ACT as a service ecosystem. A salient characteristic that differentiates Canberra from other urban areas in Australia is its urban planning strategy based on independent mostly self-sufficient neighborhoods following a 'Salt and peppering' strategy for its population. 'Salt and peppering' is the location of small-scale public housing throughout Canberra's suburbs and town centres. The objective was to support diverse and vibrant local communities and the achievement of positive social and economic outcomes for tenants and the community more broadly (Public Housing Renewal, ACT). This urban planning approach has a major impact in the distribution of the population and it is highly relevant for understanding its service provision and resource utilisation. This planning, relevant in many ways, has also originated a "hidden disadvantage" that requires a unique approach to the analysis of social and demographic characteristics of Canberra in comparison to other urban clusters in Australia (Tanton et al, 2017) (Figure 7). According to this NATSEM report "The territory government's 'salt and pepper' approach to public housing is masking the levels of disadvantage felt by 37,000 Canberrans living on an 'equivalised income' of \$26,000 a year". The spatial analysis of social and demographic characteristics should be carried out at SA1 apart from other higher levels of analysis. It is also important to note that the new developments and the progressive gentrification of several urban areas will have a major impact in the needs and provision of public mental health care in the next future.

Figure 7. The "Salt and Peppering" effect on the special distribution of key social and demographic indicators in ACT: Unemployment, Family Income and Education



The information of the administrative divisions and territorial boundaries of ACT is critical to provide indicators based on population adjusted rates, the availability placement capacity, professionals' profiles and the workforce capacity. ACT is divided in 2 areas of acute hospital care (ACT North and ACT South) and, 5 small health areas of mental health care: Belconnen, City North, City South, Gungahlin, Tuggeranong and Woden. in addition, we should consider the Local Governmental Areas and other Statistical Areas (SA1, SA 2, SA 3), postal codes and other divisions relevant to understand the social and demographic characteristics of the region. The preliminary analysis of the systems' indicators (see below) also revealed relevant information on the administrative and territorial division of the ACT region. This analysis showed that one of the selected small catchment areas (South City) behaved as an outlier in all the estimates of residential care due to its low population density (Figure 8 and Figure 9) (see Atlas 2016 and Preliminary version of Atlas 2020 at https://rsph.anu.edu.au/research/projects/atlas-mental-health-care).

Figure 8. Geographical partitioning of Mental healthcare in ACT

a) ACT as a single district (Primary Health Network)



b) ACT Small (Community MH Teams) and medium (Acute wards) catchment areas in ACT



Figure 9. A pattern graph (parallel coordinates) on the residential care resources in six small catchment areas in ACT (*).



(*) The lines are staking on the other lines drawn in advance – so it shows the last line with its colour if have the same pattern.

The system characteristics of ACT are extremely complex. Multilevel analysis using different partitions is required and the use of a single approach may lead to misleading assumptions. A recommendation that emerges from the Phase 1 preliminary analysis is that the distribution of acute mental health care in Canberra should be revised. The planning agency could consider the reassignment of acute MH care to City South to Calvary Hospital.

The small number of partitions in ACT did not allowed to conduct a hierarchical clustering analysis. To complete this analysis of and the analysis of comparative efficiency with the 2020 data it will be necessary to incorporate at least one additional comparator from Australia and to explore new systems for analyzing low samples of complex numbers.

ACT as a regional hub of healthcare

The role of ACT Health as a regional hub closely connected with the South Eastern NSW PHN is another salient characteristic of Canberra. The area of influence of Canberra covers a region of 220,000 km2 with 1.2 million people living in a diverse geographical region incorporating the ACT, Southern NSW, Murrumbidgee, and Illawarra Shoalhaven Local Health Districts. It has desert and beachside towns, Aboriginal communities, drought-stricken farms, retirement communities, a major population centre (Canberra) and other urban clusters (Wollongong and Wagga Wagga). The pattern of care utilization of Canberra health services by citizens from NSW is shown in Figure 10. This density map illustrates the importance of Canberra as the care centre for a significant part of SENSW PHN. It is important to note that this is not the case for mental health, the only major health field that does not follow this pattern. A

major issue for the future development of MH care in ACT is whether it will adopt the regional hub pattern that characterizes chronic care in this region.

Figure 10. Density map of location of patients provided care by Canberra Health Services in 2017-18. (Health Answers project, College of Health and Medicine, ANU, 2019)



Colour indicates number of patients, circle size indicates intensity (repeat visits)

Calvary Hospital as a nested system within ACT

The difficulties for informed public policy and planning of geographic and substantive boundaries of subsystems nested in broader systems have been pointed out previously (Weible & Sabatier, 2007). Problems arise in relation to the territorial scope, the substantive scope (e.g., local mental health policy), the agents or participant organisations, and the population perspectives with regards to social, demographic and epidemiological indicators. On the other hand, and from a systems thinking perspective a nested subsystem can increase flexibility and capacity of self-adaptation to changes in the environment of a system.

We first identified a nested system in Inner Sydney that is run by The St Vincent's Health Network. St Vincent's is considered a special category of health organisation within the Health organisational chart of NSW Health, apart from the statewide health services, the shared services and the core structure of LHDs and specialty networks (http://www.health.nsw.gov.au/about/nswhealth/Documents/NSW-Health-Org-Chart-2015-11-15.pdf). Therefore, St Vincent's is a special case that operates mainly as a nested subsystem within the Central and Eastern Sydney Primary Health Network (CESPHN). Although the Network operates across the jurisdictional boundaries of the SLHD and the SESLHD, the governance relationship between the network,

and	the	PHN	is	unclear
(http://www.he	ealth.nsw.gov.au/abouhttp://	www.health.nsw.gov.au/a	about/nswhealth/Docume	ents/NSW-Health-
Org-Chart-201	5-11-15.pdft/nswhealth/Docu	ments/NSW-Health-Org-C	Chart-2015-11-15.pdf) .	

In developing the CESPHN atlas, we mapped the Local Government Areas (LGAs) and Statistical Local Areas (SLAs) which are the main governance units of analysis in the LHDs, however these geographical units bore a low correspondence to the reported areas of coverage of the network. In lieu of using these units or designing a new geographical unit, the team opted for using the catchment area for CARITAS reported to the team by postcodes. However, it should be noted that the Network reported that the area of operation was far greater than this catchment area and identified services that are located across the whole CESPHN as part of the Network. Finally, it was resolved that as a nested system the SVHN organisational analysis required a separate Atlas (Annex 3 of the CESPHN Atlas) (<u>https://rsph.anu.edu.au/research/projects/atlas-mental-health-care</u>).

The characterization of Calvary Hospital as a nested system is illustrated by the different profile of patients admitted to the hospital (Figure 11). Calvary has 62% of patients admitted due to a mood disorder and 12% due to schizophrenia. The pattern of diagnosis in the Canberra Hospital are nearly the reverse, 46% of Schizophrenia and 23% of mood disorders. In addition, there are differences in other main indicators of hospitalization such as Length of Stay (LoS) and patients flows between Canberra and Calvary Hospitals. These differences in the pattern of acute care between the two general hospitals in Canberra adds on the role of Calvary Hospital as a nested system within Canberra, and on the mismatch between LoS at unit level and the LoS of the acute episode due to the transfer of patients across different units as explained in the next section (Figure 12).



Figure 11. Profile of Rates of Psychiatric diagnoses treated in acute psychiatric wards for adults in ACT

This may indicate the need to analyse ACT as a single district for understanding acute hospital care. In any case the problems in the partition of the region are particularly relevant for hospitalisation and may require an in-depth organisational analysis.

Other relevant factors to consider include significant changes in the MH care system in ACT since the completion of the 2016 Atlas, such as the opening of the Rehabilitation Unit, University of Canberra Hospital: and the impact of NDIS on the psychosocial care for persons with severe mental health conditions in ACT (Furst et al, 2019).

Metadasets

ACT MH Atlas Metadata Set

The original pseudonymized metadata set in the ACT comprised 49 key performance and systems indicators. These indicators include social and demographic characteristics of the region, characteristics of the organisations, mental health service provision (availability and placement capacity), professionals providing care and workforce capacity, as well as service utilization data. As a first step, the indicator set was analysed and represented using visual tools and discussed with the expert panel following an EbCA approach (Figures 2 and 3). A summary of the descriptive analysis of the key indicators is provided in Appendix 3.

A second version of the dictionary of indicators added the new indicators suggested by the experts and following the discussion of different sources of information in the preparatory nominal groups (see summaries

in Appendix 2). The revised list of indicators is available from the ANU research group. This list has incorporated 110 indicators to the previous one. Therefore 159 will be considered in the final discussion on the prototype tool for efficiency analysis in December 2020: 35 Social and demographic indicators, 82 indicators of service delivery, 36 indicators of resource utilization and 7 indicators of outcomes.

The EbCA process has also identified a series of key data sources will be considered in addition from the Atlas Metadata Set:

- SEIFA, Australian Bureau of Statistics (already included)
- NATSEM, University of Canberra
- Medicare
- Public Health Information Development Unit PHIDU
- Australian Institute of Health and Welfare, Mental Health Services in Australia
- National Seclusion and Restraint NBEDS (State and hospital level)
- Public Health Information Development Unit PHIDU

Finally, the 20201 metadata analysis for the efficiency study would require the update of the development of the National Health Information Strategy – Framework and its implications for MH datasets. This will be followed by Dr Nasser Bagheri.

- National Health Information Agreement: <u>https://meteor.aihw.gov.au/content/index.phtml/itemId/182135</u>
- National Health Data Dictionary: https://meteor.aihw.gov.au/content/index.phtml/itemId/268110
- Australian Health Performance Framework: <u>https://www.aihw.gov.au/reports-data/indicators/australias-health-performance-framework</u>

Major findings from the EbCA analysis of the ACT Metadata Set

The preliminary analysis of the Atlas metadata set has provided a wealth of information relevant for the modelling in 2021 (Phase 2). This includes, among others, the division of ACT in five mental health areas, the characterization of Calvary Hospital as a "nested system" within ACT, the revision of the indicators of resource utilization of hospital care and the need of a new indicator of "acute episode of care" in hospital utilization. The first recommendation has been discussed in the section above.

The analysis has identified problems of ambiguity in the process of care in some KPI used in the system such as Length of Stay (LoS). The LoS of acute hospital care in the three existing units in ACT does not reflect the actual average LoS of acute episodes in this region due to the transfer of patients between units during the same episode as shown in Figure 12.

This required the development of a new indicator "LoS of Acute Episode" that registered the total days elapsed since the hospitalization to the final discharge irrespective of the acute unit where these two events occurred. Due to the complexity of hospital acute care and the different role played by Canberra and Calvary hospitals

in the region this was the optimal indicator to assess LoS at the system level, although it required considering ACT as a single district. In addition to the different patient profiles described above, there are differences in other main indicators of hospitalization such as Length of Stay, Readmission rates and patients flows between Canberra and Calvary Hospitals in a single acute episode (Figure 12). Other additional indicators should include "Patient Turnover" (re-admission of patients in the same day) and "External transfers": total (total number of external transfers across different units in one year), and by unit.





The comparative analysis of the MH care provision in ACT in comparison with other 9 urban areas and with two regional areas in Australia, revealed that ACT has a higher availability of MH services than many other areas in Australia, follows a more community-oriented model, characterised by a predominance of community residential care over sub-acute and long-term hospital care. It has a medium range of hospital units and beds in comparison to other areas, and a larger number of outpatient services and availability of day care except for work-related day care (this type of service is only available in 4 out of 9 urban areas in Australia). It has significantly more psychosocial services as well as coordination and information services than other urban areas. In general, it shows a pattern of care more complex than other PHNs with the exception of North Perth (Atlas of Mental Health in ACT: https://rsph.anu.edu.au/research/projects/atlas-mental-health-care).

In comparison with the rates of provision of services (units of care), the indicators of resource utilisation are low. The utilisation of hospital services in ACT is placed in the medium range of urban areas in Australia. The number of Medicare-subsidised psychiatric care is the lowest among the 9 urban PHN mapped using DESDE, as it is the number of care visits provided by psychiatrists in ACT compared with other urban areas. Similarly, the number of persons accessing MBS subsidised mental health related services and mental health related medication are low in comparison to other urban areas in Australia. The Access to Allied Psychological Services (ATAPS) and the Mental Health Nurse Incentive Program (MHNIP) are also low (Atlas of Mental Health of the ACT region: https://rsph.anu.edu.au/research/projects/atlas-mental-health-care). A longitudinal analysis of the evolution of these programs will be relevant following the similar analysis we carried in Western Sydney (Maas et al, 2019).

In order to run the model, it is necessary to update the information on service provision and utilisation in ACT as there has been a considerable change of the MH care system in ACT since the completion of the 2016 Atlas. Funding has been invested in improving care provision and the new Rehabilitation Unit, University of Canberra Hospital has covered a major gap in the system. On the other hand, the impact of NDIS on the psychosocial care for persons with severe mental health conditions requires a reassessment following the previous evaluation conducted in 2018 (Furst et al, 2018). The 2020 update of the Atlas of MH is required to complete these tasks.

Two papers have been produced based in the information available from the ACT MH Atlas Metadata Set:

PAPER 1: Patterns of mental healthcare provision in urban areas

 Furst et al: Patterns of mental healthcare provision in urban areas: A comparative analysis for informing local policy (Submitted to BMC Health Service Research – 2nd review) (Bupa Foundation acknowledged)

Objective: Urbanisation presents specific challenges for the mental wellbeing of the population. A better understanding of availability of existing service provision in urban areas is necessary to plan for the needs of people with mental illness, identify care gaps and inform planning. This study aims to provide an analysis of the patterns of mental health care provision in urban areas in Australia and compare them with benchmark areas in other world regions.

Method: We used the Description and Evaluation of Services and Directories (DESDE-LTC) to analyse and compare care provision in the Australian Capital Territory-ACT, three other regions in Australia (Perth North, Western Sydney, and South East Sydney), and three benchmark areas in Chile, Finland and Spain. Patterns of availability, bed capacity and diversity of service provision from all sectors relevant to mental health were analysed using heuristics and a homogeneity test. The applicability to local policy was assessed using the Adoption Impact Ladder (AIL) in all regions, and the overall relevance evaluated by local planners in ACT.

Results: In comparison to other Australian urban areas, ACT provided more community residential care and less hospital care and was second overall only to Finland in availability of the former. However, when compared to international areas, similar gaps emerged in the four Australian urban regions, with very low availability of day care, especially work and health related day care. The Atlas information was applicable to regional and local mental health planning.

We identified commonalities in the pattern of mental health care and gaps in urban regions in Australia when compared to urban regions internationally.

Conclusion: We have identified significant differences in the pattern of urban care provision between regions that should have implications for planning, especially in equity of access to appropriate care and prioritisation of

resource allocation. and for the local outcomes of interventions based on global evidence or from evidence in other regions. Our results highlight the usefulness of an ecosystems approach to service planning in mental health care at the local level. Separate analysis of urban and rural care should be conducted for regional mental health planning.

PAPER 2: Patterns of mental healthcare workforce in urban areas

- Furst et al: A comparative analysis of patterns of workforce capacity in mental health care in urban areas (in preparation)

QuIRC Metadata Set (Support Accommodation in England)

The analysis of the QuIRC Metadata set was conducted in January-June 2020 and discussed with Prof H Killaspy in our meeting in March 2020 (Appendix 2d). This topic was selected due to a) the complexity of this type of provision for severe and complex mental health consumers, b) the relevance of supported accommodation for the planning of MH care in ACT, and c) the distinct pattern of housing and supported accommodation services in ACT as illustrated in the analysis of the ACT MH Atlas Metadata Set (https://rsph.anu.edu.au/research/projects/atlas-mental-health-care). The analysis included 148 residential services in 14 health districts in England, selected to represent the different patterns of care provision in England (Figure 13).



Figure 13. Catchment areas and services assessed in the QuIRC Metadata Set

Visualisation tools

Our analysis of the usability of data visualisation included the use of parallel coordinates and hierarchical clustering to improve the knowledge base on this dataset. The analysis of parallel coordinates provided a highly innovative approach to visualisation of a database that has undergone a detailed and extensive data cleaning and analysis in the past. The analysis provided for the first time a full visualisation of the main indicators of service provision of the three main types of community residential services (Residential care, Supported Housing and Floating Outreach), together with the information on quality of care in these services (Figure 14). Figure 15 provides a visualisation of the whole supported accommodation system. This tool identified patterns in the database not previously identified such as the existence of outliers in Residential Care and Support Housing including a residence for homeless users which was then excluded from the analysis. It also facilitates the identification of two separate groups in residential care, as well as recommendations to improve the visualisation of quality indicators.

Figure 14. Parallel Coordinates visualisation of the QuIRC Metadata Set: system provision indicators and quality indicators of care clusters in England: Residential Care (blue), Supported Housing (Red), Floating Outreach (Green) and all main types of support accommodation.

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The hierarchical clustering visualisation and analysis of the community residential care system in England is provided in Figure 15. This approach identified four major types of services that followed a gradient of quality in the domains of QuIRC. Cluster 1 included only one service that should require an audit and probably restructuring. Clusters 2 and 3 included services with different strengths and weaknesses in relation to the domains of quality and cluster 4 grouped the services with higher level of quality in most indicators.

Figure 15. Hierarchical clustering of Supported Accommodation services in England: a) Residential care, b) Supported Housing, c) Floating outreach. Profiles of the QuIRC quality domains



a) Supported Accommodation

b) Supported Housing



PAPER 3: Patterns of mental healthcare distribution across local areas

 Chung et al: Equality of mental healthcare distribution across local areas based on machine learning: Experience in the Basque Country (Spain) (in preparation: final stages before submission) (Bupa Foundation acknowledged)

Abstract

Background: The growing availability of healthcare data, is accompanied with high levels of complexity and uncertainty and this adds on the difficulty to evaluate equality and equity of healthcare provision is needed to support healthcare planning. Machine learning algorithms together with visualisations tools can facilitate interpretation of service distribution across health areas and support prioritisation guided by equality.

Methods: We developed a machine learning decision support tool using Growing Hierarchical Self-Organising Map (GHSOM) algorithm and visualisation modules for modelling expert-guided data analysis of local care provision. This tool was applied to the analysis of the patterns of care provision in 32 catchment areas of mental healthcare in the Basque Country region (Spain). We analysed 64 key performance indicators in every area and conducted four different pattern analyses on resources and utilisation of care for two main groupings of services: placement-based care (hospital, residential and day services) and outpatient care (mobile and non-mobile services). We analysed the typology of mental healthcare at meso level (catchment areas in a system), lower macro level (Bizkaia and Gipuzkoa provinces) and higher macro level (for the region).

Results: The decision support tool effectively facilitated the expert-guided hierarchical pattern analysis of local areas in the region. The inherent patterns of resources and utilisation of care services in the local areas were visually identified and compared at different analytical levels by interactive expert interpretations. Processing and reasoning the visual pattern information, the health experts were able to deeper understand and assess inequality of the geographical distribution of services. Unequal resource provision and resource utilisation of non-acute inpatient and non-mobile outpatient care services between urban and rural areas of the Biscay and Gipuzkoa systems were identified.

Conclusions: This study developed a decision support tool that utilises an advanced machine learning algorithm and visualisation methods to support complex data analysis, representation and decision-making. This study demonstrated the capacity of machine learning to the analysis of complex healthcare systems.

Computer Modelling

Use of Machine Learning (ML) for the analysis of patterns and typologies of services

The use of machine learning allowed for the development of shapes" of quality (weighted property shape per cluster) that could be used for checking patterns of care provision in the target health systems. The demonstration of this use of ML for identifying patterns of quality in residential care in England is shown in Figure 15.

Use of Relative Technical Efficiency Analysis

We tested other RTE using a DEA-MOEA and Benchmarking model, and the implications for the analysis of Supported Accommodation in ACT were discussed at the March meeting in Canberra with Profs H Killaspy and JC Garcia-Alonso.

Modelling prototype

The modelling prototype has been tested in two metadasets: Basque Country indicators are feasible and can be incorporated and analysed in the pre-processing, mid-processing and post processing phases of the simulation model.

Two different modelling techniques of the performance of the MH care system have been analysed to explore their applicability in the ACT region.

a. Self-Organising Map Network (SOMNet)

SOMNet will be used to identify patterns of care provision in local areas, outliers and bottom-up values of indicators using machine learning. The SOMNet was developed to facilitate interactive visual data mining of complex data to enable domain experts to (1) generate and verify hypotheses; (2) express interest through the process of Knowledge Discovery from Data (KDD) (see figure 2); (3) enhance information transferring between analysts and decision-makers; (4) specify information processing and present outcomes of analytical reasoning processes; and (5) identify hidden information and elicit tacit knowledge that can be formalised and transformed into rules for further data analysis. We have previously described the technical characteristics of SOMNet (Chung et al, 2018).

SOMNet has proved its utility for analysing system outliers, explaining global and local patterns, and refining key performance indicators with their analytical interpretations in regional care planning in Europe (Chung et al, 2018). We will revise the evidence-informed indicator values and ranges using SOMNet and use this information to feed the model of relative technical efficiency.

b. Efficient Decision Support – Mental Health (EDeS-MH)

EDeS-MH is a modelling tool for Relative Technical Efficiency Analysis (RTE) for guiding evidence-informed planning.

Relative Technical Efficiency Analysis is one of the main tools of causal modelling for supporting planning and management of health services and systems as shown in a recent systematic review in mental health (Almeda et al, 2019). RTE analyses the relationship between (weighted) inputs (resources) consumed and outputs (resource utilization and outcomes) produced by a set of comparable Decision-Making Units (DMU). It is "relative" because it is obtained by comparing every DMU to each other. RTE is useful for the following tasks:

- To identify ways of improving mental health service performance
- To reduce uncertainty by increasing information on the health system
- To identify the key determinants factors of efficiency within a system
- To describe complex service performance for benchmark analysis
- To help policy makers to achieve greater system understanding
- To improve resources allocation and management

EDeS-MH is a simulation model developed by the University Loyola Andalucía in collaboration with members of our ANU group. It uses a Monte Carlo Data Envelopment Analysis tool combined with a fuzzy engine. The technical characteristics of this RTE model for regional policy and planning has been published by our research group (Torres-Jimenez et al, 2015), and its practical use for guiding evidence informed planning has been tested in several regions in Europe such as Catalonia and the Basque Country in Spain (Torres-Jimenez et al, 2015; Garcia-Alonso et al, 2019), and in England (Almeda et al, 2018). The system provides a ranking of small catchment areas (for example Statistical Areas 3 (SA3) in Australia, or the community mental health areas in Spain. Small areas are classified according to three main characteristics: Efficiency, Stability and Entropy (Figure 16). The technical relative efficiency (RTE) analyses the outputs obtained using a fixed set of inputs or vice versa (the inputs required to obtain a fixed set of outputs). Stability assesses whether small variable value changes can vary the RTE scores significantly (completely unstable: 0%, completely stable: 100%). Finally, the Shannon's entropy analyzed the homogeneity of the ecosystem management within completely homogeneous: 0% (all the catchment areas are managed exactly in the same way) and completely heterogeneous: 100%. The modelling tool incorporates a semaphore visualisation tool to differentiate the areas (figure 16).
Figure 16. Relative technical efficiency of six Small Catchment Areas of Mental Healthcare in Gipuzkoa (Basque Country). Ranking of Efficiency, Stability and Entropy in relation to scenarios of Hospital, Day and Outpatient care.

Area

1

2

3

4

5

Indicator

 $\frac{P(RTE > 0.75)}{\text{Error } (\bar{\epsilon})^{(2)}}$ $\overline{RTE}^{(1)}$

P(RTE > 0.75)

 $\frac{P(RTE > 0.75)}{Error (\bar{\epsilon})^{(2)}}$ $\frac{Error (\bar{\epsilon})^{(2)}}{RTE^{(1)}}$

P(RTE > 0.75)

P(RTE > 0.75)

P(RTE > 0.75)Error ($\bar{\epsilon}$)⁽²⁾

RTE⁽¹⁾

 $\frac{\text{Error}(\bar{\epsilon})^{(l)}}{RTE^{(1)}}$

 $Error(\bar{\epsilon})^{(1)}$

 $\frac{\text{Error} (\bar{\varepsilon})^{(2)}}{RTE^{(1)}}$

Acute hospital

care scenario

0.90

0.48

0.91

0.88

0.52

Day care

scenario

0.90

0.90

0.35

Outpatient care

scenario

0.43

0.46

0.72

Efficient Decision Support – Mental Health (EDes-MH)

Efficiency, Stability and Entropy in 6 MH Districts In Gipuzkoa (Basque Country, Spain)

Stability (1)	Acute hospital care scenario	Day care scenario	Outpatient care scenario	Entropy ⁽¹⁾	Acute hospital care scenario	Day care scenario	Outpatient care scenario
Area 1	68.93	68.49	60.97	Area 1	44.80	5.02	20.08
Area 2	59.12	75.95	49.95	Area 2	55.09	2.65	48.26
Area 3	61.06	69.04	64.27	Area 3	41.30	44.27	46.61
Area 4	56.85	70.27	69.97	Area 4	54.34	37.40	41.30
Area 5	58.91	54.85	63.79	Area 5	53.39	22.36	38.85
Area 6	64.80	71.28	30.74	Area 6	46.12	1.81	80.13

The results of this modelling tool have been incorporated in Paper 4 of the series derived from this project.

PAPER 4: Patterns of mental healthcare distribution across local areas

Garcia-Alonso et al: Modeling the balance of care: impact of an evidence-informed policy on a mental health ecosystem. (Paper submitted to International Journal of Environmental Health Research and Policy – IJERPH)

Abstract

Introduction: Major efforts worldwide have been done to provide a balanced mental health (MH) care. Any integrated MH ecosystem includes hospital and community-based care, highlighting the role of outpatient care to reduce relapses and readmissions. This study was aimed i) to identify expert-based causal relationships between inpatient and outpatient care variables, ii) to assess them by using statistical procedures and, finally, iii) to assess the potential impact of a specific policy enhancing the MH care balance on a real ecosystem performance.

Methods: DESDE-LTC was used for standardizing care provision. By using multivariate linear regression (generalized least squares), causal relationships among inpatient and outpatient care variables were confirmed to finally design a Bayesian network. A decision support system, which combines data envelopment analysis, Monte-Carlo simulation and fuzzy inference, was used to assess the potential impact of an evidence-informed policy.

Results: There were strong statistical relationships among outpatient and inpatient care variables which confirmed their causal nature. The global impact of the proposed policy on the ecosystem was positive, in terms of efficiency assessment, stability and entropy.

Discussion: We have formalized the relationships among inpatient and outpatient care variables. These relationships, structured by a Bayesian network, can be used for designing evidence-informed policies trying to balance MH care provision. By integrating causal models, decision support systems are useful tools to support evidence-informed planning and decision making as they allow to predict the potential impact of specific policies on the ecosystem prior its real application, reducing the risk and considering population needs and scientific findings.

Evaluation (feasibility survey)

The on-line feasibility survey was completed by the experts that participated in the final zoom panel hold on 10 December 2020. In all 5 experts out of the original list of 12 (41.6%) participated in the final meeting and contributed to the feasibility survey. A summary of the survey results are available at Appendix 4. Respondents indicated the potential for the toolkit to be used as an information source for supporting decision making both in the ACT region and in their respective organisations. They also underscored the need for such a tool and the importance of using information from the Atlas together with improved visualization tools. The agreement on the relevance of the suggested indicator dataset of service use and the GIS for the efficiency analysis was moderate to high, but lower than for other domains of the toolkit explored in the feasibility analysis. The panel identified the EDeS-MH as the best alternative to model the efficiency of mental health services in the region, and the importance to combine this tool with other models relevant for mental health planning such as the Dynamic System Modelling of Suicidal Behaviour (Page et al, 2018, Atkinson et al, 2019). The panel judged that the proposed model would be acceptability and practical both for ACT planning at regional level as well as for supporting planning and management in specific organisations (planning agencies and NGOs), as well as for the consumers in this region. The major problems were identified in relation to the interpretation of the potential results, the need of training for use of the tool, and the need for external support to use of the system. Finally, the experts considered that the efficiency and the overall value of the tool would be high for future planning of mental health in the region.

Components of the Decision Support Toolkit

Taking into account the results of the EbCA process and the feasibility survey, the decision support toolkit suggested for the analysis of technical efficiency of the mental health system in the ACT region was considered feasible with a series of amendments to its main components:

Components of the final decision support system:

- > The model for the evaluation of mental health systems
- > The Atlas of MH in the ACT Region 2020
- > A revised version of the GIS (Interactive mapping) including service utilisation
- > The Efficient Decision Support Mental Health (EDeS-MH)

A series of actions have been taken at the completion of phase 1 and amendments to the original design of Phase 2:

Actions incorporated to improve Phase 2

- 1. *Reinforcement* of the collaboration with other key research centres working on other modelling tools for mental health planning such as the Dynamic System Modelling of Suicidal Behaviour (University of Sydney)
- 2. *Reinforcement* of the role of ACT Mental Health Community Coalition (MHCC) in the design of Phase 2 to increase community engagement and participation
- 3. *Incorporation* of an interactive GIS mapping of the Atlas of MH in the ACT Region 2020 as a module within the Decision Support Toolkit.
- 4. Incorporation of an on-line training module for planners within the Phase 2 proposal
- 5. *Incorporation* of a sustainability plan and impact analysis module within the Phase 2 proposal

Actions 1-3 have been started at the end of Phase 1:

- 1) The collaboration with other research centres involved in the production of modelling tools relevant for mental health planning in Australia has produced major outputs in January 2021. Dr S. Rosenberg is the liaison contact between CMHR-ANU and the Brain and Mind Centre at the University of Sydney, to strengthen collaboration between the two centres for developing a combined use of the Dynamic System Modelling of Suicidal Behaviour (University of Sydney) and the Atlas of Mental Health plus the Efficient Decision Support Mental Health (EDeS-MH) for the analysis of system's efficiency. Moreover, the two centres are participating in a national network funded by the Australian Government Department of Health that incorporates the leading centres on this topic in Australia. This includes collaboration with University of Queensland that will explore the contributions of our toolkit and the National Mental Health Planning in Australia".
- 2) Community engagement: The ACT Mental Health Community Coalition (MHCC) has highlighted the importance of considering the pathways of care alongside the mapping of the service delivery. A module to assess the pathways of care has been incorporated in the prototype that will be evaluated in Phase 2.
- 3) Interactive mapping: A collaboration has been established between the Visual and Decision Analytics (VIDEA) Lab at ANU, and the Social Data Analytics (SoDA) Lab at Swinburne University of Technology to produce an interactive GIS mapping of the Atlas of MH in the ACT Region 2020 (A/Prof Amir Aryani), to produce a module of interactive mapping within the toolkit. Prof A. Aryani has been invited to participate as a full member of the partnership in Phase 2 of the project. The overarching goal of the interactive mapping system will be to provide carers, consumers, organizations, planners,

and other stakeholders the overall mental health system within the ACT area to make health data easily accessible for a wide variety of end-users. The interactive version seeks to make the GIS tool fully interactive and give the end-user more control over data selection, visualization, and reporting. Online interactive health GIS tool provide the geolocation of services and care teams at the different levels of the system, allowing end-users to query data on location of services, their relationship with key social and demographic information and census data. End-users will be able to select tracts to open a separate report containing demographic data and service data for the selected tract and improve tailored and local planning. The ability to generate data at a meaningful level of spatial aggregation has been cited as a major challenge to overcome with interactive mapping systems in public health (Cromley, 2003; Highfield et al, 2011). A preliminary version of the interactive mapping module has already been produced (Figure 17).





Four scientific papers have been produced from this study. Two have been submitted and are under peerreview. Two other papers are undergoing final revision by the project partners (the titles and abstracts have been provided in the respective sections above).

Discussion

Atlases of Mental Health provide valuable information on service availability and capacity in a region, properly placing services within their context of socio demographic characteristics and planning aims. We have produced a comprehensive model for evaluation of local MH systems. This includes the revision of the visualization tools; the indicator lists and the results of the different modelling techniques in the analysis of the target datasets. In addition, our analysis has revealed that the system characteristics of ACT are extremely complex. Multilevel analysis using different partitions is required and the use of a single approach may produce misleading assumptions. A recommendation that emerges from the Phase 1 preliminary analysis is that the distribution of acute mental health care in Canberra should be revised. The planning agency could consider the reassignment of acute MH care to City South to Calvary Hospital. Another relevant aspect is the confusion between services. This leads to the design of services for every intervention required and to a model that eventually leads to more fragmentation and inefficiency.

Lessons learned

Modelling the efficiency of local mental health care, their services and interventions is a major priority at every level of the mental health system: macro (national, states, regions), meso (small catchment areas), micro (individual services) and nano (consumers and professionals). The design of a decision support tool for modelling efficiency of mental health systems is a type of low-intensity, high complex project of organizational intervention. This project was originally intended as a single project including the proof-of-concept phase and the implementation of the tool in a region in Australia. Splitting the project in two separate phases with a focus on the Proof of Concept in Phase 1 is very unusual approach in Australia, where the proof of concept and piloting is usually considered an activity prior to the main project. In spite of our large experience in the field, a careful appraisal of the proof of concept of the decision support tool for evidence informed planning has proven enriching and necessary. It has allowed the team to reinforce collaboration with the key stakeholders in the region, to identify strengths and weaknesses in the previous design and to produce a workable version, as well as to improve the collaboration and design of Phase 2. Despite the challenges imposed by COVID-19 all the objectives have been accomplished. The full engagement of ACT public agencies and the participation of key leaders from professionals and community organisations constitutes a unique experience in the Australian mental health system.

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Milestone Summary

Project Information	
Project Title:	Use of Simulation Modelling to Guide Mental Health Planning – A pilot study in the ACT
Report Date:	25 January 2021
Project Sponsor:	BUPA Foundation
Project Manager:	Dr Sebastian Rosenberg

Executive Summary					
Overall Status	Completed				
	Target	Est.	Planned	Actual	
	Completion Date	Completion Date	% Comp.	% Comp.	
Schedule	30/07/2020	31/01/21	100%	100%	
The team has undertaken information gathering sessions with key stakeholders to inform issues and key					
indicators for the project. Currently all deliverables have been completed within the allocated budget,					
including 6 tasks post	poned due to COVID-	19.	-	-	

Milestone Summary					
(see <u>Appendix 2</u> for expanded details on Stakeholder meetings)					
	Description		Actual 6/08/2010		
1. Green	Signature of subcontract with University of Sydnov	0/00/2019	0/00/2019		
2. 016611	Establish the consultation group with key	15/00/10	15/00/10		
3. Green	stakeholders from the ACT agencies (Domain experts)	13/09/19	15/09/19		
4. Green	Revision of the core team to incorporate expertise in co-creation (Dr Tom Chen) and interactive mapping and Co-op (Dr Amir Aryani, Swinburne University)	1/10/19	1/10/19		
5. Green	Interviews with key stakeholders in ACT (domain experts)	1/10/19	1/10/19		
6. Green	Establish an observers' group	15/10/19	15/10/19		
7. Green	Stakeholder preparatory meeting 1 with nominal group to analyse the Australian Capital Territory (ACT) health indicator dataset (Dr JA Salinas, Loyola University, Spain)	28/10/2019	28/10/2019		
8. Green	Stakeholder preparatory meeting 2 with nominal group to analyse the modelling of mental health care, its use in Europe and applicability in ACT (Prof Carlos Garcia-Alonso, Loyola University, Spain)	8/11/2019	8/11/2019		
9. Green	Notification of CHN approval of amendment to contract	22/11/2019	22/11/2019		
10. Green	Interim progress report 1	1/12/2019	20/12/2019		
11. Green	Stakeholder preparatory meeting 3 with nominal group to analyse the key components of the proof- of-concept study and its application to the Australian Capital Territory (ACT) health indicator dataset (Prof L Salvador-Carulla, ANU)	10/12/2019	10/12/2019		
12. Green	Ethics application submitted: Protocol 2019/964 (Integrated Atlas of Mental Health ACT PHN region 2020)	17/12/2019	17/12/2019		
13. Green	Meeting with the European team to discuss the findings of the preparatory meetings and adapt the model to the ACT case	23/01/2020	23- 30/1/2020		
14. Green	Submission the manuscript "Patterns of mental healthcare provision in urban areas: A comparative analysis for informing local policy". This is focused on the comparison of the pattern of mental care in the Australian Capital Territory and other international comparators in Spain, Chile and Finland	30/01/2020	30/01/2020		
15. New	A second manuscript has been prepared on workforce capacity in ACT in comparison to other urban areas and will be submitted on 1 March 2021	01/10/20	01/03/21		
16. Green	Stakeholder meeting: Comparisons of Modelling Tools/Approaches for Decision Making in Australia and the UK (with Prof H Killaspy)	18/02/2020	17/03/20		
17. Green	Submission of the ethics application of the qualitative analysis of patterns of decision making by ACT stakeholders (University of Sydney) and feasibility of the proof-of-concept model	20/02/2020 Postponed due to COVID-19 New date: 01/10/20	25/10/20		

Milestone Summary (see Appendix 2 for expanded details on Stakeholder meetings)				
Current Status	Description	Planned	Actual	
18. Green	Start the 2020 Atlas of Mental Health Care in the ACT region	20/02/2020	01/07/20	
19. Green	Establish the final 'end-user group' with the stakeholders	20/02/2020	17/03/20	
20. Green	Information meeting to other stakeholders in ACT (as per suggestion of the OMHW): education, employment, housing, social services	02/03/2020 Postponed due to COVID-19	10/12/20	
21. Green	Identify the baseline for impact analysis through an evaluation, (Menzies Centre for Health Policy). Feasibility analysis of the decision support toolkit within ACT Mental Health care.	17/03/2020 Postponed due to COVID-19	15/01/20	
22. Green	Deliver workshop 1 to analyse a case example of the applicability of the modelling tool: Analysis of the supported accommodation system in England. Implications for ACT. Prof H Killaspy UCL (UK).	18/03/2020	18/03/2020	
23. Green	Finalise indicators to be incorporated into the simulation model	1/04/2020	1/04/2020	
24. Green	Interim progress report 2	1/04/2020 Postponed due to COVID-19	10/09/20	
25. Green	Preparation of the Nominal group meeting: Feasibility and Validity of the Proof-of-Concept model	9/04/2020	10/09/20	
26. Green	Deliver workshop 2 (nominal group) to analyse the external validity of the simulation model based on the proof-of-concept study in the ACT using a co-design/co-creation approach	30/04/2020 Postponed due to COVID-19	10/12/20	
27. Green	Develop and deliver report on the feasibility of the Decision Support System Model in the ACT and implications for the design of phase 2* of the pilot	30/06/2020 Postponed due to COVID-19	21/01/21	
28. Green	Final progress report	31/07/2020 Postponed due to COVID-19	25/01/21	

BUPA Final REPORT 1 - Simulation Modelling to Guide Mental Health Planning

Acquittal of Funds Interim Report (*)			

(*) The project acquittal has been provided to BUPA by the Project Management Office of the College of Health and Medicine.

Appendix 1: Team and Participants

ANU Centre for Mental Health Research Team Members

Luis Salvador-Carulla, Sebastian Rosenberg, Jose Alberto Salinas, Nasser Bagheri, Hossein Tabatabei-Jafari, Natasha Katruss, Marita Linkson, Youn-Jin (Jina) Chung, MaryAnne Furst, Sue Lukersmith, Amir Aryani, Tom Chen

Key Speakers: preparatory meetings and case study

Prof Luis Salvador-Carulla



Professor Luis Salvador-Carulla is Head of the Centre for Mental Health Research at the Research School of Population Health, Australian National University. He has been an advisor to the Government of Catalonia (Spain), the Spanish Ministry of Health, the European Commission (EC) and the World Health Organisation (WHO). His research has focused on developing decision support systems in health and social policy, including tools for analysis of technical efficiency and benchmarking, indicators for health policy analysis and priority setting in mental health and in disability. He has coordinated the Integrated Atlas of Mental Health Project for mapping mental health services in over 30 local areas around the World. In 2012 he received the Harvard Medical School Leon Eisenberg Award for his contribution in the field of developmental disorders.

A/Prof Jose Alberto Salinas



Dr Salinas is a health geographer. He is Associate Professor of Quantitative Methods at Universidad Loyola Andalusia, Spain; and Research fellow at the ANU College of Health and Medicine. He developed his PhD on Spatial Data Analysis through a Multi-Objective Evolutionary Algorithm applied on mental health data. His main area of interest is the relationships between health and territory. He has applied GIS in social and health studies, service maps and spatial data analysis in health ecosystems research in Europe, America and Australia.

Prof Carlos R. Garcia-Alonso



Prof Carlos R. Garcia-Alonso is Deputy Vice-Chancellor of the Loyola University Andalusia. He is an Agricultural Engineer. PhD. His areas of research are Operational research, Modelling, Simulation models and computational economy and Management of the uncertainty (Generalized information theory and Fuzzy logic). He has played a central role in the development of health systems engineering in Spain. Carlos has designed and developed the following software prototypes (main designs): computerbased system for the assessment of autocorrelation geographical analysis (to identify and locate highly significant-prevalence and incidence-spatial areas mainly for health care), computer-based system for the evaluation of relative technical efficiency (health care management) and a simulation model for the assessment of illnesses costs (health care management). All of them are hybrid models that include: a simulation engine, a fuzzy inference engine (for expert knowledge management) and, finally, an operational or a statistical model (cost analysis, autocorrelation analysis, relative efficiency, etc.). He is the secretary of the research reference network PSICOST and has participated in major Horizon 2020 European projects in mental health economics and service research such as **REFINEMENT and PECUNIA.**

Prof Helen Killaspy



Helen Killaspy is Professor and Honorary Consultant in Rehabilitation Psychiatry at University College London and Camden and Islington NHS Foundation Trust in the UK. She leads national and international programmes of research that focus on the assessment of quality of care for people with complex mental health problems and the evaluation of complex interventions for this group. She is the National Professional Adviser for mental health rehabilitation services for the hospital registration authority in England and Wales, the Care Quality Commission. She is past Chair of the Faculty of Rehabilitation and Social Psychiatry of the UK Royal College of Psychiatrists, Topic Advisor for the NICE guidance group on mental health rehabilitation and Chair of the Advisory Group for the Royal College of Psychiatrists' peer accreditation service for rehabilitation services ('AIMS-Rehab').

Participating Stakeholder Organisations

ACT Health, ACT Office of Mental Health and Wellbeing, ACT Health, Mental Health Community Coalition of the ACT, Capital Health Network, University of Sydney, University of Notre Dame, RANZCP ACT, Canberra Health Services

Appendix 2: Summary of Stakeholder Meetings



Meeting 1: Mon 28 Oct 2019 2.00 – 5.00pm

Meeting 2: Fri 8 Nov 2019 9.00 – 12.30pm (then lunch 'til 1.00pm)



Meeting 3: Tue 10 Dec 2019 9.15 – 1.00pm (then lunch 'til 1.30pm)

Meeting 4: 18 Feb 2020 (TBC) Preparatory meeting for stakeholders: Mental Health Indicators in the ACT (2016)

Preparatory meeting for stakeholders: Modelling Mental Health Care in the ACT (2016)

Proof of Concept Project Meeting: Modelling Mental Health Care in the ACT

Comparisons of Modelling Tools/Approaches for Decision Making in Australia

Meeting 5: 2 Mar 2020 (TBC)

Meeting 6: 18 Mar 2020 (TBC)

Meeting 7: 9 Apr 2020 (TBC) ACT General Public Agencies meeting

Case Study: Modelling Efficiency of Supported Accommodation in England

Nominal group meeting: Feasibility and Validity of the Proof-of-Concept model

Appendix 2a: Details of Preparatory Meeting 1

Meeting 1: Preparatory meeting for stakeholders: Mental Health Indicators in the ACT (2016)



Agenda

2.00 – 2.10pm	ARRIVAL COFFEE AND REGISTRATION
2.10 – 2.25pm	Welcome and introduction to BUPA Foundation project Prof Luis Salvador-Carulla, Head, Centre for Mental Health Research, ANU
2.25 - 2.35pm	Social and demographic indicators A/Prof Jose A. Salinas, Visiting Fellow, Centre for Mental Health Research, ANU
2.35 – 2.50pm	Service availability A/Prof Jose A. Salinas, Visiting Fellow, Centre for Mental Health Research, ANU
2.50 – 3.05pm	Placement capacity A/Prof Jose A. Salinas, Visiting Fellow, Centre for Mental Health Research, ANU
3.05 – 3.25pm	Workforce capacity A/Prof Jose A. Salinas, Visiting Fellow, Centre for Mental Health Research, ANU
3.25 – 3.45pm	AFTERNOON TEA
3.45 – 5.00pm	Analysis of KPIs A/Prof Jose A. Salinas, Visiting Fellow, Centre for Mental Health Research, ANU
5.00pm	CLOSE

Summary of Outcomes

Session 1 (2-4pm): Presentation of service indicators of ACT mental healthcare systems

- Provided contextual information on indicators of services (Presenter: Luis)
 - Study areas
 - Socio-demographic indicators
 - Service availability indicators
 - Placement capacity indicators
 - Workforce capacity indicators
 - Discussion on defining professionals and measuring FTE (Elizabeth, Luis, Seb)
 - Service utilisation indicators
 - Patient flow across services between two ACT hospitals
 - Discussion on measuring 'LoS' (Lee-Anne, Bruno, Stacy, Jim, Seb, Luis)
 - > Different hospital roles and infrastructure affect LoS and turnover
 - > Flow diagram illustrates issues affecting management of patient flows
 - > Worth considering how natural geographical flow affects where people go. Possibility of developing clearer guidance drawing on this information for ACT community about where they should go.
 - User flow through emergency room between two ACT hospitals
 - Discussion regarding what this information means for how MH emergency services work in ACT
 - Interactive parallel coordinate visual analysis of indicators of ACT catchment areas
- Suggested to include participants (experts) from any agencies for this project into publications as co-authors and application of grants as co-investigators

Session 2 (4-5pm): Discussion on analysis of key performance indicators

All discussions are grouped by topics.

Topic 1: Data

- Consider other local context in terms of landscape service changes / data improvement since first mapping (Bruno)
- How to compare data between 2016 and 2020? (Bruno)
- How to link indicators with outcomes? For example, is it possible to compare the outcomes of day services with outpatient services? This would require some analysis of relative efficiency (Bruno)
- How to link the data with assessment of quality (any threshold)? (Bruno)
- Development of national MH planning framework how is this being used in the ACT, including a clearer understanding of which indicators are available/desirable for reporting progress in the ACT (Bruno)
- There is a need to incorporate GP MH service utilisation data no specific funding available to analyse GP system in ACT, but Medicare data could be useful (Elizabeth and Stacy)
- System should also record and report NGO data. There is work in Qld underway already (Elizabeth)

Topic 2: Model

• Consideration of tailored models for groups (e.g., young and old)

Topic 3: Funding

- Consider funding changes since first mapping and any gaps arising? (Stacy)
- How to account for private sector services in ACT arrival of new provider may be opportunity? Existing modelling capacity could include private sector data if it was available (Jim, Luis)
- The model will be further enhanced by service refinement and analysis of supported accommodation (Luis)
- Siloed funding = siloed reporting. People get lost in transitions between services. Funding models should permit tracking and reporting across services (Elizabeth)

Topic 4: Outcome(s)

- Consider what outcomes should be reported for every analysis how should progress be monitored/reported (Luis)
- For example, next mapping should consider an appropriate quality outcome(s) e.g. patient satisfaction & preventable hospitalisation (Jane)
- The directories developed as part of the mapping process are useful for service planning (Luis)
- Next mapping process can fit with broader regional planning process how should systemic outcomes be reported? (Seb)
- And where specific outcome information is missing, what are reasonable proxy measures to be reported? (Bruno)
- Need to consider whole of ACT community culture in relation to acceptance of mental illness (Elizabeth). Tools for measuring culture exist and could be implemented in the future (Luis)
- Need to ensure that indicators measure the things which mean most beyond health service utilisation rate to consider broader issues such as employment and housing (Lee-Anne)
- Interaction between different parts of MH systems affect outcomes e.g. role of employment support for young people (Van)
- Also important to consider physical health outcomes (Van)
- The overall dysfunction of the system demonstrates issues with quality and patient flow that need to be addressed (Bruno)

Topic 5: Decision Support

- Future meetings should consider how decision makers use this model to help their work what skills and capacity do they need? (Simon)
- Need to ensure model (AI) and system support decision makers not lead them (Lee-Anne)
- Real time dashboards can be developed to assist decision-makers immediately (Nasser).
- DDS tools are developed for modelling, beyond health care to include other key aspects of mental health needs, like supported accommodation (Luis)
- Co-creation: importance of funding and supporting this approach to decision making process (Tom)

Jose	Salinas-Perez	ANU CMHR	Core group
Luis	Salvador-Carulla	ANU CMHR	Core group
Sebastian	Rosenberg	ANU CMHR	Core group
Jim	Gillespie	University of Sydney	Core group
Alisha	Chand	ACT Health	Domain expert
Bruno	Aloisi	ACT Health Mental Health Justice Health Alcohol & Drug Service (MHJHADS) Canberra Health Services	Domain expert
Elizabeth	Moore	ACT Office of Mental Health and Wellbeing	Domain expert
Lee-Anne	Rogers	ACT Office of Mental Health and Wellbeing	Domain expert
Stacy	Leavens	Capital Health Network	Domain expert
Van Anh Ti	Mai	Clinical Nurse Consultant at AMHRU (Acting)	Domain expert
Simon	Viereck	Mental Health Community Coalition of the ACT	Domain expert
Jane	Desborough	ANU CMHR	Observer
Jina	Chung	ANU CMHR	Observer
Nasser	Bagheri	ANU CMHR	Observer
Hossein	Tabatabaei Jafari	ANU CMHR	Observer
Tom	Chen	ANU CMHR	Observer
Siobhan	Bourke	ANU CMHR	Observer

Attendees

Appendix 2b: Details of Preparatory Meeting 2

Meeting 2: Preparatory meeting for stakeholders: Mental Health Indicators in the ACT (2016)



Agenda

ARRIVAL COFFEE AND REGISTRATION
Introduction Prof Luis Salvador-Carulla, Head, Centre for Mental Health Research, ANU
Modelling of Mental Health Care Prof Carlos R. Garcia-Alonso, Visiting Fellow, Centre for Mental Health Research, ANU
Preparatory Scenarios Prof Carlos R. Garcia-Alonso, Visiting Fellow, Centre for Mental Health Research, ANU
MORNING TEA
Preparatory Modelling Prof Carlos R. Garcia-Alonso, Visiting Fellow, Centre for Mental Health Research, ANU
LIGHT LUNCH & CLOSE

Summary of Outcomes

Session 1 (9-11am): Introduction of modelling mental health systems

- Discussions
 - Dynamic Systems information and modelling algorithm changes
 - How to improve data (in collection)?
 - Risk of modelling: mismanagement
 - Difficulty of use of modelling algorithms people don't know how to use
 - Strategies in health area for right decision-making environment training...

Session 2 (11-1pm): Demonstration of practical modelling in Europe (e.g. No. of beds)

- Discussions
 - Modelling across areas, services and people access
 - Service unit comparison for modelling
 - Expert assumption vs statistical values in real
 - Optimal size of population for mental health systems/services
 - Roles of every services in ACT
 - Movement of psychiatrist from continuing care to day care in hospital by policy in Europe
 - How long does it take to get a causal diagram in real world?
 - Degree of accuracy what/how to modify values in the model?
 - Challenges for decision-makers on output expectation changes
 - System improvement by model and expectation modification to be realistic
 - No context and culture in ACT for reasonable information of mental health systems

Attendees

Jose	Salinas-Perez	ANU CMHR	Core group
Luis	Salvador-Carulla	ANU CMHR	Core group
Sebastian	Rosenberg	ANU CMHR	Core group
Carlos	Garcia-Alonso	ANU CMHR	Core group
Bruce	Shadbolt	ACT Health	Domain expert
Lee-Anne	Rogers	ACT Office of Mental Health and Wellbeing	Domain expert
Simon	Viereck	Mental Health Community Coalition of the ACT	Domain expert
Leith	Felton-Taylor	Mental Health Community Coalition of the ACT	Domain expert
Liz	Schroeder	National Mental Health Commission	Domain expert
Jina	Chung	ANU CMHR	Observer
Nasser	Bagheri	ANU CMHR	Observer
Hossein	Tabatabaei Jafari	ANU CMHR	Observer
Sue	Lukersmith	ANU CMHR	Observer
MaryAnne	Furst	ANU CMHR	Observer

Appendix 2c: Details of the First Nominal Meeting (Meeting 3)

Meeting 3: Proof of Concept Project Meeting: Modelling Mental Health Care in the ACT



Agenda

9.15 – 9.30am	ARRIVAL COFFEE AND REGISTRATION
9.30 – 9.40am	Welcome and Introductions
9.40 – 10.15am	Defining the ACT as a Jurisdiction:
	Catchments
	Area of influence Single district
	Regional approach
10.15 – 10.45am	Historical Influences on Mental Health Care in the ACT and
	Implications
	Nested System/Calvary
	Salt and Pepper Housing
10.45 11.00pm	Other issues and reports
10.45 - 11.00am	MORNING TEA
11.00 – 11.45am	Key Indicators for the Proof-of-Concept Project
	Socio-demographic
	Service provision, including accessibility, availability, capacity and workforce
	Service utilisation, including NGOs Outcomes
	Gaps
11.45 - 12.15pm	Modelling for Proof of Concept
	Characteristics and approach
12.15 – 1pm	What is missing?
	Care pathways (Capital?)
	Primary Care
	Private services
	Regional ACI
1.00 - 1.30 nm	
1.00 - 1.00 hill	

Summary of Outcomes

Session 1 (9-11am): Recaps and issues with planning in the ACT

- Discussions
 - Recap of previous two meetings
 - Difficulties with the ACT having been designed using a 'salt and peppering' approach
 - Require a more detailed/granular approach to data in order to avoid masking issues, e.g. some disadvantaged SE groups may be living in affluent suburbs and therefore not considered in healthcare decision making.
 - However, this assists to bridge social isolation gaps, as people from all SE groups will be attending the same public schooling due to dispersion of public housing across ACT suburbs.
 - Public housing has been moved from city centers (e.g. Braddon) but is now more dispersed throughout suburbs (with access to services in main hubs of Gungahlin, Belconnen, Tuggeranong, etc.)
 - There is little experience with urban planning from small to large cities (200,000 population to 600,000 population), which makes it hard to find a successful model for the ACT to follow.

Session 2 (11-1pm): Discussion of Missing Key Indicators

- Discussions
 - Missing/important indicators
 - Rental and mortgage stress
 - Underemployment
 - Car ownership
 - Children going home to an empty house after school
 - Housing issues
 - Transfers between hospitals or units within hospitals
 - We are missing true early intervention approaches (0 to 5 year olds).
 - University of Canberra is conducting a survey on 30,000 people in the ACT, reporting on whether they live with a MH issue; this may help inform key indicators and data for this project.
 - Lack of access to public hospital data from Calvary makes service planning difficult.
 Additional difficulties are that the Calvary public hospital is a nested system.
 - Websites on ACT mental health services do not clearly state whether there are psychiatrists available in residential care facilities, though stakeholders working in this area advise that they are. This highlights the importance of the ATLAS in obtaining, documenting and coding this information.
 - Many people utilising private services are excluded from public services (which may not be available via private).
 - How should the ACT data be examined/treated?
 - As a regional hub for Goulburn, Young, Yass, Murrumbidgee area?
 - o By catchment area, e.g. Calvary for northside vs Canberra hospital for southside?
 - As a single district?

Jose	Salinas-Perez	ANU CMHR	Core group
Luis	Salvador-Carulla	ANU CMHR	Core group
Sebastian	Rosenberg	ANU CMHR	Core group
Denise	Riordan	ACT Chief Psychiatrist	Domain expert
Lee-Anne	Rogers	ACT Office of Mental Health and Wellbeing	Domain expert
Elizabeth	Moore	ACT Office of Mental Health and Wellbeing	Domain expert
Stacy	Leavens	Capital Health Network	Domain expert
Steph	Lentern	Capital Health Network	Domain expert
Leith	Felton-Taylor	Mental Health Community Coalition of the ACT	Domain expert
Jina	Chung	ANU CMHR	Observer
Nasser	Bagheri	ANU CMHR	Observer
Hossein	Tabatabaei Jafari	ANU CMHR	Observer
MaryAnne	Furst	ANU CMHR	Observer
Natasha	Katruss	ANU CMHR	Observer
Jane	Desborough	ANU CMHR	Observer
Tom	Chen	ANU CMHR	Observer
Siobhan	Bourke	ANU CMHR	Observer

Attendees

Appendix 2d: Details of the Final Nominal Meeting (Meeting 4)

The Australian National University Centre for Mental Health Research



BUPA Project Final Meeting of Expert Panel Modelling mental health care in the ACT Proof of Concept

This event is supported by funding from the **BUPA Health Foundation** and the **ANU Policy Greenhouse - Collaboration Initiative**

Thursday 10 DECEMBER 2020

11.30am – 1.30pm *via Zoom*

AGENDA

This final meeting in our series will focus on a presentation outlining the key components of the proof of concept of a tool to model and guide mental health planning in the ACT.

11.30am Welcome from Chair - Dr Sebastian Rosenberg

11.50am Series of 10 minute presentations on Proof of Concept components

- Spatial analysis of social factors Dr Nasser Bagheri
- 2020 ACT Mental Health Atlas Mary Anne Furst
- Data CO-OP Platform A/Prof Amir Aryani
- Visual analysis of the ACT Mental Health system Dr Youn Jin (Jina) Chung
- Modelling healthcare in the ACT Prof Luis Salvador-Carulla
- Decision Support Systems for evidence-informed planning Dr Sebastian Rosenberg
- 12.50pm Q&A Dr Sebastian Rosenberg
- 13.15pm Future Steps for the Project Dr Sebastian Rosenberg & Prof Luis Salvador-Carulla

Amir

Aryani

13.30pm Close



Luis Salvador-Carulla Head, ANU Centre for Mental Health Research



 Fellow, and Head,
 Head of Social

 Mental Health
 Data Analytics

 Policy Unit, ANU
 (SoDA) Lab,

 Centre for Mental
 Swinburne

 Health Research
 University of

 Technology



Nasser Bagheri Fellow, and Lead, Visualisation and Decision Analytics (VIDEA) lab Head, ANU Centre for Mental Health Research



Youn Jin (Jina) Chung Postdoctoral Fellow, ANU Centre for Mental Health Research



Mary Anne Furst PhD Candidate, ANU Centre for Mental Health Research

Sebastian	Rosenberg	ANU CMHR	Core group/Presenter
Luis	Salvador-Carulla	ANU CMHR	Core group/Presenter
Nasser	Bagheri	ANU CMHR	Core group/Presenter
Jina	Chung	ANU CMHR	Core group/Presenter
MaryAnne	Furst	ANU CMHR	Core group/Presenter
Amir	Aryani	SoDA Lab Swinburne University	Core group/Presenter
Jim	Gillespie	University of Sydney	Core group
Carmen	Huckel-Schneider	University of Sydney	Core group
Natalie	Johnson	ACT Office of Mental Health and Wellbeing	Domain expert
Elizabeth	Moore	ACT Office of Mental Health and Wellbeing	Domain expert
Lee-Anne	Rogers	ACT Office of Mental Health and Wellbeing	Domain expert
Peter	McGeorge	Consultant on MH New Zealand	Domain expert
Tom	Chen	A/Prof Services University of Canberra	Domain expert
Sue	Lukersmith	ANU CMHR	Observer
Hossein	Tabatabaei Jafari	ANU CMHR	Observer
Haribondhu	Sarma	ANU CMHR	Observer
Marita	Linkson	ANU CMHR	Observer/Event mgt

Attendees

Appendix 3: Example of Key Indicators

The development of indicators is a function being undertaken by the stakeholder group (currently with them for finalisation). The list below is just an example of indicators that will be included:

	Numerator	Denominator	Unit
Density ratio	Inhabitants (total)	Area (km ²)	
Dependency ratio	Percentage of population aged below 15 years old and above 64 years old	Population aged between 15 and 64 years old	
Ageing index	Population aged below 15 years old	Population aged above 64 years old	
Indigenous status (%)	Population who identified themselves as being of Australian Aboriginal and/or Torres Strait Islander	Total population (without not stated)	X 100
Born overseas (%)	Population born overseas	Total population (without not stated)	X 100
Single parent families (%)	Single parent families with children under 15 years old	Total families (without not applicable)	X 100
Living alone (%)	Lone person in usual residence	Total population (without not applicable)	X 100
Needing assistance (%)	Population who has needed for assistance with core activities	Total population (without not stated)	X 100
Year 12 of high school or equivalent completed (%)	Population with year 12 or equivalent as highest Year of School Completed	Population above 14 years old (without not stated or not applicable: <15 y.o.)	X 100
Unemployment (%)	Unemployed population	Labour force (total population without not stated, not applicable or not in labour force)	X 100
Income <\$400/wk. (%)	Population earning less than \$500 per week, including those on negative incomes	Population above 14 years old (without not stated or not applicable: <15 y.o.)	X 100
Dwellings with no internet connection (%)	Dwellings with no internet access	Total dwellings (without not stated or not applicable)	X 100
IRSD Score	Decile of the Index of Relative Social Disadvantage Score (Australia=1000)		
Australian neighbourhood social fragmentation index	It is a synthetic index that captures three domains: attachment to the neighbourhood, sharing values and norms and transience. Seven indicators are used: lone person household, non-family household, rented households, married people, people living < 1 year in the neighbourhood, families with school children and people lived more than 5 years in the neighbourhood (Bagheri at al. 2019)		

Appendix 4: Summary of the Feasibility Survey (N: 5)

Q7 - There is no potential for the toolkit to be used as an information source for

supporting decision making in the ACT region.



Q10 - There is a need for a toolkit to support decision making in mental health planning



Q13 - The toolkit provides novel information that is useful for planners and decision

makers in the ACT region

in the ACT region



Q16 - In your opinion is the Atlas of Mental Health Care important enough to be included

as one of the BASIC tools in the toolkit?



Q18 - In your opinion is the System Indicator Data Set important enough to be included



as one of the BASIC tools in the toolkit?

Q19 - In your opinion is the GIS Spatial Analysis important enough to be included as one



of the BASIC tools in the toolkit?

BUPA Final REPORT 1 - Simulation Modelling to Guide Mental Health Planning

Q20 - In your opinion is the Visualisation tools important enough to be included as one of











Q23 - In your opinion is the Growing Hierarchical Self-Organising Map (GHSOM)



important enough to be included in the toolkit?

Q24 - In your opinion is the Efficient Decision Support-Mental Health (EDs-MH) important





Q25 - In your opinion is the Dynamic System Modelling of Suicidal Behaviour important



enough to be included in the toolkit?







Q30 - The information provided by the toolkit will not cause rejection by the consumers



and other stakeholders in the ACT region.





comparison to other Australian jurisdictions and organisations in the ACT region.

Q42 - The interpretation of the potential results of the toolkit does not require significant



training for use in the ACT region.

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Q45 - The interpretation of the potential results of the toolkit does not require significant

support by external experts in the ACT region.



Appendix 5: ANU – University of Sydney sub-contract



Research Services Subcontract

between

The Australian National University (ABN: 52 234 063 906)

and

The University of Sydney (ABN: 15 211 513 464)

PREC0027 | Research Services Subcontract | Release Version 2.0 | 2 April 2019

PARTIES

THE AUSTRALIAN NATIONAL UNIVERSITY (ABN 52 234 063 906) an educational and research institute and body corporate pursuant to the *Australian National University Act 1991* (Cth) as represented by the Research School of Population Health, of Acton in the Australian Capital Territory, 2601 (University)

AND

THE UNIVERSITY OF SYDNEY (ABN 15 211 513 464) an educational and research institute and having its registered office at Camperdown NSW 2006 (Subcontractor)

BACKGROUND

- A. The University and the Funder have entered into the Funding Agreement. A copy of the Funding Agreement is set out at Appendix A.
- B. The Subcontractor is to be provided with some of the Funds provided by the Funder under the Funding Agreement for the achievement of the aims of the Funding Agreement.
- C. The University must comply and the Subcontractor must act consistently with the Funding Agreement, including in respect of matters pertaining to sub-contractors.
- D. The parties agree to the terms set out below.

AGREED TERMS

1 Definitions and Interpretations

- 1.1 All defined terms in the Funding Agreement will have the same meaning in this Agreement unless otherwise defined in this Agreement.
- 1.2 The rules of interpretation applicable to this Agreement are the same as are applicable in the Funding Agreement.
- 1.3 Except where the context requires otherwise, the following definitions are incorporated in this Agreement:

Agreed Terms means clauses 1 to 13 of the Agreement which set out terms and conditions agreed by the Parties.

Agreement means this agreement and includes all Schedules and appendices (including, for avoidance of doubt, the Funding Agreement).

Confidential Information means information disclosed by a party (the discloser) to the other party (the recipient) that:

(a) is by its nature confidential;	
--	--

- (b) is designated by the discloser as confidential;
- (c) the recipient knows or ought to know is confidential;
- (d) is included in the terms of this Agreement,

but does not include information which:

(e) is or becomes public knowledge other than by breach of this Agreement or any other confidentiality obligations; or

(f) has been independently developed or acquired by the Contractor, as established by written evidence.

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Funder means BUPA Foundation.

Funding Agreement means the agreement between the University and the Funder executed on 2 September 2019 regarding the Category 1 project - *Use of Simulation Modelling to Guide Mental Health Planning – A pilot study in the ACT. (Phase 1: Proof of concept trialling of the Alenabled toolkit using historical local data from 2016)*, substantially in the form of Appendix A.

Intellectual Property or IP means all rights resulting from intellectual activity in the industrial, scientific, literary and artistic fields (whether or not registered or registrable or having to undergo any other process for grant, registration or the like) including:

- (a) copyright (including future copyright);
- (b) inventions (including granted patents and patent applications);
- (c) trademarks (including registered trademarks and trademark applications);
- (d) designs (including registered designs and design applications);
- (e) circuit layouts and the like;
- (f) trade secrets;
- (g) know-how; and
- (h) plant breeder's rights.

Party means either the University or the Subcontractor and Parties means both the University and the Subcontractor.

Project means the Project as defined in the Funding Agreement.

Subcontract Services means the part of the Project that the Subcontractor must undertake as described in Schedule 1.

Term means the term of this Agreement as provided in clause 3.

1.4 This clause 1 will survive the expiration or termination of this Agreement.

2 Priority of Documents

- 2.1 If there is inconsistency between any of the documents forming part of this Agreement, those documents will be interpreted in the following order of priority to the extent of any inconsistency:
 - 2.1.1 Funding Agreement (provided at Appendix A);
 - 2.1.2 Agreed Terms; and
 - 2.1.3 Schedules.

3 Term of Agreement and Termination

- 3.1 Unless earlier terminated, this Agreement is in effect from the date of execution and remains in effect until the Funding Agreement ceases to have effect.
- 3.2 The University will have the right to terminate this Agreement on terms no less favourable than those accorded to the University under the Funding Agreement.
- 3.3 Without limiting clause 3.2, the University may terminate this Agreement or reduce its scope by written notice to the Subcontractor if the Funding Agreement is terminated or reduced in scope.
- 3.4 Upon expiration or termination of this Agreement, each party will at the request of the other, return or destroy all Confidential Information received from the other party during the Term.

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4 Obligations of the Subcontractor

- 4.1 The Subcontractor will undertake the Subcontract Services in a proper and professional manner.
- 4.2 The Subcontractor agrees to comply with all provisions of the Funding Agreement capable of application to the Subcontractor and to ensure that it does not by act or omission place the University in breach of the Funding Agreement.
- 4.3 Without limiting clause 4.2, the Subcontractor must comply with the Funding Agreement, in its capacity as a sub-contractor, or as if it were itself a party to the Funding Agreement as the case requires.
- 4.4 The Subcontractor must not enter into an arrangement to subcontract some or all of the performance of the Subcontract Services to another party otherwise than under a formal agreement that satisfies the requirements of this clause 4.
- 4.5 The Subcontractor warrants that it is financially viable and has the necessary relevant expertise to perform its obligations in relation to the Subcontract Services.
- 4.6 The Subcontractor agrees to:
 - 4.6.1 not subcontract the performance of any part of the Subcontract Services without the prior approval in writing of the University;
 - 4.6.2 ensure that any work performed by an approved subcontractor in relation to the Subcontract Services is in accordance with the Funding Agreement and this Agreement;
 - 4.6.3 if requested, promptly provide a copy of any subcontract relating to this Agreement to the University; and
 - 4.6.4 repay to the University any Funds which
 - (a) are not properly acquitted;
 - (b) remain unspent or not committed; or
 - (c) which have been spent for purposes other than the Subcontract Services,
 - within one month after the termination or expiry of this Agreement.
- 4.7 The University may impose any terms and conditions it considers appropriate when giving its approval under clause 4.6.1.
- 4.8 The Subcontractor agrees to be fully responsible for the performance of the Subcontract Services and for ensuring compliance with the requirements of this Agreement and will not be relieved of that responsibility because of any subcontract entered into.

5 Obligations of the University

- 5.1 The University will provide the Subcontractor with a proportion of the Funds as detailed in Schedule 1 of this Agreement in consideration for the Subcontractor fulfilling the Subcontract Services.
- 5.2 The Subcontractor acknowledges that the University is responsible for liaising with the Funder and administering the Funds.

6 Intellectual Property

6.1 Ownership of each party's Background Intellectual Property remains with the contributing party.

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- 6.2 Each party grants to the other party a free, world-wide, non-exclusive licence in respect of the Background IP (including with the right to sub-licence) to the extent necessary to perform the Subcontract Services under this Agreement.
- 6.3 Copyright in scholarly works arising in the conduct of the Project remains with the author.
- 6.4 Ownership of Project Intellectual Property vests immediately upon its creation with the University.
- 6.5 The University grants to the Subcontractor a non-exclusive, royalty free licence to use the Project Intellectual Property, or tangible embodiments of the Project Intellectual Property, for internal research, publication and teaching purposes, but not for purposes of commercial manufacture or distribution.
- 6.6 This clause 6 will survive the expiration or termination of this Agreement.

7 Dispute Resolution

- 7.1 A Party must not start arbitration or court proceedings (except proceedings seeking interlocutory relief) about a dispute arising out of this Agreement unless it has complied with this clause 7.
- 7.2 A Party claiming that a dispute has arisen must notify the other Party giving details of the dispute ('Notification').
- 7.3 On receipt of a Notification, each Party must negotiate in good faith to resolve the dispute and, if necessary to resolve the dispute, involve the relevant senior officers of the Parties directly in those negotiations.
- 7.4 If a dispute is not resolved within 30 days (or longer period agreed between the Parties), the Parties will refer the dispute for mediation by the Australian Disputes Centre Limited (ADC) for resolution in accordance with the ADC guidelines for commercial mediation.
- 7.5 The fees of the mediator will be paid by the parties in equal proportions.

8 Indemnity

- 8.1 Without limiting clause 4.2, the Subcontractor must at all times indemnify the University, its officers, employees, students and agents (those indemnified) from and against any loss, liability, damage or expense (including reasonable legal costs) whatsoever incurred or suffered by any of those indemnified or arising from any claim, suit, demand, action or proceeding by any person against any of those indemnified where such loss, liability, damage or expense was caused or contributed to in any way:
 - 8.1.1 by any wrongful, unlawful or negligent act or omission of the Subcontractor, or its officers, employees, agents, subcontractors or invitees in performing the Subcontract Services in connection with this Agreement.
- 8.2 The Subcontractor's liability to indemnify the University under clause 8.1 will be reduced proportionally to the extent that any wrongful, unlawful or negligent act or omission of the University or its officers, employees or agents caused the loss, liability, damage or expense.
- 8.3 The Subcontractor's liability in connection with this Agreement shall be limited to the amount equivalent to the Fees paid by the University under this agreement.
- 8.4 The University may enforce the indemnity in clause 8.1 in favour of the persons specified in clause 8.1 for the benefit of each of such persons in the name of the University or of such persons.
- 8.5 If payment under an indemnity to the University gives rise to a liability for the University to pay GST, the Contractor must pay and indemnify the University against the amount of such GST.

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8.6 This clause 8 will survive the expiration or termination of this Agreement.

9 Notices

9.1 Any notices under this Agreement must be in writing and sent by pre-paid registered mail or facsimile (providing a printed confirmation that the facsimile was successfully sent is obtained) and addressed to the Parties as set out below, or at such substituted addresses as the Parties may notify each other in writing:

(a) For the University:

Research School of Population Health Grants Management Office rsph.rm@anu.edu.au

(b) For the Subcontractor:

Commercial Development & Industry Partnerships

cdip@sydney.edu.au

9.2 In the absence of proof to the contrary, a notice will be deemed to have been received, in the case of pre-paid registered mail, 3 days after it was sent if sent locally and 10 days after it was sent if sent overseas and, in the case of facsimile transmission, at the time recorded on the transmission confirmation report.

10 Insurance

The Subcontractor must maintain the same insurances as required of the University under the Funding Agreement and must, upon request, provide the University with evidence that it holds such insurances.

11 Entire Agreement

This Agreement constitutes the entire agreement between the Parties with respect to the subject matter of this Agreement.

12 Waiver

12.1 Failure by either party to enforce a provision of this Agreement will not be construed as in any way affecting the enforceability of that provision, or the Agreement as a whole.

13 Applicable Law

13.1 This Agreement will be governed by and construed in accordance with the Law for the time being in force in the Australian Capital Territory and the parties agree to submit to the exclusive jurisdiction of the courts of the Australian Capital Territory.

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EXECUTED AS AN AGREEMENT

SIGNED

for and on behalf of the Australian National University ABN 52 234 063 906 by an authorised officer in the presence of:

1anon & Alberto

(Signature of witness)

Lyndall Strazdins) (Printed name of authorised officer))

Gord H

(Signature of authorised officer)

(Signature of authorised officer)

)

)

)

)

)

)

)

)

))

)

)

Sharon Alberto

(Printed name of witness)

13,12,19) Date)

SIGNED

for and on behalf of the University of Sydney ABN 15 211 513 464 by an authorised officer in the presence of:

Signature of Witness)

Amber Dalmmple

(Printed name of witness)

Dr Kathryn Sunn (Printed name of authorised officer)

A Dec 2019.

Date

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Appendix A Funding Agreement

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Schedule 1 Subcontractor Services and Funds payable to the Subcontractor

A. Subcontractor Services - Menzies Centre for Health Policy

The evaluation team from the Menzies Centre for Health Policy (MCHP) will collaborate in identifying a baseline for impact analysis.

The MCHP will work with the local domain experts, document analysis and other qualitative methods to establish the current structures and processes of decision making within ACT MH care. Methods used will include interviews, focus groups and document analysis.

Timetable		
Dates	Action	Responsibility
31 October 2019	Human Research Ethics approval from ANU HREC	ANU
31 October 2019	Identification and agreement of interview subjects to be interviewed	ANU
November 2019	Interviews with significant domain experts and mental health administrators, ACT	MCHP
November 2019	Provision of relevant documents on mental health administration in ACT for document analysis	ACT partners and ANU
30 March 2020	Baseline analysis from interviews and documentary analysis	MCHP
31 May 2020	Baseline Report for ACT study	MCHP

B. Funds payable to the Subcontractor

Fee due (ex GST) - \$15,000

Payment invoicing date: on execution of the subcontract \$15,000

1 Invoicing requirements

The invoice must be in a form approved by the University and must:

- (a) contain the Subcontractor's name, address and ABN;
- (b) contain the contract number or purchase order number provided by the University (if any);
- (c) contain the name of the University Contract Manager;
- (d) contain an itemised list of the Funds payable together with any substantiating material required;
- (e) contain an itemised list of the amount of any allowances and costs to be paid by the University together with any substantiating material required;
- (f) specify the period covered by the invoice; and
- (g) contain any other information reasonably requested by the University from time to time.

For the avoidance of doubt, the Invoicing Contact Details are as follows:

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University:

Contact Name: Tony Kimburi Position: Senior Finance Officer, Research School of Population Health Email: <u>rsph.fn@anu.edu.au</u> Telephone: 02 6125 2586

Subcontractor:

For any questions about invoices raised by the University of Sydney, please contact: finance.collection@sydney.edu.au.

2 Funds

- (a) The Funds are payable by the University within 30 days of receipt by the University's Contract Manager of a correctly rendered Tax Invoice.
- (b) If an invoice is found to have been rendered incorrectly after payment, any underpayment or overpayment will be recoverable by or from the Subcontractor, as the case may be, and, without limiting recourse to other available means, may be offset against any amount subsequently due by the University to the Subcontractor under this Agreement.
- (c) Unless specified otherwise in this Schedule 1 the Subcontractor must not charge the University for any fees, charges or expenses (including travel and accommodation, document reproduction, transportation and courier charges, and telecommunications charges) in addition to the Funds. The University is under no obligation to pay any amount in excess of the Funds.

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Appendix 6: Initial proposal to BUPA Foundation

FOUNDATION GRANTS PROGRAM 2018



Mental Health Models of Care

FULL REQUEST FOR PROPOSAL – INVITATION ONLY

(Extract of original proposal only)

1. YOUR DETAILS

a) Principal Project Lead:	Professor Luis Salvador-Carulla	
b) Lead Organisation*:	Australian National University	
c) ABN:	52 234 063 906	
d) Address:	Centre for Mental Health Research (CMHR)	
	63 Eggleston Rd Acton Canberra 2601	
	+61 2 6125 2741	
e) Phone Number:	0468 440028	
f) Mobile:	luis.salvador-carulla@anu.edu.au	
g) Email:	http://rsph.anu.edu.au/research/centres-departments/centre- mental-health-research	

*The lead organisation can differ from the administering organisation. The administering institute is required to be a higher education institution for contracting and funding provision. Details are requested in section 5.

2. THE PROJECT

a) Project title

Beyond Mapping:

Transforming Australia's Mental Health System through Evidence-informed Policy and Practice, by implementing a new Integrated Care Pathway for People with Severe Mental Illness

b) Project synopsis

Note: This is to be a lay summary of your proposed research. Write it as if you are explaining what you will do and its value to your family over dinner. A maximum of 200 words.

Recurring inquiries demonstrate Australia's mental health system is broken. Planners and professionals don't know how to fix it.

Our project will use a suite of proven digital tools together with expert knowledge and local experience to help decision-makers and drive better outcomes for people with severe mental illness.

We have already developed the regional Integrated Atlases of Mental Health, now covering 50% of the Australian population, showing people <u>what services they have now</u> and highlighting gaps.

Bupa Foundation (Australia)

This project will now implement decision support tools to help local decision-makers understand:

- which local areas and services are performing up to standard
- the right changes to integrate mental health in the local area
- where services should open or close
- which staff should work where; and
- how, when and in what order to make these changes.

A critical problem in mental health is housing. Our project will start with improving decision-making on supported accommodation in Perth North, developing methods suitable for national implementation.

Our project is an Australian-first toolkit to drive practical change, focusing not just on health but on the broader social determinants of health, including employment, housing and education – *building an integrated care pathway for people with severe mental illness.*

c) Project duration

Proposed Commencement Date*	1 April 2019
Proposed Completion Date	30 March 2021

*funding available from 1st January 2019.

d) Total requested funding (from the Foundation)

AUD \$1m

3. THE RESEARCH

a) Aims of the project (i.e. your hypothesis to be tested) A maximum of 100 words.

This project will:

- 1. Build an effective, integrated care pathway for severe mental illness based on -
 - Collection of real time local service data
 - Implementation of best practice examples
 - Deployment of tested decision support tools
 - Co-production with local community, combining experience and expertise
- 2. Model the practical impact of this pathway on the provision of supported accommodation in Perth North.
- 3. Demonstrate scalability of the adoption of this pathway in three other regions
- 4. Evaluate broader financial and policy impacts of this pathway
- 5. Make our findings publicly available via open access, to drive national implementation and beyond.

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b) Background to project

Provide background to the issue you are aiming to solve including academic, clinical and government context, the evidence base that informs it and how it is related to other research in this area. A maximum of 400 words.

Australia's mental health services focus on hospital-based models of care. We lack service alternatives. This is inefficient and undesirable. In WA repeated snapshot surveys revealed that 43% of the 200 inpatients at Graylands Psychiatric Hospital could be discharged if only appropriate community and residential services were available. Other data from Perth North demonstrate vast health resources inefficiently allocated to patients in need of stable, supported accommodation, with \$120m spent on just 112 clients over four years without satisfactory resolution of their housing needs.

The WA Government is decommissioning Graylands and will build a range of contemporary residential, recovery-oriented, care options. A natural experiment is occurring.

To manage this, decision-makers in WA will respond with, at best, crude estimates about the number of residential beds necessary to meet demand. They will be unable to design local changes with reference to any broader, integrated system of mental health, considering employment, education, social inclusion, transport and other key recovery factors.

This dilemma is familiar. Australia lacks the decision-support tools to effectively address it. Services and information systems operate in unhelpful silos. 'Central Office' planning typically fails to reflect the complexity of the real-world problems faced by local area health services and consumers daily.

Our Integrated Atlases of Mental Health Care are a first step, equipping local decision-makers to understand their local mental health service landscape.

We will build on this progress by implementing a suite of proven, dynamic decision-support tools. These tools, already in regular use overseas, will help local decision makers answer important pragmatic questions like:

- Do I have the right number of supported accommodation beds and are they in the right places?
- Do I have the right mix of services between residential care, supported housing and floating outreach?
- Do I have the right mix of staff across my services?
- How can I design the best balance of quality services for consumers and their families?
- How well integrated are my services with in other key areas, such as health, employment and social inclusion?

This project will equip local decision-makers in North Perth to shift from an acute bed focus to designing and building an integrated pathway for people with mental illness.

The tools we will use have broad application, to other regions and beyond mental health. They represent the next generation of practical and effective decision-making, using new technologies to support an integrated, 21st century response to mental illness in Australia.

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c) Detailed project plan

Please outline the research activities that will be completed as part of this project as well with detail and justification of research methodologies. This could include but not limited to participant recruitment, control or comparators for intervention studies, statistical analyses, ethics requirements and stakeholder engagement.

Overview

This project will assess the application of internationally proven decision-support systems technology to Australian circumstances. Our project follows an organisational learning approach to local quality improvement. We will conduct evidence-informed implementation of a new integrated care pathway for people with severe mental illness in the Perth North region. We will evaluate the extent to which this technology, new to Australia, helps drive better decision-making in mental health. We will prepare guidance to enable use of this technology elsewhere and in other settings.

"Integrated care" brings together all the inputs of care delivery, management and organisation of services related to diagnosis, treatment, care, rehabilitation and health promotion. Horizontal integration includes all sectors involved in care for a target population (health, social, education, employment, housing, justice, self- and peer-support). Vertical integration refers to the coordination of care at all different levels of specialisation and complexity from primary to tertiary care). Normative integration is intended to ensure consistency of values and approach throughout the system.

Integration is the better way improve access, quality and the patient experience. "Person-centred integrated care" is aimed at engaging and empowering persons in the management of their individual care; and the promotion, prevention and planning at the system level, equity, quality, efficiency and ethics of the care and health system. The anticipated benefits and outcomes of this integration is that all people are able to access high-quality health services that meet their needs and preferences for improved health of populations.

There were 32 separate statutory inquiries into mental health between 2006-12. There is general agreement that Australia's mental health system is in crisis, not fit for purpose in the 21st century. Decision-makers in mental health are currently operating largely in the dark. The key outcome of this project will be to end this inadequate and often dangerous situation.

The Project Plan

Our project plan has three key phases:

- 1. Development of the Decision Support Toolkit (structured according to Deming's questions) in four stages
- 2. Implementation
 - a. development of the project in Perth North
 - b. scaling Up adoption in our partners' service regions, in other regions and beyond mental health

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3. Outcomes and Policy Impact - was our process successful and is our project making a difference?

We now provide detail on the activities in the first two project phases. Phase 3 is dealt with under the Outcomes section, later in this proposal.

Phase 1 - Development of the Decision Support Toolkit

This phase focuses on the development of a new decision-support Toolkit to drive better decision-making in mental health. This Toolkit, already operating successfully elsewhere (Spain and the UK), will answer W.E. Deming's four key questions for leadership and quality improvement, adopted by the US Institute for Healthcare Improvement. These questions are shown the table below, together with a practical example of what they mean for local planners.

Key Question for Quality Improvement and Leadership in Change		What issue does this raise for local planners?	Toolkit Product to be established
1.	Do you know how good you are?	What is the model of care and the care pathway used in a local area?	An integrated model that shows the full current state of mental health care in a local health district or region.
2.	Do you know where variation exists?	What is the pattern of service availability, capacity and workforce?	A decision support system, drawing on the above model, integrating local professional and consumer expertise, knowledge and preferences.
3.	Do you know where you stand relative to the best?	How well is the mental health system performing? Are some services working better than others?	A digital Relative Technical Efficiency (RTE) tool for catchment areas to enable benchmark analysis (comparison across jurisdictions).
4.	Do you know the rate of improvement over time?	How do you plan change over time in relation to both provision (service availability, capacity and workforce) and local need?	A digital action plan to set priorities, allocate resources and schedule activities to achieve a specific system intervention: integrated care pathway for severe mental illness.

Together with the Integrated Atlases of Mental Health, and building on local knowledge, these Toolkit products are the building blocks of a more intelligent approach to responding to the complexity of mental illness and the need for systemic integration. This project will establish their use in Australia, first in Perth North, but with a clear view to their broader application across mental health and elsewhere. To demonstrate the scalability of our approach in Perth North, the model we implement will be tested for suitability in several other Primary Health Network areas participating in our research alliance; Central and Eastern Sydney, the ACT and Western Sydney.

Our overall approach aligns well with BUPA's stated areas of research interest, as shown below.

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e) Both expert and experiential panels to be provided with short summaries of the evidence gathered in a) and b) above. They will also evaluate a draft model of mental health arising from this work and discuss how to best use decision-support systems for mental health planning. These panels will meet over the life of the project, including to consider feasibility and validate results. Our project will engage panels at two levels both at the development phase and at implementation: nationally to ensure co-design, confirm feasibility, and to facilitate the broader applicability of the model developed; and locally to be as clear as possible about the real-world situation in Perth North. Drawing on real time local data, the Perth groups will have access to data visualisation techniques to build their understanding of their situation, including numbers of services, staff, locations, gaps etc.

The final product of this part of the project is the development of a knowledge base on which to develop the model of community mental health care in Australia and the decision-support system necessary to make it happen.

2. Do you know where variation exists?

Answering this question requires development and implementation of a decision support system. Our project has agreement from local providers to collect real time local service data on utilisation and outcomes. This phase will provide an analysis of the pattern of variation in service availability, placement and workforce capacity in Perth North, combined with information on resource use and outcomes. We will use the SOMNet approach which takes a complex set of data to represent and analyse variation of care.



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3. Do you know where you stand relative to the best?

To respond to this question, we need to implement a digital Relative Technical Efficiency (RTE) tool designed to enable benchmark analysis, such as already exists in Europe.

Comparative Efficiency Analysis of small health areas in Bizkaia (Spain): Efficiency ranking an	d
benchmarking	

Small health areas	Input management	Output management
(mental health centres)	(Input oriented DEA)	(Output oriented DEA)
Ajuriaguerra	Inefficient	Likely efficient
Barakaldo	Efficient	Efficient
Basauri	Likely efficient	Efficient
Bermeo	Likely efficient	Efficient/Likely eff.
Derio	Efficient/Likely eff.	Efficient/Likely eff.
Durango	Likely inefficient	Efficient/Likely eff.
Erandio	Efficient	Efficient
Ercilla	Efficient/Likely eff.	Efficient
Etxaniz	Likely inefficient	Efficient/Likely eff.
Galdakao	Likely efficient	Efficient/Likely eff.
Gernika	Efficient/Likely eff.	Efficient/Likely eff.
Ortuella	Likely efficient	Efficient/Likely eff.
Otxarkoaga	Likely eff./Likely ineff.	Likely efficient
Portugalete	Efficient	Efficient
Santurtzi	Likely efficient	Efficient/Likely eff.
Sestao	Efficient	Efficient
Uribe	Efficient/Likely eff.	Efficient
Zalla	Likely eff./Likely ineff.	Efficient/Likely eff.
Recalde	Likely eff./Likely ineff.	Inefficient

This RTE tool analyses the relationship that exists between inputs (such as beds and places, workforce capacity, availability of mental health services and budget), and outputs (such as number of admissions, average length of stay, discharges and readmissions). RTE is a good indicator to assess the performance of mental health services, permitting fair comparison between different areas. It can suggest ways to improve mental health care management, reducing waste of resources and/or increasing outputs.

By seeing the system as whole rather than in pieces, this RTE approach offers a guide to priority setting by identifying the sequence of services where the resource allocation will produce a better system overall. Our RTE methodology will drive the design of evidenced-informed policies applicable to a range of mental health and other services. This analysis of efficiency and benchmarking in Perth North will also enable comparison with other health districts for a Comparative Effectiveness Analysis. Other Primary Health Networks, Western Sydney and Capital Health Network (ACT), are providing additional data to participate in this process.

4. Do you know the rate of improvement over time?

Evaluation of system efficiency using the Monte Carlo DEA: The case of small health areas

Mercedes Torres-Jiménez^{a,*}, Carlos R. García-Alonso^b, Luis Salvador-Carulla^c, Vicente Fernández-Rodríguez^d European Journal of Operational Research 242 (2015) 525–535

Answering this question requires development of another Relative Technical Efficiency (RTE) model, this one specifically established to support resource allocation and implementation of the integrated care pathway for severe mental illness in Perth North. By seeing the system as whole rather than in pieces, this RTE approach offers a guide to priority setting by identifying the sequence of services where the resource allocation will produce a better system overall.

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This model identifies the most likely specific consequences of interventions and policies on selected scenarios (reflecting different perspectives of the mental health system) as well designing potential new ones. This delivers critical new capacity for decision-makers to model options for change, test their thinking and compare the outcomes of alternative approaches. They will then be better placed to design evidenced-informed interventions, reducing the risk associated with decision-making.

The practical result of this model is a web-based tool that will equip decision-makers with new capacity to answer questions like:

- Do I have the right number of supported accommodation beds and are they in the right places?
- Do I have the right mix of services between residential care, supported housing and floating outreach?
- Do I have the right mix of staff across my services?
- How can I design the best balance of quality services for consumers and their families?
- How well integrated are my services with in other key areas, such as health, employment and social inclusion?



While the focus is on developing this model for application in Perth North, we intend to also demonstrate the scalability of this tool in our partner Primary Health Networks, Central and Eastern Sydney, Western Sydney and Capital Health Network (ACT).

Phase 2: Implementation

We have established strong links with key partner organisations to ensure the successful implementation of the new Decision Support Toolkit in Perth North and to scale it up to the other participating PHNs and eventually to Australia. This includes a set of consultation panels, training courses and workshops, described in more detail in the Outcomes section later in this proposal.

Project implementation will occur in two stages:

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- Demonstration stage Perth North
- Scaling Up stage

Demonstration stage - Perth North

This project is based on the constructive partnership which already exists between the partner organisations and the WA Primary Health Alliance (WAPHA). This has also involved collaboration with other mental health planning and provider organisations in Western Australia, focusing on the development of Integrated Mental Health Atlases of the Perth Metro Region and Country WA in 2016-2017 and more recent updates to the Atlases for the Kimberley Region and Perth North in 2018 (now publicly available). These atlases have been extensively used for health planning, priority setting and resource allocation in WA. In 2017-2018, we also mapped our Atlas classification system to the National Mental Health Service Planning Framework.

All these reports have highlighted critical care gaps in WA in relation to community residential and support accommodation, particularly affecting Perth North. The planned decommissioning of Graylands Psychiatric Hospital offers a unique opportunity to test the usability of the new Decision Support Toolkit built in Phase 1 of this project. Can it drive more evidence-informed approaches to planning, leading to better balanced care and supported accommodation in Perth North?

The Graylands decommissioning and the associated shift to supported accommodation in the community is being undertaken through an essentially top-down tripartite arrangement that reflects a unique, in Australia at least, funding and operation of state based mental health services: the WA Mental Health Commission (WAMHC) is responsible for state-level planning and funding services including hospitals; the WA Department of Health is the overall "system manager" while the area health services such as North Metro Health Service (NMHS) which have the clinical and operational expertise are the health system providers who enact agreed plans.

The default for the WAMHC is to use population planning approaches built around the National Mental Health Service Planning Framework (NMHSPF) with the area health service, NMHS, undertaking the local implementation. The division of responsibilities and separation of clinical and operational expertise among the key players underscores the need for credible local level decision support resources.

Without such resources there is the risk of generic data being applied resulting in planning not properly reflecting local circumstances. For example, the NMHSPF is based on whole-of-population estimates. It fails to account for regional information and provides no mechanism for local clinical, operational or consumer expertise to properly support mental health decision-making.

Moreover, there is a separate COAG-endorsed requirement for Primary Health Networks to develop placebased Joint Regional Integrated Mental Health Plans with area health services. Again, while whole of population approaches can provide macro-level estimates to support these plans, the need to localise and align the commissioning of local services at the sub-regional level (for example within local government areas) requires decision support technologies calibrated to such meso and micro level contexts. It is in these contexts that local expertise and knowledge, including that of health consumers, carers and community, as well as clinicians and others who live and work in these settings are invaluable.

Dr Danny Rock. Principal Advisor & Research Director of WAPHA and member of the executive committee of this project will be liaison coordinator between the project teams and the planning and provider organisations in Perth (mainly WAPHA and NMHS).

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The specific tasks in Perth North will involve:

- a training course on the Decision Support Toolkit for evidence informed planning
- the organisation of local expert and experiential panels for the co-design and feasibility analysis of the Toolkit (in Year 1)
- the final local panels for assessing the practicability and impact of the Toolkit in the development and implementation of the decommissioning of Graylands Hospital
- liaison with WAPHA and other WA agencies to revise the metadata set that will be used in the development of scenarios and modelling for the analysis of the model of MH care in Perth North
- the SOMNet analysis and the RTE analysis of benchmarking and resource allocation
- the development of detailed stepped priorities to guide the deployment of the Supported Accommodation Strategy in WA.

Scaling-up stage

The second stage of the project's implementation is scaling up in our other partner organisations.

As noted in the project plan, while the focus of implementation of the new Decision Support Toolkit is North Perth, three other Primary Health Networks (PHNs) are also keenly engaged as partners in our project. Central and Eastern Sydney, and Capital Health Network (ACT) Western Sydney. Supported accommodation has been identified as a key issue in the Integrated Atlases of Mental Health undertaken in all these regions.

There is a broader context to the engagement of these PHNs in this project. In NSW, there is a significant project underway (similar to the decommissioning of Graylands) to re-locate 380 people from long term inpatient care (> 1 year) into new supported accommodation in the community – this is the "My Choice: Pathways to Community Living" (PCLI) project. NSW is also planning for a further 500 people who require supported accommodation. There are specific plans in Central and Western Sydney, particularly following reports into existing boarding house accommodation. Similarly in the ACT, a new Housing Strategy has just been released and local service recognise the link between supported accommodation and easing inpatient blockages.

Our PHN partners, other designated decision makers and stakeholders will participate in our project panels, courses and workshops. They will participate in the development of the Decision Support Toolkit and assist in the evaluation of its feasibility, readiness and practicality for local decision-making. This work will be informed by regular reporting of progress and results from Perth North.

In the final phase of the project and once the preliminary reports from the use of the Toolkit in Perth North are released, this project will work with the three PHN partners to assess the practicality of its implementation locally.

At the conclusion of this project in 2021, we will host two final workshops for decision-makers, one on the west coast and one on the east coast of Australia to share project learnings and technology. This is key step towards the dissemination to a broader audience with the decision-support Toolkit.

A formal dissemination strategy will be developed to plan for this broader application of the Toolkit into a range of areas beyond partner organisations and beyond mental health, including rural areas, the disability sector among others. This is described in more detail under the Outcomes section of this proposal.

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- Ageing), and other countries
- 4) We will provide a scalability plan of this pathway in three other regions (Central and Eastern Sydney PHN, ACT Capital Health Network, Western Sydney)

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- 5) We will evaluate and report financial and policy impacts in practicability, readiness and adoption for wider use
- 6) This project has the potential to fundamentally shift the way mental health and other services are planned and implemented. We will make our findings available via open access, to drive broader adoption across Australia and elsewhere.

While this project could rightly be called ambitious, the project team has led the development of 19 Integrated Mental Health Atlases in just over three years. There is very strong interest in the tools described in this proposal. Our method is feasible within the BUPA project grant timeframe.



4. THE OUTCOMES

a) What are the outcomes of the research. Why have these been chosen and how they will be measured.

The third key phase of our project relates to outcomes. Our approach is explained here.

The focus of this project is to implement an Australian adaptation of a Decision Support Toolkit operating overseas and applying it (first) to the issue of supported accommodation in Perth North.

The scope of this project and the BUPA funding timeframes place limitations on what can be realistically evaluated over the period of the project. For example, it is not realistic to expect new accommodation to be available necessarily within the project timeframe. Nor is a useful assessment of the impact of the intervention on consumer wellbeing outcomes likely.

The critical project outcome therefore is that the Toolkit is built and working. On this basis, <u>the key</u> project outcome is that the Decision Support Toolkit has proved useful and has been adopted by local <u>decision-makers</u>.

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We will be confident of this outcome if:

- 1) The local integrated model of what the Perth North mental health system has been completed.
- 2) Challenges, gaps and inefficiencies in the local system have been identified using the integrated model and acknowledged by local planners / in planning meetings.
- 3) All relevant stakeholders have had input into the development of the Decision Support Tool and panels have been conducted.
- 4) The Decision Support Toolkit has been localised using data from the integrated model as well as local expertise and experience and is ready to use in local planning.
- 5) The Decision Support Toolkit has been used in local planning meetings / by local planners.
- 6) Decisions about the establishment, continuation, or discontinuation of mental health services have been made using the Decision Support Toolkit.
- The local integrated model has been used to compare what the state of mental health care in Perth North looks like after the use of the Decision Support Toolkit, compared to baseline.
- 8) The use of the local integrated model, and Decision Support Toolkit (including the process of localisation) has been embedded into standard planning practice by means of recommencing with point 1 above.

In order to evaluate this, we will adopt a mixed qualitative and quantitative approach to our assessment of outcomes. Our evaluation method will draw on proven, published tools and approaches.

Process Evaluation

The process evaluation will determine WHY and HOW, key project milestones are being met as well as the EXPERIENCE, SUSTAINABILITY and ACCEPTABILITY of the project for local stakeholders. The process evaluation will:

- Document the conduct of the project compared with the project plan, including any changes to governance, tools, participants and processes (fidelity)
- Determine the extent to which the tools were able to be developed in, and for, the local context as intended (implementation)
- Evaluate the experience of the various stakeholders that were part of the process (and were intended to be part of the process) (acceptability and sustainability)

The process evaluation will adopt a qualitative interpretive approach. Stakeholders will be interviewed at key intervals during the project. This will include participants in panels (including consumers), local health workers, administrators, and members of the project team. The evaluation research officer will also be an observer at all panels, project meetings and local planning meetings. Field notes from these meetings will be analysed together with the interviews to draw out a 'rich case study' of the deployment of the integrated model and Decision Support Tool in Perth North.

The process evaluation will adopt a qualitative interpretive approach, following the previous experience of members of our partnership in the analysis of complex interventions in health policy and program organisations (Haynes et al, 2017).

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Impact evaluation

The maturity and impact of the Decision Support Toolkit will be evaluated in several steps using validated tools we have used previously in health systems research (Chung et al, 2018). Its general feasibility will be assessed once the training course and the general panels have taken place during the first semester of the project. The local feasibility evaluation in Perth North will be assessed after running the local training courses and the panels in this region. The other measures will be collected at the end of the project both in the local area and from the final national panels.

The indicators selected for the quantitative impact evaluation of the implementation of the Toolkit include feasibility, practicability, readiness and adoption. Our evaluation of impact will incorporate each of these dimensions.

We will also conduct a context evaluation, so as to understand the barriers and facilitators related to adoption of the Toolkit in the region.

A final critical element of our evaluation of outcomes relates to the experience of care. We will deploy several tools designed to understand the cohort and, taking into account time limitations, the impact of the Toolkit as it emerges in Perth North.

We will then combine these evaluation methods in a synthesis, designed to report on the extent to which our key project outcome was fulfilled. This synthesis will be provided in a report structured against the evaluation domains outlined by Greenhalgh and colleagues (2016) for evaluating adoption, engagement, scale-up, spread, and sustainability of health and care technologies.

b. How will your research outcomes positively impact the mental health and wellbeing of the Australian population?

Explain how the knowledge generated from this research project will be made available and transferred to those who can apply it to improve mental health care and how you will measure this. We expect this to include traditional research metrics of knowledge advancement (i.e. publications, conferences, citations etc) but also specific examples of translation such as patient and practitioner workshops/training, informing guidelines, policy submissions, advocacy, changes to practice at a team, organisation or regional level and potential for scalability.

We have previously outlined the suite of policy reports, guides, academic publications and other material that will arise as a result of this project. Together, these aim to influence the future direction of the way Australia plans to meet the challenge of mental illness.

We will develop a specific Dissemination Strategy that will incorporate both the adoption of the Decision Support Toolkit for Evidence informed planning, and its applicability for modelling the integrated care pathway for severe mental illness in other regions.

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This strategy will follow our previous international work in this area (Lukersmith, 2017). It will be developed to focus on several areas we already identify as key targets for future implementation of the Toolkit, including:

- Other PHNs we will first target the urban PHNs where Integrated Atlases of Mental Health have been completed, followed by other urban PHNs in Australia. The third cluster will incorporate rural PHNs already mapped, and finally the other regional/rural PHNs in Australia. The Federal Government has already indicated its interest in supporting this approach.
- Psychogeriatrics and aged care the 19 Atlases of Mental Health already completed in Australia have identified major gaps in access, availability and capacity of the service delivery system for psychogeratrics in Australia.
- Psychosocial disability support another key priority is the use of the Toolkit to inform the development and evolution of the housing support provided by National Disability Insurance Scheme. We are preparing a mapping of the disability services in selected PHN regions in collaboration with the NSW Department of Premier and Cabinet in 2019.
- Other sectors the Toolkit can be used to better understand supported accommodation and other programs developed by large organisations in the public sector (eg housing, AOD or homelessness care), large NGOs and in the private sector.

While beyond the scope of the BUPA timeframe, it is our intention to evaluate this dissemination strategy and the ongoing implementation of the Toolkit. We would be happy to keep BUPA informed of the results of this evaluation going forward.

This project is founded on members of the research team's work on successful international models of mental health systems change. We will continue to contribute to this global conversation at academic level – through conference presentations and publications – and participation in high level policy dialogues with national and global mental health leaders. The BUPA project will demonstrate new ways of understanding and changing Australia's mental health system, it should also feed back into global debates.

Timeline of project (include research activities, deliverables and key milestones). Link to the expected outcomes outlined above, where applicable.

Note: If successful these will be used to inform Funding Milestones and reporting requirements for the project.

The key research activities, milestones and deliverables are shown in the project Gantt Chart below.

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