Royal Commission into
Victoria's Mental Health System

WITNESS STATEMENT OF JO-AN ATKINSON

I, Jo-An Atkinson, Associate Professor, of Building F, Level 5, 94 Mallet Street, Camperdown, NSW, say as follows:

1 I make this statement on the basis of my own knowledge, save where otherwise stated. Where I make statements based on information provided by others, I believe such information to be true.

2 I am providing evidence to the Royal Commission in my personal capacity.

Background

Qualifications and relevant experience

3 I have more than 20 years' experience in health service delivery and clinical research in Australia, as well as public health operational research to inform strategies for disease control and elimination in the Asia-Pacific region. I have particular experience leading research on the use of various forms of systems modelling to address challenges such as suicide prevention and mental health service planning.

4 I have a Bachelor of Occupational Therapy, which I received in 1998 from The University of Queensland, and a clinical research Master of Philosophy, which I undertook between 2003 to 2005 at the Royal Brisbane and Women's Hospital through the University of Queensland.

5 I worked as an allied health professional in hospitals in the UK and in Australia for over 10 years, providing care for inpatients and outpatients. From 2008 to 2011 I worked as the Research Manager for the Pacific Malaria Initiative Support Centre (which was based at the University of Queensland School of Population Health and supporting a joint AusAID / Global Fund program to eliminate malaria in the South West Pacific).

6 I was awarded a PhD in International Public Health in 2012. My PhD thesis focused on the individual, household, community, and health system factors that impacted malaria prevention and health system effectiveness in the scale up of interventions in the Solomon Islands and Vanuatu. It was during my PhD studies that I became more deeply aware of complex systems science and the use of systems modelling and simulation to forecast infectious disease transmission, and as a tool for testing alternative strategies to reduce and eliminate transmission.

Please note that the information presented in this witness statement responds to matters requested by the Royal Commission.

7 On being awarded my PhD, I worked from 2012 to 2013 as a Research Fellow with the Infectious Disease Epidemiology Unit, School of Population Health (SPH), University of Queensland, before moving to Sydney where I took up a position with the Sax Institute's Implementation Science group.

8 In 2014, I joined The Australian Prevention Partnership Centre ("**Prevention Centre**") – a $25 million national initiative administered by the Sax Institute and funded by the National Health and Medical Research Centre, the Australian Government Department of Health, NSW Ministry of Health, ACT Health and the HCF Research Foundation. The aim of the Prevention Centre is to explore systems approaches to building an effective, efficient and equitable system for the prevention of lifestyle-related chronic disease. Under that initiative, I built a program of work in systems modelling and simulation to inform lifestyle-related chronic disease prevention policy and planning with a small team of talented colleagues. Our policy partners recognised the value of this approach, which then led to the establishment of a consultancy service called Decision Analytics within the Sax Institute, of which I was Director until January 2020.

9 Decision Analytics provided a service to national and state policy agencies and regional planners in using systems modelling and simulation to develop interactive decision support tools to help address complex health system, service planning, and population health problems. Over the past 5 years (through the Prevention Centre and Decision Analytics, and in partnership with policy agencies and regional planners) my team and I developed over 30 models to tackle issues such as suicide prevention, mental health service planning, alcohol related harms, tobacco control, childhood overweight and obesity, diabetes in pregnancy, osteoporosis, cardiovascular disease, state-level health system service planning to improve hospital performance, child protection service system reform, and homelessness.

10 In addition to my formal qualifications, I have undertaken a range of short- and semester-long courses in applied mathematics, epidemiological and statistical methods, health care modelling, systems thinking & design thinking, data-informed simulation modelling in health, and in the use of smartphones and wearable technology (such as smart watches or fitness trackers) to better understand individual health behaviours.

11 Attached to this statement and marked 'JAA-1' is a copy of my CV.

Current role and responsibilities

Computer Simulation and Advanced Research Technologies ("CSART")

12 I have been Managing Director of CSART since its inception in 2018.

13 CSART is a not-for-profit organisation working at the intersection of computer science, data science, systems science, health and behavioural sciences. We are committed to Open Science (a movement to make scientific research transparent and accessible to everyone). Our goal is to put better analytic tools in the hands of decision makers and working to create the necessary workforce, technological, and systems infrastructure to make systems modelling and computer simulation more broadly available and more routinely used to support decision making. CSART is an alliance of centres of excellence around the world, undertaking both methodological development and applied research. I discuss applied research further in paragraph 20 below.

14 CSART is working to build global capacity in the use of computer simulation and advanced research technologies to support policy and planning decisions that better address society's most complex, persistent health and social problems.

15 The core areas of CSART's work are:

(a) Interdisciplinary national and global health focussed systems modelling and simulation to support strategic and operational decision making to improve health and social systems.

(b) Training and capacity building activities shared across the alliance that encompasses:

i. student research projects and shared supervision and mentorship of postgraduate students between CSART partner institutions;

ii. collaborative development and adaption of training materials and provision of short courses; and

iii. postgraduate student placements and exchanges between CSART's partner organisations internationally to promote contacts between talented young scientists and foster the next generation of science leaders.

(c) Fostering collaboration and exchanges between leading scientists through joint organization of symposia, seminars, workshops and lectures.

(d) Sharing of research expertise, materials, technological innovation, data and scientific knowledge through collaborative national and international grant applications and projects.

16 My role as Managing Director is to spearhead the implementation of strategic and operational priorities of CSART to achieve its mission[1] and vision[2].

Brain and Mind Centre ("BMC")

17 In addition, in February 2020 I commenced a part-time role with the Brain and Mind Centre ("**BMC**") at The University of Sydney, where I Head the Systems Modelling and Simulation group, as part of the Youth Mental Health and Technology program led by Professor Ian Hickie. My role in this position is to advance a program of work in the application of systems modelling and simulation in the areas of mental health and suicide prevention, and in particular, in youth mental health. This program of work spans local, regional and national levels – that is, my team is applying systems modelling and simulation to:

(a) inform improvements in operational efficiency and coordination of *local* services to improve the effectiveness, equity, and timeliness of care;

(b) support *regional* decision making regarding strategic investments to improve mental health and suicide prevention; and

(c) inform *national* system reform to enhance Australia's 'mental wealth.'

18 Over the past five years, my teams and I have been commissioned to build a national model, and our primary clients have been Primary Health Networks ("**PHN**s").

System Design

My research background

19 My research background has spanned clinical research, international public health research in infectious disease prevention, chronic disease prevention in Australia, and, most recently, mental health and suicide prevention. This research experience has included the use of quantitative, qualitative and participatory research methodologies, and the design of strategies for community engagement in prevention initiatives.

20 My research experience has often been policy driven, and has primarily been applied research. Applied research refers to research that is used to solve a specific, practical issue affecting a public health policy or program, as opposed to basic research that aims

[1] CSART's mission is "to provide better access to advanced research technologies and transparent decision support tools to help policy makers and planners make sense of complex problems and generate collective action to help solve them." For more information about how CSART seeks to achieve this mission, see http://www.csart-world.com/

[2] CSART's vision is "a world where human health and wellbeing are enhanced by providing policy makers and system planners more intelligent tools to facilitate better decisions…". For more information about how CSART seeks to achieve this vision, see http://www.csart-world.com/.

to advance scientific knowledge which may or may not be directly applicable or immediately useful. Systems modelling and simulation is used for both applied and basic research. In applied research, the research question is usually determined in partnership with relevant decision-makers and stakeholders, rather than being a question determined solely by researchers. Because of this, the success of my research has necessitated the fostering of partnerships between policy agencies, research institutions, and civil society. These partnerships have the added advantage of facilitating capacity building, innovation and research translation to improve population health.

21 Throughout my career, I have been committed to ensuring the right analytic tools are used to answer a question, even if we need to look to methods from outside of the traditional tool kit of epidemiologic and health economic research.

22 I bring this diverse experience to my work on mental health and suicide prevention in Australia.

The application of system modelling and simulation to mental health systems

Challenges impacting the mental health system

23 Mental health systems of care in Australia face a number of complex challenges. These challenges are not dissimilar to what I have seen in my broader national and international public health work. Coupled with the fundamental importance of good mental health underpinning cohesive and productive societies, these challenges have provided the impetus for my increasing focus on mental health and suicide prevention research. In my view, there are four key challenges.

24 *First,* there is a broad range of perspectives about why the rates of mental illness in Australia remain relatively constant, and why problems with mental health systems persist despite decades of successive statutory inquiries, system reforms, significant investment by national and state governments, and substantial contributions from business, community and philanthropic organisations. Even amongst experts, there is little agreement about the reasons for this inertia, and the appropriate strategies now required to address the challenges. Victoria is certainly not alone in this. For example, the problems with the mental health system are variously attributed to one or more of the following:

(a) inadequate support for the implementation of previous reforms;

(b) insufficient overall funding;

(c) inappropriate distribution of funding across acute care in public hospitals, primary care, and community-managed mental health needs;

(d) poor distribution of services across geographic and socioeconomic strata;

(e) insufficient investments in workforce, appropriate training, and infrastructure including psychiatric beds;

(f) poor targeting of interventions across the lifespan;

(g) investments are made in programs and services that lack evidence, with a push to focus only on those that are evidence-based;

(h) services demonstrated to be effective have failed to be delivered at scale; and

(i) a lack of strong accountability mechanisms, and monitoring and evaluation infrastructure to demonstrate the impact of investments.

25 *Second,* over the past few decades, there have been advances in life course epidemiology, an increasing awareness of, and research into, the social determinants of mental health and suicidal behaviour, as well as research into effective interventions to address these issues. These advances have significantly broadened the range of options in which investments are being made and are being advocated for. This amplifies the first challenge I discussed above.

26 *Third,* service planning is made more difficult by geographic variation and changes over time in population needs.

27 *Fourth,* the task of mental health reform and service coordination is further challenged by the division of roles and responsibilities between federal, state and territory governments, regional primary health networks, and private and non-government sectors. These divisions create a level of system complexity that makes the sharing of information and the provision of integrated and coordinated, client-centred services and interventions, and their evaluation very difficult.

28 In mental health, and across public health more broadly, these complex challenges have resulted in a move towards the implementation of comprehensive strategies, with investments in a broad range of different programs and services. This approach is based on the rationale that if we invest a little bit in everything, it will have a greater effect. However, these broad strategies can lack focus, or sufficient actual investment in time, resources and capacity to implement in specific geographic and socio-economic contexts. Consequently, this approach may actually undermine the potential impact of investments by spreading available resources too broadly over a range of poorly targeted and poorly coordinated programs and services. This, in turn, makes the mental health system even more complex and difficult to navigate for clients.

29 However, sometimes even targeted strategies fail to be cognizant of the delicate balance and interaction of core elements of the mental health system in a particular context, and

the flow-on impact that programs and services acting on one part of the system can have elsewhere in the system.

30 In light of these challenges, the focus of systems modelling in mental health over the past few years has been on equipping decision makers with the most appropriate decision analytic tools. As I explain further below, the purpose of these tools is to help decision makers navigate all of this complexity and uncertainty and help make better decisions about the most effective suite of mental health system strengthening initiatives and suicide prevention interventions for a given population or region.

Systems modelling for the mental health system

31 Systems modelling provides a method of bringing together a variety of sources of evidence such as research and evaluations, expert and local knowledge, practice experience, and data, to map and quantify a complex system. We go through a process of bringing all the information together – mapping the flows of people through the system, understanding how and why those flows change over time, making sure we've captured all relevant aspects of the problem and the broader system and then we, in effect, simulate things over time. We essentially create a computer simulation model of what is happening in the real world, including the bottlenecks, barriers, incentives, disincentives, sources of inertia and delay in the system, and other relevant local factors that influence system performance and effectiveness.

32 When applied to mental health, these maps capture the flow of people through the mental health and social systems, including: i) pathways to psychological distress; ii) pathways from psychological distress to mental disorder; iii) mental health service pathways; iv) pathways to suicidal behaviour; and v) recovery pathways. These maps are quantified, tested and validated by:

(a) verifying that the structure and performance of the model has face validity[3] among diverse system actors. This verification takes place through a participatory process, which I discuss further from paragraph 39 below; and

(b) testing whether the model accurately reproduces historic, real-world data patterns. This testing can be applied across a range of mental health indicators and outcomes. We test the model against historic real-world data patterns across a range of indicators to make sure that the model – the hypothesis of how the system currently operates – is represented accurately.

[3] Face validity is the extent to which the model is subjectively regarded as relevant and consistent with what it set out to achieve. Put differently – it measures whether, on its face, the model looks like it will achieve its goals.

33 The key benefits of systems modelling and simulation for mental health system strengthening and suicide prevention can be summarised as follows:

(a) **Adaptive:** Systems modelling is uniquely able to capture factors that bedevil traditional analytic approaches. Those factors include population and demographic dynamics, changes over time in environmental drivers of psychological distress, mental disorders and suicidal behaviours, workforce dynamics, the interrelationship between service supply versus demand, and the potentially non-additive effects of intervention combinations.

(b) **Comprehensive:** Systems models leverage significant investments already made in research and evaluation. These models bring together the best available evidence from a diverse range of sources, such as population surveys, expert and local knowledge, practical experience, and administrative datasets. This allows us to capture our best understanding of local system structures and flows, and the behaviours of system actors that drive system performance and mental health outcomes.

(c) **Interactive:** The process of systems modelling delivers an interactive decision support tool. This tool provides a safe environment to test system reform options, policies, and service planning scenarios before implementing them in the real world. This not only facilitates more efficient use of limited resources but can avoid potential unintended consequences that can occur even when investing in evidence-based interventions. The tool can also explore disinvestment scenarios.

(d) **Accessible:** The software platforms for systems models are compatible with standard laptops or desktops. The model interfaces increasingly make the structure, logic and assumptions of models understandable by lay audiences. The transparent and interactive nature of these tools can assist in engaging broad stakeholder groups, which helps build consensus and collaborative action.

(e) **Instructive:** Systems modelling can help identify which data and evidence gaps are more important than others in understanding how best to tackle complex, persistent health and social problems. This assists in prioritising research and new data collection.

I elaborate on these key benefits further below.

34 The specific tools and processes we use in systems modelling (also known as dynamic simulation modelling or computer simulation) depend on the question that is trying to be answered, and the scale of the 'problem'. There are three types of systems modelling methods:

(a) **System dynamics**, which looks a system in aggregate. This method captures all elements of the system at a high level. We would use this method for modelling a national, state, or regional system.

(b) **Agent-based modelling**, which is an approach used to model a population of individuals, rather than flows of groups of people. In developing this kind of model, we establish a virtual population with key characteristics that reflect the real-world population, as well as a set of behavioural rules that govern how people are likely to behave on the basis of their characteristics, their environment and the influence of their social networks. We can use agent-based modelling to forecast individual trajectories in relation to their mental health, social, educational and vocational outcomes. We can also use this type of modelling to understand heterogeneity in a population with regards to risk and the differential effectiveness of interventions.

(c) **Discrete event simulation**, which is process-centric. We use this method when we want to look at an individual service and address questions such as how that service can best manage resourcing and operational efficiency.

It is also possible to adopt a hybrid approaches, which combine elements of one or more of the above methods.

35 It is my view that the goal of systems modelling is not to give decision makers *the answer*. It is to give them *the tools and processes* to work with their stakeholders to test their assumptions, to explore the likely of impact of different options, to weigh up the trade-offs of choosing one suite of interventions over another, *before* implementing strategies. The models can therefore be used to inform collaborative investment decisions that can help make best use of available resources to deliver impact.

36 This decision-making process is facilitated by the interactive interfaces we build into the models that facilitate model transparency. These interfaces allow decision-makers and their stakeholders to critique and alter assumptions, turn interventions on and off, scale them up and down, stagger their implementation and forecast how different combinations of programs, services and incentives will play out over the short and long term. Decision-makers can run scenarios to look at likely impacts of such changes on factors such as:

(a) forecast changes to levels of psychological distress in the population;

(b) emergency department ("**ED**") presentations;

(c) self-harm or other psychiatric hospitalisations;

(d) suicide deaths;

(e) educational and vocational outcomes;

(f) cost-effectiveness estimates;

(g) productivity gains; and

(h) differential impacts on different subgroups in the population, such as Aboriginal and non-Aboriginal people, different age groups, different local health districts ("**LHDs**"), or groups with different socioeconomic status.

37 Systems models can then be used to inform where best to target investments, and with what intensity, in order to optimise the impact of limited resources and develop more effective, locally tailored strategies for reducing mental disorder and suicidal behaviour. This saves a lot of time and resources, and arguably save people's lives. For example, systems modelling is particularly beneficial for issues like suicide prevention, as system reform options cannot safely be tested in the real world using traditional research methods.

38 In addition, insights from mental health systems modelling applications in Australia have delivered important learning that has facilitated improved decision-making for a number of PHNs.[4]

The importance of a participatory approach (co-design)

39 A unique aspect of our mental health systems modelling work at the BMC is our fundamental commitment to a genuine participatory or co-design approach to our modelling. It is vital to bring systems modelling out of back rooms and make it more broadly accessible. As one of our policy partners once described it, it's like turning a black box into a glass box.

40 Our participatory approach brings together researchers and end-users, and deeply engages them in the process of developing these decision support tools. For most of our modelling projects we have engaged multi-disciplinary, multi-sectorial stakeholders from health and social policy agencies, local government, non-government organisations, public and private care providers, emergency services, research institutions, community groups, health economists,[5] and importantly, people with lived experience of mental illness and suicide.

41 This broad engagement has facilitated communication and learning among representatives from different parts of the system (also known as knowledge mobilisation). It has also facilitated systems learning, whereby stakeholders gain a better understanding of the interacting components of the system and how the system behaves

[4] I discuss our system dynamics work with PHNs at paragraphs 50 to 64 below.

[5] Health economists (whether from academia or from treasury) are important stakeholders in the co-design process. They help us source cost data and factor in the health economic component to our models. This means the models can forecast not just mental health related outputs but also cost/benefit outputs (eg whether a particular intervention is cost-effective).

and responds to different actions and under different assumptions. Systems learning can refine thinking, advance contentious debates, build consensus and foster more collaborative investments and action.

42 Put differently, the transparency and democratization of the decision-making process can act to unify communities and align actions to bring about change. It gets people out of their corners and helps them think more systemically. Bringing people on this journey also aids model credibility and robustness by allowing the model to be scrutinised by local stakeholders, which in turn improves modelling literacy among lay audiences.

43 Systems modelling can be contrasted with the approach commonly adopted by decision makers when considering which interventions, or other system reforms, to invest in. That traditional approach generally involves:

(a) reviewing the existing evidence to identify what has been shown to be effective;

(b) undertaking consultations about the proposed intervention/s or reform/s;

(c) funding the chosen intervention for a number of years; and

(d) conducting an evaluation after that period to decide what to do next.

If the evaluation finds that the intervention was not effective, disinvestment is likely to occur and the process starts again. Our modelling has shown examples of some initiatives taking more than 5 years to show impact but over the longer term that impact amplifies, making the initiatives a good long-term investment. Under the usual evaluation approach, the value of those initiatives would not have been recognised.

44 In contrast, when working with a systems model, we can ask more detailed questions about the ultimate scale, timing and intensity of investment required to have an impact on a particular 'problem'. We can also attain a better understanding of when we should be expecting to see that impact. In this way, systems modelling supports monitoring and evaluation and helps decision makers set realistic (rather than arbitrary) targets for impact. Anecdotally, people who have engaged in the participatory process of systems modelling tell us things like, "We would never look back. Now that we've seen the benefits of the systems approach, we couldn't go back to the traditional idea of taking an individual piece of evidence and saying 'that looks like a good bet, let's scale it up'."

45 It generally takes us around six months to build system dynamics models with a participatory process. If we didn't adopt the participatory approach, it may take less time to build or customise a model. However, for the reasons discussed above, we find the participatory approach an invaluable part of the work we do.

Embedding systems modelling in ongoing monitoring and evaluation

46 Once we have built the systems model (interactive decision support tool), we hand over the tool to the commissioning organisation. To try to ensure a smooth transition and effective use of the model 'on the ground' on an ongoing basis, one of our strategies during the model building process is to involve key representatives from the commissioning organisation or agency in the weekly/fortnightly meetings of the core model building group. The main purpose of those meetings is to review model structure, assumptions and parameterisation in a detailed way as the model is being built. This helps to build the commissioning organisation's 'in-house' capacity to understand and drive the model. We believe that building the model is just half of the job, so as part of the handover process and beyond, we conduct 'Super user' training to support an organisation to continue to use the model over time.

47 It is important for us to not see a model used once to inform an immediate decision, and then put on the shelf. We see systems models as a long-term decision support asset, rather than a one-off decision support tool. After deployment of a model, systematic monitoring and evaluation can determine the extent to which the model forecasts are corresponding with real-world outcomes over time. Information from monitoring and evaluation is used to refine model parameters to improve forecasting capabilities and guide subsequent decision-making in a timely and proactive way. This provides a continuous improvement framework. Used in this way, initial weaknesses of systems models become a strength as they force us to ask; "*What is the next most important data we need to collect in order to be more certain about our decisions?".* In this way, the modelling helps to identify data collection and research priorities.

48 In addition, when we see a discrepancy between model forecasts and real-world observations, there could be a number of different explanations; it could indicate a problem with our understanding of the system (which may in turn require refinements of the model), or provide an early signal of challenges with implementation of reforms, programs or services (which then allows organisations to respond more quickly to adjust implementation in order to put things back on track). In either case, realising there is a discrepancy helps us more quickly investigate what is not right – if we can identify and fix any issues early, then we can improve effectiveness and outcomes.

49 As new data comes in, these models are refined and updated to improve their predictive capabilities. For example, if, over time, additional questions arise about new interventions or there is a new national or international study which indicates that a particular intervention is effective, we can add that information into the model. This then allows decision makers to test what might happen if they introduce this new intervention into their local system, and scale it up. All of these features of our approach to systems

modelling and simulation in mental health provide a more efficient and appropriate framework for predictive planning, monitoring and evaluation.

The interrelationship between mental health bed capacity and the size of community teams in relation to suicide

50 During the past decade, there has been ongoing debate regarding the impact of reductions in psychiatric beds on suicide rates, and the potential effect of re-allocation of acute hospital funding to community-based mental health services. The debate has centred around the following interrelated questions:

(a) Is there a threshold at which reductions in beds start to adversely impact suicide rates?

(b) If so, where does that threshold lie?

(c) Is there a minimum number of beds per 100,000 population that we need to set in order to avoid an adverse impact on suicide rates?

It is infeasible to conduct a real-world experiment to answer these questions.

51 To try to answer these questions, my colleagues, Dr Adam Skinner, Professor Mark Heffernan, Professor Ian Hickie, Dr Ante Prodan, Professor Andrew Page and I used a system dynamics model which had been developed in partnership with WentWest PHN and their stakeholders for the Greater Western Sydney ("**GWS**") population catchment.[6]

52 Using that model, we simulated cuts to psychiatric beds for the GWS catchment under different conditions related to community-based service capacity to forecast the likely impact on suicide rates over a 10-year period.[7] Specifically, we simulated a range of scenarios in which the number of psychiatric beds was reduced from its baseline level of about 28 per 100,000 population, down to 25, 20,15, and 10 beds per 100,000. We first ran these scenarios keeping the number of community-based mental health practitioners unchanged at the baseline level of about 10.5 per 100,000 population. We then ran the psychiatric bed cut scenarios with *increased* capacity of community-based mental health practitioners from 10.5 to 11.5 and 12.5 per 100,000 population.[8] For each scenario, we compared the total number of forecasted suicide deaths for the period 2018–2028 with

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[6] Page A, Atkinson JA, Campos W, Heffernan M, Ferdousi S, Power A, et al. (2018) A decision support tool to inform local suicide prevention activity in Greater Western Sydney (Australia). *Australian and New Zealand Journal of Psychiatry*, 52:10, 983-993.

[7] Atkinson JA, Page A, Skinner A, Heffernan A, Prodan A & Hickie I B. (2019) The impact of reducing psychiatric beds on suicide rates, *Frontiers in Psychiatry*, 10, 448.

[8] For the purpose of the model, we defined community-based mental health practitioners as community-based psychiatrists, psychologists, social workers and mental health nurses.

the baseline scenario of business as usual (being no change in psychiatric beds or community-based services capacity).

53 The forecasts demonstrated that as we made cuts to the proportion of psychiatric beds, suicide deaths increased; but as we increased community-based service capacity, we could make further cuts to psychiatric beds without increasing suicide deaths. These findings showed that not all reductions to psychiatric beds result in increased suicides. They also showed that a dynamic 'tipping point' exists that is influenced strongly by the availability of community-based mental health services. In other words, community-based mental health services have a moderating effect on the impact of reducing psychiatric bed numbers for suicide rates.

54 This study showed us that there is no 'safe minimum number of psychiatric beds' that can be standardly applied. Rather, the context-specific population demographics, behaviours and service use dynamics will determine where a threshold lies. These factors in turn determine the extent to which funding earmarked for psychiatric beds could be reallocated to community-based mental health services to deliver improved suicide prevention outcomes and suggest that there is likely to be regional variation. These sorts of dynamic interactions are best captured and explored using systems modelling approaches before being implemented in the real world.

55 This research shows how systems models not only help to identify where the tipping point exists in a particular region or state, but also provide useful decision analytic tools to support service planning for suicide prevention. It is important to note that these simulations were conducted to understand the research questions outlined above and to highlight the value of systems modelling in answering questions that are difficult to test in the real world. These findings do not represent a recommendation for cutting psychiatric beds in the GWS region, a decision of that nature would require broader considerations and exploration of the simulated impacts on other parts of the system and on mental health outcomes other than suicide, in partnership with decision makers and key stakeholders.

56 Attached to this statement and marked 'JAA-2' is a copy of a 2019 paper titled "The impact of reducing psychiatric beds on suicide rates" which reports the results of this study.

The impact of increasing mental health service provision on suicide rates and the prevalence of mental illness

(a) Suicide rates

57 I have participated in research exploring:

(a) the extent to which improving mental health services capacity would contribute to reductions in suicidal behaviour; and

(b) the combination of service capacity improvements that would likely deliver the largest reductions in suicide attempts and deaths over the period 2018–2028.[9]

58 Again using the GWS systems model, we simulated scenarios that increased hospital staffing and training, numbers of psychiatric beds and numbers of community-based mental health practitioners available to deliver services (as a proxy for community-based metal health services capacity). We also simulated strategies to re-engage those lost to services. Ten different scenarios were tested.

59 In summary, the findings indicated that against a baseline of business as usual, the greatest number of suicides (approximately 29%) could be prevented in the GWS context by focusing on a combination of increases in:

(a) hospital staffing and training (assuming a 2% staff increase per annum and an additional five training units per annum);

(b) community-based mental health services capacity (assuming 5 additional practitioners per annum);

(c) expansion of mental health assessment capacity (assuming a mental disorder diagnosis rate of 10% per annum and an annual growth in assessment capacity of 2%); and

(d) strategies to re-engage 45% of those lost to mental health services.

60 This study also showed that, over the short term, re-engaging those lost to metal health services had a substantial effect on reducing attempted suicide and suicide deaths. However, there was a projected rebound effect and by the end of the 10-year period, these outcomes start to move closer to baseline levels. The model pointed to this effect being a result of inadequate service capacity over time to meet the increased demand of those being reengaged with services, meaning those people just bounce off the system again. That said, *the combination of* initiatives to increase services capacity as described

[9] Atkinson JA, Page A, Heffernan A, McDonnell G, Prodan A, Campos, B et al. (2019) The impact of strengthening mental health services to prevent suicidal behaviour, *Australian & New Zealand Journal of Psychiatry,* 53(7), 642-650, available at <https://journals.sagepub.com/doi/10.1177/0004867418817381>.

above and then to reengage those lost to services, was estimated to lead to a reduction of over a quarter of suicide deaths in the region over a 10-year period (2018-2028).

(b) Prevalence of mental illness

61 My colleagues and I recently completed two pieces of commissioned systems modelling work which provided two PHNs with decision support tools for mental health services planning and suicide prevention in their regions. Both of those projects were for PHNs in New South Wales (North Coast PHN and Hunter New England and Central Coast PHN). These models were developed through a genuine participatory process, under the leadership of the PHNs, in collaboration with the LHDs and over 50 local stakeholders in each PHN area.[10] The modelling was led by Dr Adam Skinner (System Dynamics modeller with the BMC) and health economics expertise were provided by Associate Professor Kenny Lawson (Health Economist).

62 These models looked at the impacts of 1) mental health and suicide prevention interventions; 2) changes to the social determinants of mental health; and 3) changes to mental health service capacity, on factors such as the prevalence of psychological distress, service utilisation, mental health-related ED presentations and psychiatric hospitalisations, and suicidal behaviour.

63 The key finding of this work are still being analysed and, at the time of finalising this statement, have not yet been reported.

64 When considering the findings of systems modelling, it is important to recognise that the impacts of simulated service capacity changes and interventions are context-dependent. As such, results from systems modelling carried out in one region are not necessarily generalisable to the Victorian context due to likely differences in population and demographic dynamics, changes over time in environmental drivers of psychological distress, mental disorders and suicidal behaviours, and mental health care workforce and service dynamics.

65 However, this body of work does highlight the following qualitative aspects of system behaviour, which will have broader relevance to applications of systems modelling to other regions:

(a) the changes over time and interactions of supply versus demand and how these dynamics influence the impact mental health and suicide prevention initiatives are likely to have; and

[10] The participatory process for this project is portrayed in a video prepared by Hunter New England and Central Coast PHN, available at: https://www.youtube.com/watch?v=VCMr-7vRQqE&feature=youtu.be.

(b) the existence of system thresholds, system inertia, interacting (non-additive) intervention effects[11] and potential unintended consequences.

Leveraging data and predictive analytics to guide investment and design of health services

66 Computer simulation has long been used to solve complex strategic and operational problems, optimise system design and resource management, and improve efficiency and public safety. Computer simulation has contributed to many scientific and industrial advances: it has been instrumental in achieving advanced technological exploits such as putting a human on the moon; it is also essential embedded infrastructure in weather forecasting and predictions of destructive weather events, enabling decision making that saves lives.

67 Unfortunately, the health and social policy sectors have lagged behind in the routine use of these approaches to support policy, planning, monitoring, and evaluation. To address this lag, health systems can, and should, use systems modelling and simulation. When compared with traditional approaches to national, state and regional decision making in mental health, systems modelling provides a more robust, systematic and disciplined way to guide investment decisions and the design and scale up of programs and services.

68 The idea of harnessing systems modelling and simulation to improve decision-making in mental health is not a theoretical exercise; we are doing it successfully across a number of vanguard PHNs, and it is being applied at state and national levels.

69 These models bring together so many complex, moving pieces. There is no way a human brain could capture all of the multi-agency data sets, research literature and 'on the ground' knowledge, let alone anticipate how seemingly good 'solutions' are going to play out under different scenarios in the short and long term. Systems modelling brings all of this together in one tool, which goes through a rigorous process of testing and validation.

Measuring the outcomes of systems modelling

70 One way to measure the success of systems modelling is to examine whether the forecasts are ultimately reflected in the real world over time. While we do not yet have

[11] Traditional health economic modelling assumes that the impact of implementing intervention A and intervention B is just the sum of the two (A + B). Systems modelling does not need to make such simplistic assumptions; rather, it allows us to specify the mechanism by which interventions have their effect, and where the intervention will act in the system. The impact of switching on intervention A and intervention B is an emergent property of the model. Sometimes, two interventions together can have a less than additive effect (i.e. < A + B), sometimes they can indeed have an additive effect (i.e. A + B), and sometimes they can have a synergistic effect, meaning that the impact is greater than the sum of each of the interventions simulated individually (i.e. > A + B).

examples of this in relation to mental health, we have seen modelling predictions reflected in real life in other areas, including public health.

71 For example, in 2016 my colleagues and I modelled the New South Wales Premier's target to reduce childhood overweight and obesity by 5% over 10 years. The New South Wales government was at the time facing the challenge of deciding how best to invest to achieve this ambitious target, and how to manage expectations about how soon progress towards the target would be seen. After undertaking the participatory process and building the model in 2016, we were asked to come back in 2017 to add some additional interventions. In 2019, the New South Wales Ministry of Health received some new data and we were again asked to refine the model on the basis of this data, however, we found that the model was in fact still forecasting what was being seen in the real world.

72 This is not to suggest forecast models are perfect. Particularly on the initial building of a model, there are likely to be discrepancies between our best understanding of how a system works and what is happening in the real world.[12] The constant refinement of these models as new data comes in makes them more robust over time.

The preconditions required to enable data-driven system design and the barriers to successful implementation

Not just about more resources

73 A necessary pre-condition to successful data-driven system design is the availability of skilled resources. Specifically, we need a pipeline of people with technical competency in systems modelling to undertake this work across the country. We also need project coordinators who are capable of facilitating participatory processes and who can communicate the systems modelling and simulation approach to academic, policy and lay audiences alike. At the BMC, University of Sydney, we are working to build this workforce in mental health, and CSART is leading capacity building more broadly through its international alliance. However, the rate at which this workforce can be scaled will be determined by our ability to secure the necessary resources.

74 Building this workforce requires not only the right training, but also better recruitment and retention capabilities. Talented computer scientists and systems modellers are regularly lost to the private sector. I believe there are a lot of people in this field who want to use their expertise to provide a public service. We need to be able to support and retain those people by providing opportunities, remuneration and job security which are attractive enough to prevent losing them to the private sector. This is vital if we are to see more routine use of systems modelling and simulation in the health and social policy sectors

[12] See further the discussion of discrepancies at paragraph 47 above.

where it is so desperately needed to avoid system failures that can have devastating effects on people's lives.

75 The tertiary education system can play a role in helping to address this challenge. For example, I believe that public health and clinical training around the country should include at least some exposure to systems thinking and modelling to support health system design and strengthening. This content should be delivered in both undergraduate and postgraduate training. Faculties of Medicine and Health could build stronger ties with Faculties of Engineering and Business (where these systems modelling methods are usually taught) to leverage existing expertise and materials to develop courses relevant to the health sector.

Greater integration and sustainability

76 Systems models should be embedded in the ongoing monitoring and evaluation cycle that informs policy and planning decisions. The decision analytic infrastructure offered by data-driven system design and mental health system strengthening should be used to guide sustained investments over the long term. This will reduce ad hoc investments that drive fragmentation of mental health and suicide prevention programs and services.

77 There needs to be significant investment in:

(a) the workforce and infrastructure that will facilitate more routine applications of this modelling; and

(b) the data systems that facilitate iterative model refinement and support model users on an ongoing basis.

Formal mechanisms should be established for maintaining and updating commissioned models over time. This will be important to secure their sustainability, particularly when the in-house champion of a systems modelling project moves into a different role or leaves the commissioning agency altogether.

78 We need processes in place to make sure these tools are less dependent on individual champions, are more routinely used, and are ultimately a part of decision makers' standard toolkit.

Improved systems literacy

79 A further precondition is literacy in systems modelling methods. This is required not only of policy makers and program planners, but also the research community.

80 Much of the research community is still entrenched in half a century of the use of static and linear analytic approaches; there is distrust of 'new methods' not widely understood.

This reticence is being slowly overcome by the participatory processes we are engaging in, which take the research, policy and practice communities on a journey of learning.

Insufficient data?

81 A common misperception is that the quantity and quality of available data are insufficient to inform the development of such sophisticated models (and therefore we should wait until the quality and quantity of data is perfect). In my view, we do ourselves a significant disservice by waiting for data to be perfect before engaging in systems modelling and simulation. Indeed, with issues as complex as mental health and suicide, it is unlikely that such a thing as 'perfect data' exists.

82 The models we have developed already rely substantially on publicly available data from sources including:

(a) population health surveys (managed by the Australian Bureau of Statistics and state governments);

(b) regional needs assessments;

(c) Medicare claims records;

(d) government and non-government reports (such as the Mental Health Services in Australia series published by the Australian Institute of Health and Welfare);

(e) published research; and

(f) hospital and emergency department administrative databases.

This available data is then supplemented by significant expert and local knowledge.

83 The process of bringing together everything we know and have measured relating to a particular complex problem, allows us to see more clearly where the gaps in our knowledge are. Through sensitivity analysis, we can better understand which data or evidence gaps are more important than others to target. For example, people may think, "we don't have evidence-based research or data about parameter A, so we should collect data on that, otherwise the model won't be sufficiently robust to inform decision making". But if we conduct a sensitivity analysis and find that changes to parameter "A" actually have no impact on suicide rates or prevalence of mental disorder, then we can conclude that collecting data to inform parameter "A" is probably less important.

84 In this way, systems modelling allows us to better inform research priorities and identify the next most important piece of data we need to collect in order to make us more confident in our decisions.

Less uncertainty?

85 There are of course always uncertainties, and improvements can be made to all models (not just systems models). Some people argue that a weakness in systems modelling and simulation is that they don't necessarily predict with precision what's going to happen (for example, in terms of suicide or rates of mental illness). However, this misunderstands the core purpose and use of these models. Uncertainty need not be a barrier to implementation, provided we use these models appropriately and we don't assume or expect that they are a crystal ball.

86 Because we forecast a baseline and then the comparative impacts of different options for intervention, we are, in essence, looking at what strategy or suite of interventions is likely to represent the best investment, even under alternative assumptions. By analogy, a weather forecasting model does not look to pinpoint the exact time the first drop of rain is going to fall in the day, but rather the relative chance of rain in the morning, afternoon or evening. That level of forecasting is still useful and can allow us to prepare adequately for the day ahead.

Guiding principles for public investment in mental health research

87 In general terms, investments in research should be made across the spectrum, from basic science to clinical research all the way through to applied health systems and operational research. Of these areas, I think it is the latter (operational research) where the research community could particularly benefit from greater support and strengthening (particularly in the use of systems modelling methodologies). I believe that operational research in the health and social sectors can have a significant impact and role to play in providing advice to governments and policy agencies to inform better decisions, and in deciding how research funds are spent.

88 These investments should focus on demonstrating how best to use the evidence generated from trials of new therapies and technologies to inform public health policy and scaling and implementation strategies. An emphasis on prioritising interventions that have a sound evidence base, and the strengthening of data systems to support monitoring and evaluation are indeed important principles for guiding public investment in mental health; but in my view, these are not the only considerations.

89 Systems modelling needs to be a core part of this toolkit. Systems modelling has demonstrated that there are some effective interventions that take a long time to deliver population level effects, but simulations have demonstrated that over the longer term they can have an amplifying effect and can deliver some of the most significant impacts (such as programs to improve community connectedness).

90 A further reason why public investment should target systems models is because they allow us to bring together and operationalise a body of research evidence, data and expert and local knowledge in a way that the current tools cannot. Participatory systems modelling allows us to answer vital questions about the mental health system, such as: what is the ideal selection, design, targeting, timing, intensity, consistency, and coordination of integrated programs and services that will deliver the greatest impacts on mental health outcomes and suicide prevention in a given context?

91 There are extraordinary inefficiencies in an approach that guesses at these questions, implements the so-called 'answers', evaluates them to have been ineffective, and repeats the process iteratively. That kind of cycle offers very little learning about the system structures and behaviours that drive system performance, quality of care, and patient outcomes. This wasteful approach would be unfathomable in sectors such as engineering and business; yet there remains an inertia against evolving to more routine use of systems modelling and simulation. This inertia subsists despite lives being at stake, and despite population health and well-being being intrinsically linked to our national productivity and collective 'mental wealth'. We must break through this inertia and invest in systems modelling as a core part of the toolkit for transforming the mental health system to deliver better outcomes. Such approaches will bring a more systematic and disciplined approach to coordinating new national, state and regional investments in mental health.

The role of governments in promoting mental health research

92 Governments are important system actors whose actions significantly influence the behaviour of other system actors. There is a saying in system dynamics modelling that *structure drives behaviour.* While I am not a governance expert, I think it follows that the structure and mechanisms governing research funding in mental health influence the extent to research partnerships are formed and sustained and the extent to which innovation is fostered. As my colleagues and I reflected in correspondence to The Lancet, on the whole, there persists "a conservative research culture, emanating from the high competition for restricted funds, such that forays into alternative methods [such as systems modelling and simulation] are perceived as high risk and exploratory."[13]

[13] Atkinson et al. (2018) "Systems modelling tools to support policy and planning" *The Lancet,* 391(10126), 1158-1159, available at https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)30302-7/fulltext.

The role of effective clinical therapies

93 Effective clinical therapies are a critical ingredient, but in my view, they are only one aspect of a complex and multifaceted system that supports the mental health and wellbeing of communities in Australia.

Employing evidence of human behavioural influences in mental health service design

94 Evidence into the human behavioural factors influencing health and social behaviours, perceived need for services, the utilisation of services and compliance with therapies (among other behaviours) is indeed an important source of information informing our systems models; but again, it is only one piece of the complex puzzle.

The utilisation of technology to deliver services by people experiencing mental illness

95 I am aware of advanced technology platforms being used for mental health and wellbeing research and mental health care coordination.[14] Such platforms are used as a supplement to, rather than a replacement of, that care. They can facilitate and improve access to timely, appropriate and coordinated care. These sorts of technologies also provide a rich source of timely, granular data. Such data is valuable for delivering new insights into the trajectories of people with mental illness, and the patterns of their interactions with service systems. Those insights can in turn inform the refinement of systems models.

96 Beyond the general observations above, I cannot comment at this time on what specific factors are impacting the utilisation of these technologies by people experiencing mental illness or by the workforce. However, I am aware that the Brain & Mind Centre at the University of Sydney, in collaboration with other partners, is seeking to answer such questions through their Project Synergy trial.[15]

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[14] An example of this is InnoWell, a collaboration between PwC and the University which "provides health professionals and service providers services with an online clinical tool to better understand where the person using their service is at and track their progress. It provides crucial information they can use to triage patients, ensuring those with the most immediate need are seen first. It also allows them to monitor the effectiveness of treatments and programs to aid their decision making for the future." For more information about the InnoWell platform, see https://www.innowell.org/enterprise.

[15] For more information about Project Synergy, see https://synergy.innowell.org/ and https://www.sydney.edu.au/brain-mind/our-research/youth-mental-health-and-technology/project-synergy.html. See also Hickie IB, Davenport, TA and Burns, JM (2019) "Project Synergy: co-designing technology-enabled solutions for Australian mental health services reform" *The Medical Journal of Australia,* 211(7 Suppl); Hickie IB, Scott EM, Cross SP, Iorfino F, Davenport TA, Guastella AJ et al. (2019) "Right care, first time: a highly personalised

Key barriers faced by health services in translating research into practice

97 Translation of findings of individual studies and evaluations are important, but they represent only a single piece of information in a much larger puzzle. That puzzle involves designing and refining a mental health system that performs effectively, efficiently and equitably over the short and long term.

98 Taking individual pieces of research and trying to work out whether or not they're going to improve the system of care can be a very difficult task. This difficulty is highlighted by a project carried out in partnership with Western New South Wales PHN. The project involves the application of systems modelling for the rural population catchment of Western New South Wales, as part of the National Suicide Prevention Trial Evaluation funded by the Commonwealth Department of Health.

99 At the time of preparing the model, there was research that mental health training was an effective intervention. Specifically, there was research that suggested:

(a) GPs who have received training are 1.4-1.48 times more likely to (correctly) diagnose a mental illness than a GP who has not received training, leading to increasing referrals to mental health services;[16] and

(b) mental health education programs can improve recognition of suicide risk and increase the rate of help seeking for mental health problems by more than 50%.[17]

100 These interventions were being considered among a suite of other interventions for implementation in the Western New South Wales region, and based on the evidence they seemed to be worth investing in. However, simulating these two interventions in the systems model developed for the region (reflecting the local context and service dynamics) resulted in an unanticipated adverse impact. The simulation projected an *increase* self-harm hospitalizations by 5.36% and *increase* suicide deaths by 4.24% over the next decade (2021-2030).

101 This simulated unintended increase in suicidal behaviour provided an opportunity for learning about system behaviour in the region. Interrogation of the model revealed that this intervention combination generated more mental health service demand than the

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and measurement-based care model to manage youth mental health" *The Medical Journal of Australia,* 211(9 Suppl).

[16] Pfaf JJ, Acres JG and McKelvey RS (2001) "Training general practitioners to recognise and respond to psychological distress and suicidal ideation in young people" *Medical Journal of Australia*, 174(5), 222-226.

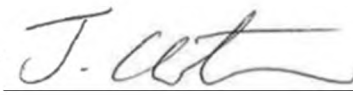
[17] Jorm AF, Griffiths KM, Christensen H, Korten AE, Parslow RA and Rodgers B (2003) "Providing information about the effectiveness of treatment options to depressed people in the community: a randomized controlled trial of effects on mental health literacy, help-seeking and symptoms" *Psychological Medicine*, 33(6), 1071-1079.

existing growth in service capacity would be able to cope with. This showed decision makers that services capacity growth at baseline levels would be inefficient to meet the increased demand of this new intervention.

102 The interactive model then allowed regional decision makers to test alternative scenarios for increasing community based and hospital based service capacity. That is, there were able to explore what increase in service capacity would be needed to meet the increased demand (generated by the implementation of GP training and mental health education programs), and what would the timing and scale of those increases need to be?

103 We found that when the two new interventions were combined with service capacity increases, there would be a synergistic effect. That is, with a carefully timed and coordinated strategy of services capacity increases *along with* increases in mental health literacy and early referral, the model forecast reductions in: suicidal behaviour; self-harm hospitalisations; and suicide deaths, greater than each strategy individually.

104 I have co-authored a paper which reports the results of this study. At the time of finalising this statement, the manuscript has been submitted to the Australian & New Zealand Journal of Psychiatry but is still under peer review and has yet to be published.

sign here ► 

print name Jo-An Atkinson

date 29 April 2020

Royal Commission into
Victoria's Mental Health System

ATTACHMENT JAA-1

This is the attachment marked 'JAA-1' referred to in the witness statement of Jo-An Atkinson dated 29/04/2020.

Associate Professor Jo-An Atkinson

Current work and experience:

Associate Professor Atkinson is Managing Director of Computer Simulation & Advanced Research Technologies (CSART); Head of Systems Modelling and Simulation with the Brain and Mind Centre, University of Sydney; and was founding Director of Decision Analytics at The Sax Institute. She has experience in leading transdisciplinary teams that work at the intersection of systems science, data science and health sciences to improve the health and wellbeing of populations through the development of interactive decision support tools. These tools are used by health departments and service planners to forecast the impact of alternative decision options before they are implemented in the real world; saving both time and resources. A/Prof. Atkinson works in partnership with government departments, policy agencies, program planners and researchers in health and social sectors, and implements a participatory approach to model development. This approach facilitates transparency of model structures, logic and assumptions, and enables the compilation of the body of evidence, data, expert and local knowledge in a way that captures the complex and dynamic nature of our most challenging health and social problems. In bringing together researchers with policy end users and deeply engaging them in the process of developing these models, the developed tools incorporate context specific insights from policy and practice, are driven by policy priorities, and help build consensus for collaborative action.

A/Prof. Atkinson has led work in the application of system dynamics modelling, agent-based modelling, discrete event simulation, and hybrid methods to provide decision support capability to address challenges such as ***suicide prevention, mental health service planning, alcohol related harms, tobacco control, childhood overweight and obesity, diabetes in pregnancy, osteoporosis and cardiovascular disease, state-level health system service planning to improve hospital performance, child protection service system reform, and homelessness.***

A/Prof. Atkinson has more than 20 years' experience in health service delivery and clinical research in Australia, as well as public health operational research to inform strategy for disease control and elimination in the Asia-Pacific region. This experience has included the use of quantitative, qualitative and participatory research methodologies. Her research interests have included exploring human behavioral and system-level influences on intervention effectiveness; exploring acceptability of new and existing technologies for disease prevention; and the design of strategies for community engagement in prevention initiatives. More broadly, A/Prof. Atkinson's experience and interests have been in fostering national and international partnerships between policy agencies, research institutions, and civil society to facilitate capacity building, innovation and research translation to improve population health.

Qualifications / Associations:

- PhD (International Public Health): 2012
- M. Phil (Research): 2005
- B. OccThy: 1998
- Associate Member of the Institute of Community Directors Australia
- Over **$12 million** in grants and commissioned work
- H-index - 17

Employment history (last 10 years):

- Head, Systems modelling and simulation, Brain and Mind Centre, University of Sydney (2020 – current)
- Managing Director – Computer Simulation & Advanced Research Technologies Ltd. (2018 – current)
- Director, Decision Analytics, Sax Institute (2017 – 2020)
- Senior Research Fellow (Evidence Synthesis & Simulation), The Australian Prevention Partnership Centre, Sax Institute (2014-2017)
- Research Fellow, Implementation Research Group, Sax Institute (2013-2014)
- Research Fellow, Infectious Disease Epidemiology Unit, School of Population Health (SPH), University of Queensland (2012-2013)
- Research Manager, Pacific Malaria Initiative Support Centre, SPH, University of QLD (2008-2012)
- Senior Allied Health Specialist (Hand & upper limb rehabilitation), Occupational Therapy Department, Royal Brisbane & Women's Hospital (2001-2008)

Research grants and commissioned work:

- **2019 – Delivering an integrated decision analysis, monitoring & evaluation infrastructure to support more effective and responsive child and youth mental health systems in Bogota, Colombia** – Botnar Foundation Grant **CHF 1,404,564** (CIA: Jo-An Atkinson, CIs: Ian Hickie, Adam Skinner, Paulo Goncalves, Nate Osgood, Ante Prodan, Laura Ospina-Pinillos, Salvador Camacho, Florence Secula, Sandro Sperandei).
- **2019 – NHMRC Centre of Research Excellence for reducing suicidal thoughts and behaviours in young people presenting for health care – Research grant - $2,495,765.50** (CIs: Ian Hickie, Patrick McGorry, Jo Robinson, Andrew Chanen, Andrew Page, **Jo-An Atkinson**, Elizabeth Scott, Simon Judkins, Niels Buus)
- **2019 – Systems modelling to inform strategic planning to achieve the NSW Premier's target to halve homelessness by 2025 - $100,000 – Commissioned** by the Strategic Policy Unit, Department of Communities and Justice (Investigators: **Jo-An Atkinson** & Mark Heffernan).
- **2019 - Dynamic simulation modelling to support strategic planning for suicide prevention - $158,525 – Commissioned** by Hunter New England and Central Coast Primary Health Network, NSW (Investigators: **Jo-An Atkinson,** Adam Skinner, Kenny Lawson, Sam Carter, Jacinta Heath).
- **2019 – The relationship between social media and suicide clusters - $640,660 – National Suicide Prevention Research Fund, Australia** (Lead Investigator: Jane Pirkis; CIs: Jo Robinson, Madelyn Gould, Andrew Page, **Jo-An Atkinson**, Matthew Spittal, Lay San Too, Karina Witt, Mark Sinyor, Benedikt Till, Ante Prodan, Nathaniel Osgood).
- **2018 – Building a compelling case for prevention – Phase II - $750,000 Commissioned** by the Australian Prevention Partnership Centre (Lead Investigators: **Jo-An Atkinson** & Rob Carter; CIs: Danielle Currie, Jacqui Davison, Paul Crossland, Jaithri Ananthapavan, Steven Begg).
- **2018 – Systems modelling to inform strategic planning for improved system performance to better support vulnerable children and families in NSW - $100,000 Commissioned** by Their Futures Matter (Investigators: **Jo-An Atkinson** & Mark Heffernan).
- **2018 - Dynamic simulation modelling to support strategic planning for suicide prevention - $278,809 Commissioned** by the University of Sydney, Australia (Lead Investigators: **Jo-An Atkinson**, Adam Skinner, Ian Hickie, Tracey Davenport, Shane Cross, Frank Iorfino).
- **2018 - Systems Modelling of Osteoporosis & Cardiovascular Diseases - $1,390,000 Commissioned** by Amgen Australia (Lead Investigator: **Jo-An Atkinson**; CIs: Geoff McDonnell, Mark Heffernan, Andrew Page, Nate Osgood, Ante Prodan).

- **2018 – A decision support tool to inform state-wide integrated health service planning in Queensland - $249,990 Commissioned** by Queensland Health, Systems Planning Branch (CIs: **Jo-An Atkinson,** Geoff McDonnell, Mark Heffernan).
- **2018 – MRFF: Harnessing big data and dynamic simulation modelling to tackle child and adolescent overweight and obesity and associated unsustainable healthcare expenditure in Australia - $905,000 – Medical Research Futures Fund, Commonwealth Department of Health.** (Lead Investigators: Andrew Wilson, **Jo-An Atkinson**, Louise Baur; CIs: Louise Freebairn, Geoff McDonnell, Alison Hayes, Ante Prodan, Nate Osgood).
- **2017 – Developmental evaluation of the place-based suicide prevention trials - $440,000 - Victorian Department of Health and Human Services** (Lead Investigator: Anne Redman; CIs: Graham Meadows, Jane Pirkis, Andrew Page, Sallie Newel, Jo Robinson, **Jo-An Atkinson**, Anna Williamson, Peter Fernando, Sonia Wutzke, Frances Shawyer, Vrinda Edan, Joanne Enticott).
- **2017 – Evaluation of National Suicide Prevention Trial - $1,995,300 – Commonwealth Department of Health.** (Lead Investigator: Jane Pirkis; CIs: **Jo-An Atkinson**, Bridget Bassilios, Philip Burgess, Greg Carter, Adele Cox, Dianne Currier, Annette Erlangsen, Jane Gunn, Meredith Harris, Kairi Kõlves, Kylie King, Karolina Krysinska, Andrew Page, Andrea Phelps, Jo Robinson, Marisa Schlichthorst, Matthew Spittal).
- **2017 - Dynamic simulation modelling to inform smoking reduction strategies in Queensland - $327,500 Commissioned** by Preventive Health Branch, Prevention Division, Queensland Department of Health (**Lead Investigator: Jo-An Atkinson**; CIs: Adam Skinner, Pippy Barnett, Mark Heffernan, Geoff McDonnell, Lennert Veerman).
- **2017 – Commissioned extension to dynamic simulation modelling to support strategic planning to meet the Premier's target** for reducing childhood overweight and obesity by 5% over 10 years – **$41,233 - NSW Health** (**Lead Investigator: Jo-An Atkinson**; CIs: Mark Heffernan, Geoff McDonnell, Vincy Li, Thomas Lung).
- **2017 – Dynamic simulation modelling to support strategic planning for the prevention of alcohol related harms in Tasmania** in partnership with the Department of Health and Human Services, Tasmania - **$120,000** (Commissioned by The Australian Prevention Partnership Centre) (**Lead Investigator: Jo-An Atkinson**; CIs: Mark Heffernan, Geoff McDonnell, Jacqui Davison).
- **2017 – Dynamic simulation modelling of chronic disease risk factors – Part I:** Building a compelling case for prevention - **$345,000** (funds provided by The Australian Prevention Partnership Centre – Project conducted in partnership with Deakin Health Economics, the Commonwealth Department of Health and ACT Health) (Lead Investigators: Geoff McDonnell, Rob Carter; CIs: Mark Heffernan, Paul Crosland, Louise Freebairn, Jacqui Davison, **Jo-An Atkinson**, Michael Lambert).
- **2016 – Dynamic simulation modelling to support strategic planning to meet the Premier's target** for reducing childhood overweight and obesity by 5% over 10 years **(in partnership with NSW Health and NSW Department of Premier and Cabinet) - $90,000** (funds provided by The Australian Prevention Partnership Centre) (**Lead Investigator: Jo-An Atkinson**; CIs: Nick Roberts, Vincy Li, Mark Heffernan, Geoff McDonnell, Thomas Lung).
- **2016 – Dynamic simulation modelling: Supporting strategic planning for Gestational Diabetes Mellitus prevention and service delivery in ACT (in partnership with ACT Health) - $61,700** (funds provided by The Australian Prevention Partnership Centre) (**Lead Investigators:** Louise Freebairn, **Jo-An Atkinson;** CIs: Nate Osgood, Geoff McDonnell).
- **2015 – Dynamic simulation modelling: Supporting decisions to reduce alcohol related harms in NSW (in partnership with NSW Ministry of Health) - $137,800** (funds provided by The Australian Prevention

Partnership Centre) (**Lead Investigator: Jo-An Atkinson**; CIs Eloise O'Donnell, Dylan Knowles, Geoff McDonnell, Ante Prodan, Andrew Page).

- **2015 – Towards a national suicide prevention surveillance and simulation system (in collaboration with WentWest Primary Health Network) - $60,500** (funds provided by Western Sydney University Research Partnerships Program matched by cash and in-kind contributions from Synergia, Brain and Mind Research Institute, Sax Institute) (**Lead investigators:** Andrew Page, **Jo-An Atkinson**; CIs: Ian Hickie, Mark Heffernan, Geoff McDonnell, Philip Gandar).
- **2013 - Rapid review of evidence commissioned by the Agency for Clinical Innovation, NSW**: Drivers of large-scale change in complex health systems; Co-investigator - **$23,000**
- **2011 - Global Fund Round 8** Operational Research Grant PNG – Co-investigator - **$32,700**
- **2011 - Papua New Guinea Internal Competitive Research Award Scheme** – Co-investigator - **$35,000**
- **2009 - Implementation Research commissioned by the Vanuatu Ministry of Health**: Community participation for malaria elimination: Part I. Maintaining motivation for prevention practices; Part II. Social and cultural aspects of treatment-seeking behaviour – **Lead Investigator – Jo-An Atkinson - $77,580**
- **2008 - Implementation Research commissioned by the Solomon Islands Ministry of Health**: Acceptability and preferences of bed nets for malaria prevention – **Lead Investigator – Jo-An Atkinson - $113,658**
- **2003 - Royal Brisbane & Women's Hospital Foundation Grant – Lead Investigator – Jo-An Atkinson - $22,000**

Awards:

- 2011 - Award - Graduate School International Travel Award ($5000) – University of Queensland
- 2011 - Award - For outstanding record of research performance and publication – School of Population Health (SPH), University of Queensland (UQ)
- 2010 - Award - For outstanding record of research performance and publication – SPH, UQ
- 2009 - Award - For outstanding record of research performance and publication – SPH, UQ
- 2004 - Award - Clinical Research Excellence Award ($500) – Queensland Health
- 2004 - Prize - Sir Ian MacFarlane Research Medal for Research Excellence ($1000) – Queensland Health

Publications:

Louise Freebairn, **Jo-An Atkinson**, Yang Qin, Christopher Nolan, Alison L Kent, Paul M Kelly, Luke Penza, Ante Prodan, Anahita Safarishahrbijari, Weicheng Qian, Louise Maple-Brown, Roland Dyck, Allen McLean, Geoff McDonnell and Nathaniel D Osgood. *'Turning the tide' on hyperglycemia in pregnancy: Insights from multi-scale dynamic simulation modelling.* BMJ Open Diabetes Research & Care (accepted, January 2020).

Jo-An Atkinson, Ian B. Hickie. *Op-ed: The Productivity Commission inquiry into mental health: a missed opportunity.* The Mandarin, Monday 18th November 2019: https://www.themandarin.com.au/120646-the-productivity-commission-inquiry-into-mental-health-a-missed-opportunity/

Jo-An Atkinson, Adam Skinner, Kenny Lawson, Sebastian Rosenberg, Ian B. Hickie. *Bringing new tools, a regional focus, resource-sensitivity, local engagement and necessary discipline to mental health policy and planning.* (Under review, BMC Public Health)

Louise Freebairn, Kurt Kreuger, Cathy Watson, Zongjian Yang, Ante Prodan, Kathleen Graham, Glen Draper, Geoff McDonnell, Erica Nixon, **Jo-An Atkinson**. *"Stopping before you start": Reducing and preventing initiation of tobacco use in the ACT.* Proceedings of the International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2019: https://mssanz.org.au/modsim2019/I2/freebairn.pdf

Jo-An Atkinson, Adam Skinner, Sue Hackney, Andrew Page, Linda Mason, Mark Heffernan, Dianne Currier, Kylie King, Jane Pirkis. *Systems modelling and simulation to inform strategic decision making for suicide prevention in a rural context* (Under review ANZJP – submitted Dec 19).

Louise Freebairn, **Jo-An Atkinson**, Nathaniel Osgood, Paul M Kelly, Geoff McDonnell, Lucie Rychetnik. *Turning conceptual systems maps into dynamic simulation models: an Australian case study for diabetes in pregnancy.* PLoS ONE, 2019; 14(6): e0218875

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Reports:

Jo-An Atkinson, Mark Heffernan, Tamsin Knight, Aman Pabla, Bonnie Skinner. *Systems modelling and simulation: Testing strategies to achieve the Premier's target for reducing homelessness in New South Wales.* A report prepared for the Strategic Policy Unit, Department of Communities & Justice, NSW Government, December 2019.

Cindy Peng, Mark Heffernan, Geoff McDonnell, Ante Prodan, Kenny Lawson, **Jo-An Atkinson.** *Key Insights Report: Dynamic Simulation Model of Cardiovascular Disease in Australia.* A report prepared for Amgen Australia, July 2019.

Jo-An Atkinson, Ian Hickie, Andrew Page, Adam Skinner, Sebastian Rosenberg, Kenny Lawson. Submission to the Australian Government Productivity Commission's Inquiry into the Social and Economic Benefits of Improving Mental Health. *How do we ensure that mental health reforms and resources deliver best outcomes for individuals, communities and the 'mental wealth' of the nation?* https://www.pc.gov.au/__data/assets/pdf_file/0016/239011/sub046-mental-health.pdf

Adam Skinner, **Jo-An Atkinson**, Andrew Page. Insights Brief: Dynamic modelling to inform suicide prevention commissioning decisions. A report prepared for Western NSW Primary Health Network, February 2019.

Cindy Peng, Danielle Currie, **Jo-An Atkinson**, Mark Heffernan, Kurt Kreuger, Geoff McDonnell & the HMRI Health Research Economics team. *Key Insights Report: Dynamic simulation model of osteoporosis and related burden in Australia.* A report prepared for Amgen Australia, February 2019.

Jo-An Atkinson, Mark Heffernan, Geoff McDonnell, Anton du Toit. *Key Insights Brief: Dynamic modelling to inform state-wide service planning.* A report prepared for Queensland Health, October 2018.

Jacqui Davison, **Jo-An Atkinson**, Mark Heffernan. *Key Insights Brief: Modelling strategies to reduce alcohol related harms in Tasmania.* A report prepared for the Tasmanian Department of Health and Human Services, March 2018.

Adam Skinner, Pippy Walker, **Jo-An Atkinson**, Mark Heffernan, Geoff McDonnell, Lennert Veerman. *Queensland Health decision support tool: Testing strategies to achieve reductions in smoking prevalence*. An Insights report prepared for Queensland Health, December 2017.

Jo-An Atkinson, Andrew Page, Mark Heffernan, Geoff McDonnell. *WentWest suicide prevention decision support tool: Testing strategies to achieve reductions in suicidal behaviour in Western Sydney.* An Insights Report prepared for Western Sydney Primary Health Network (WentWest), December 2017.

Jo-An Atkinson, Vincy Li, Mark Heffernan, Geoff McDonnell, Nick Roberts, Anton duToit, Thomas Lung. *Testing strategies to achieve the Premier's target for reducing childhood overweight and obesity in NSW. Key Insights from dynamic simulation modelling.* A report prepared for NSW Health, December 2017.

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Atkinson JM, Wilson A, Mittman B, Dominello A, Patel C, Brown B. *Drivers of large-scale change in complex health systems: A rapid review of best evidence.* A report prepared for the Agency for Clinical Innovation, New South Wales, October 2013.

Cooper T, **Atkinson J**, O'Donnell E, Wilson A. *What works for reducing dementia incidence in Australia's aging population*? Evidence Brief prepared for the Australian Prevention Partnership Centre, 2015.

E. Morrice, **J. Atkinson**, A. Wilson. *What large-scale lifestyle interventions work to prevent type 2 diabetes?* Evidence brief prepared for the Australian Prevention Partnership Centre, 2015.

Teaching and supervision:

- **Course coordination** - Global Health and Infectious Disease, University of Queensland (2011)
- **Teaching and tutoring** for the following courses:
  - Masters of Public Health, University of Sydney – guest lecture (Aug 2016, Oct 2018)
  - Masters of Health Technology Innovation, University of Sydney - guest lecture (2016).
  - Graduate Program in Health Policy - Analyzing Health Policy, University of Sydney – guest lectures (2014, 2017)
  - Introduction to Epidemiology (Masters level – 2009, 2010, 2011, University of Queensland)
  - Research Protocol Design (Masters level – 2011, UQ)
  - Social Perspectives in Population Health (Masters level – 2010, 2011, UQ)
  - Communicable Disease Management & Control (Masters level – 2011, UQ)
  - International Disease Control Priorities (Masters level – 2009, 2010, UQ)
  - Introduction to Population Health (Undergraduate level – 2011, UQ)
- **Research Higher Degree Co-supervision:** Masters students (x 8) and PhD candidates (x5).
- **Clinical mentoring and staff supervision** (2001-2008) during appointment as a **Clinical Specialist** in Allied Health (Surgical Services – Hand Therapy), Royal Brisbane & Women's Hospital (RBWH).

Courses taken in addition to formal qualifications:

- ***Data-informed simulation modelling in health.*** Short course February 20-24th, 2017; hosted by The Australian Prevention Partnership Centre, Sydney, Australia.
- ***Understanding Health Behavior Using Smartphones and Wearables*** – Short course May 8-11, 2017; hosted by Western Sydney University and Sax Institute, Sydney, Australia.
- ***Simulation modelling for health economics*** (Melbourne, November 2015; hosted by The Australian Prevention Partnership Centre)
- ***Simulation modeling for the prevention of lifestyle-related chronic disease*** (Sydney, April 2015; hosted by The Australian Prevention Partnership Centre)
- ***Health Care Modelling, Systems Thinking & Design Thinking Workshop*** (Adelaide, Feb 2015: Hosted by Flinders University)
- ***Advanced Epidemiology and Biostatistics*** course (Introduction to spatial epidemiology & mathematical modeling of infectious disease – University of QLD, December 2011)
- ***Epidemiology & Statistical Methods*** (3-week residential summer course, Florence – June / July 2011: hosted by the European Educational Programme in Epidemiology)
- ***Cultural Epidemiology: Principles and Practice*** (short course Nov 2010 – University of Queensland)
- ***Introduction to Biostatistics*** (audited, University of Queensland, 2010)
- ***Health and Development*** (audited, University of Queensland, 2009)
- ***Management training*** workshop, 'Managing Staff for High Performance' (2006)
- ***Applied Mathematics***, University of Queensland (1 semester, 2004) – High Distinction

Conference and symposium presentations:

- Qin Y, Freebairn L, **Atkinson J**, Dyck RF, Osgood ND. 2019. *A Multi-Scale Co-Designed Simulation Model for Gestational and Type 2 Diabetes*. Invited Presentation. INFORMS Annual General Meeting 2019. Seattle, WA. Oct. 20-23, 2019.
- **Jo-An Atkinson.** Invited speaker: *Systems modelling and simulation supporting policy and planning for reducing the burden of osteoporosis in Australia.* Jean Hailes Women's Health Symposium Dinner, 22nd, October 2019, Australian National University, Canberra,

- **Jo-An Atkinson**. Invited speaker: *Dynamic Simulation Modelling – overview and applications in other jurisdictions*. ACT Health Forum on Dynamic Simulation Modelling for Health Policy and Planning, 15th October 2019, Canberra.
- Graham Meadows, Joanne Enticott, Scott Patten, Sarah Francis, **Jo-An Atkinson**, Ante Prodan, Sebastian Rosenberg, Ellie Fossey. *Resolving the Australian paradox of increased mental health care expenditure and stable prevalence*. Oral presentation accepted to The International Federation of Psychiatric Epidemiology Conference, Sao Paulo, 8-10 April 2019.
- **Jo-An Atkinson.** Invited presentation: *Co-development of interactive decision support tools to inform health policy and planning: Sharing the Australian experience.* Swiss Tropical and Public Health Institute, Spring Symposium 2018: 'Clinical Decision Support and Health Information Systems: Potential and Pitfalls of New Technologies.' 25th April, 2018, Basel, Switzerland
- **Jo-An Atkinson**. Invited presentation: *Co-development of interactive decision support tools to inform health policy and planning*. Digital Health: Inter-disciplinary research showcase to explore the potential to enhance population-health. February 2018, Western Sydney University, Paramatta, Australia.
- Louise Freebairn, **Jo-An Atkinson**, Geoff McDonnell, Shaowen Qin and Ante Prodan. Conference Session organisers: *Healthcare Decision support – methods, applications, and challenges*. The 22nd International Congress on Modelling and Simulation, 3-8 December, 2017, Hobart, Australia.
- L. Freebairn, **J. Atkinson**, N. Osgood, P. Kelly, A. Safarishahrbijari, W. Qian, A. McLean, C. Nolan, A. Kent, G. McDonnell, L. Rychetnik. *Dynamic Simulation Modelling to inform decision making for diabetes in pregnancy in the Australian Capital Territory.* The 22nd International Congress on Modelling and Simulation, Hobart, Tasmania, Australia, 3-8 December 2017.
- V. Li, N. Roberts, **J. Atkinson**, M. Heffernan, G. McDonnell, C. Rissel. *Dynamic simulation modelling for guiding action on childhood overweight and obesity.* ANZOS-AOCO-OSSANZ Joint Scientific Conference, Adelaide, Australia, 4-6 October, 2017.
- A. Page, **J. Atkinson**, M. Heffernan, G. McDonnell, I. Hickie. *Decision tools to inform current suicide prevention initiatives in Australia.* IASR/AFSP International Summit on Suicide Research, Henderson, Nevada, November 5-8, 2017.
- R. Whitehead, **J. Atkinson**, M. West, on behalf of the Queensland Smoking Reduction Modelling Consortium. *Modelling a smoke-free Queensland – developing a 'what if' tool for smoking reduction efforts.* Oceania Tobacco Control Conference, Hobart, Tasmania, 17-19 October 2017.
- **Jo-An Atkinson**, Andrew Page. Invited Webinar for Black Dog Institute. *Decision tools to inform current suicide prevention initiatives in Australia*. 26 September, 2017, Sydney Australia.
- M. Heffernan, **J. Atkinson**, G. McDonnell, N. Roberts, V. Li, L. Freebairn, J. Davison, A. Prodan. *Reducing Childhood Overweight and Obesity: Can the target be reached by 2025?* Oral presentation at The 35th International Conference of the System Dynamics Society, Cambridge, Massachusetts, USA, July 16-20th, 2017.
- N. Roberts, Vincy Li, E O'Donnell, **J Atkinson**, S Wutzke, and Beverley Lloyd. *Building consensus and guiding action: A 'what if' tool for tackling wicked problems*. 15th World Congress on Public Health, Melbourne, Australia, 3-7 April 2017.
- M. Heffernan, A. Page, **J. Atkinson** & G. McDonnell. *A system dynamics model of Australian suicidal behaviour and suicide prevention strategies*. The Asia Pacific System Dynamics Conference, Singapore, 19-22nd February 2017.

- Moore G. & **Atkinson J**. (Co-presentation) Invited Webinar for McMaster Health Forum, Canada: *Lessons learned from implementing a rapid synthesis program to support evidence-informed health systems: Australia.* AEST 25th Nov 2016.
- M. Livingston, **J. Atkinson**, J. Mitchell, E. O'Donnell, N. Lewis: *Using Systems Science to Support Decision Making to Reduce Alcohol Related Harms*. The Australasian Professional Society on Alcohol and other Drugs: 2016 Scientific Conference, Sydney, NSW.
- L. Freebairn, **J. Atkinson**, P. Kelly, G. McDonnell, L. Rychetnik: *Simulation modelling: A systems approach to support the use of evidence to inform decision making in gestational diabetes care.* The 21st International Congress on Modelling and Simulation in November 2015, Gold Coast, Queensland.
- **Invited keynote speaker**: '*Challenges and strategies for achieving community participation at scale to support disease prevention initiatives.*' Colloquium of the Institute of Tropical Medicine, Antwerp: The Human Factor, Social Sciences in Global Health Research. Belgium, 24-27 November 2014.
- **J. Atkinson**, A. Page, R. Wells, A. Milat, A.Wilson: '*Seven steps to targeted policy for complex public health problems.*' The 3rd Annual NHMRC Research Translation Faculty Symposium, Melbourne 12-13 November 2014.
- R. Wijesinghe, **J. Atkinson** et al. Abstract accepted for oral presentation: *'Provider and community responses to the new malaria treatment regime in Solomon Islands.'* 61st Meeting of the American Society of Tropical Medicine & Hygiene (ASTMH), Atlanta, USA, November 11-15, 2012.
- J. Pulford, A. Tandrapah, **J. Atkinson** *et al.* Poster presentation: *'Feasibility and acceptability of insecticide treated plastic sheeting (ITPS) for vector control in Papua New Guinea.'* Malaria 2012 Conference: Saving Lives in the Asia Pacific, Sydney, 31st Oct-2nd Nov 2012.
- **J. Atkinson**, M.L. Johnson, R. Wijesinghe: Poster presentation: *'Operational research to inform a sub-national surveillance intervention for malaria elimination.'* Malaria 2012 Conference: Saving Lives in the Asia Pacific, Sydney, 31st Oct-2nd Nov 2012.
- J. Pulford, A. Tandrapah, **J. Atkinson** *et al*: *'Feasibility and acceptability of insecticide treated plastic sheeting (ITPS) for vector control in Papua New Guinea.'* Challenges in Malaria Research Conference, Basel, Switzerland, 10-12th Oct 2012.
- J. Pulford, A. Tandrapah, **J. Atkinson** *et al*: '*Feasibility and acceptability of insecticide treated plastic sheeting (ITPS) for vector control in Papua New Guinea.*' XVIII International Congress for Tropical Medicine and Malaria, Rio de Janeiro, Brazil, 24-28th Sept 2012.
- **J. Atkinson** *et al.* Invited presentation: '*Lessons from 60 years of community participation in communicable disease control and elimination.'* Asia Pacific Malaria Elimination Network (APMEN) – International Forum on Community Engagement, Chiang Mai, Thailand, 22nd Nov 2011.
- **J. Atkinson** *et al.* Poster presentation: '*A cluster randomized controlled cross-over bed net acceptability and preference trial in Solomon Islands: community participation in shaping policy for malaria elimination.*' Australasian Epidemiology Association Conference, Sydney, October 2010.
- **J. Atkinson** *et al.* Oral Presentation: *'Bed net acceptability and preference in Solomon Islands.'* International Forum - Malaria Elimination in Solomon Islands and Vanuatu, Brisbane, 8th Feb 2009.
- **J. Atkinson** *et al.* Oral Presentation: *'Barriers and motivators to participation in malaria prevention and treatment.'* Vanuatu Community Mobilization Project Design Workshop, SPH, Brisbane, 7th Sept 2009.

- **J. Atkinson** *et al.* Oral Presentation: *'Bed net acceptability and preference in Solomon Islands.'* SPH Research Higher Degree Conference, Ballymore, Brisbane, 6th Nov 2009.
- **J. Atkinson** *et al.* Oral Presentation: '*A Randomized, Controlled Trial to Determine the Efficacy of Paper Tape in Preventing Hypertrophic Scar Formation in Surgical Incisions that Traverse Langer's Skin Tension Lines.'* The 10th Triennial Congress of the International Federation of Societies for Surgery of the Hand (IFSSH) and Hand Therapies (IFSHT), Sydney, March 2007.
- **J. Atkinson** *et al.* Oral Presentation: *'Hand Therapy e-Learning Modules: Educating the Hand Therapists of Tomorrow.'* RBWH Healthcare Symposium, Brisbane, October 2007.
- **J. Atkinson** *et al.* Oral Presentation: *A Randomized, Controlled Trial to Determine the Efficacy of Paper Tape in Preventing Hypertrophic Scar Formation in Surgical Incisions that Traverse Langer's Skin Tension Lines.'* The 5th Annual Health and Medical Research Conference, Brisbane, Nov 2005.

Royal Commission into
Victoria's Mental Health System

ATTACHMENT JAA-2

This is the attachment marked 'JAA-2' referred to in the witness statement of Jo-An Atkinson dated 29/04/2020.

frontiers in Psychiatry

BRIEF RESEARCH REPORT
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The Impact of Reducing Psychiatric Beds on Suicide Rates

Jo-An Atkinson[1,2], Andrew Page[2], Adam Skinner[1], Mark Heffernan[3], Ante Prodan[4] and Ian B. Hickie[5]*

[1] Decision Analytics, Sax Institute, Sydney, NSW, Australia, [2] Translational Health Research Institute, Western Sydney University, Sydney, NSW, Australia, [3] Dynamic Operations, Sydney, NSW, Australia, [4] School of Computing, Engineering & Mathematics, Western Sydney University, Sydney, NSW, Australia, [5] Brain and Mind Centre, University of Sydney, Sydney, NSW, Australia

There has been ongoing debate regarding the impact of reductions in psychiatric beds on suicide rates, and the potential effect of reallocation of acute hospital funding to community-based mental health programs and services. Computer simulation offers significant value in advancing such debate by providing a robust platform for exploring strategic resource allocation scenarios before they are implemented in the real world. We report an application that demonstrates a threshold effect of cuts to psychiatric beds on suicide rates and the role of context specific variations in population, behavioral, and service use dynamics in determining where that threshold lies. Findings have important implications for regional decision-making regarding resource allocation for suicide prevention.

Keywords: public mental health, suicide prevention, threshold effects, psychiatric beds, systems modeling and simulation

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****Correspondence:***
Jo-An Atkinson
Jo-An.Atkinson@saxinstitute.org.au

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INTRODUCTION

The past decade has seen debate regarding the impact of reductions in psychiatric beds on suicide rates and the potential effect of reallocation of acute hospital funding to community-based psychosocial, primary, and community health services (1–5). The debate centers around the key questions of whether there is a threshold at which reductions in beds start to adversely impact suicide rates, where that threshold lies, and therefore the minimum number of beds per 100,000 population required. The answers remain elusive and difficult to study in the real world.

Computer simulation offers value allowing exploration of likely impacts of counterfactual scenarios in a low-risk way. An existing systems model developed for decision analysis to support regional suicide prevention planning (6) was used to answer three questions: i) Do all cuts to psychiatric beds increase suicides? ii) If there is a threshold, where does it lie? iii) Can the threshold be raised by increasing capacity of community-based services?

METHODS

A system dynamics model was developed for Western Sydney Primary Health Network (PHN) (6). Western Sydney is one of the fastest-growing urban populations in Australia with a diverse population and geography. The structure, parameterization, calibration, and validation of the model drew on a range of data sources including population survey data, systematic reviews (and meta-analyses), administrative data, and expert knowledge of multidisciplinary stakeholders,

detailed elsewhere (6). Briefly, the model captures i) the pathway from vulnerability, to psychological distress, to mental disorder; ii) mental health service pathways, including assessment of care needs and delivery of low-to-moderate-intensity services (community-based services), and high-intensity services (tertiary or hospital services); iii) pathways to suicidal behavior (attempted suicide and suicide) either with or without contact with mental health services; and iv) mental health recovery pathways with or without contact with mental health services. The model has an open population, with births and migration contributing to the population and deaths (from causes other than suicide) subtracting from the population. The computational model was developed using Stella Architect® software (www.iseesystems.com/). Estimates of the effects of interventions, and the specific mechanism of action in the model, were based on evidence from the literature and informed by stakeholder feedback for local application. Key assumptions of the model are provided in **Supplementary file 1**, and all model parameters are published in Page et al. (6).

The effect of tertiary service capacity on suicide was explored by simulating a range of scenarios in which the number of psychiatric beds per 10^5 population was reduced at the start of 2018, either with or without a simultaneous increase in community-based services capacity (the number of community-based practitioners per 10^5 population). For each scenario, we compared the cumulative number of suicides for the period 2018–2028 with the corresponding number of suicides under a baseline scenario of no change in psychiatric beds or community-based services capacity. The impact of uncertainty in the estimates on the simulation results for two key model parameters that determined the rate at which patients enter mental health service pathways (general practice visits per person per year and psychiatric assessment capacity per week) was assessed *via* sensitivity analysis. Latin hypercube sampling was used to draw 100 sets of values for each parameter from a uniform joint distribution spanning ±10% of the default values. Differences in projected suicides between the baseline and services capacity reduction scenarios were calculated for each set of parameter values and summarized using simple descriptive statistics.

TABLE 1 | Sensitivity analysis results.

Psychiatric beds per 10^5	Suicides (median)	Change in total suicides (%)		
		Median	2.5th pctl	97.5th pctl
Baseline (10.55 community practitioners per 10^5)				
27.86	1,862	–	–	–
Community capacity per 10^5 = 10.55				
10	1,963	5.40	2.98	8.30
15	1,938	4.15	1.94	6.68
20	1,903	2.22	0.60	4.04
25	1,866	0.05	0	0.69
30	1,862	0	−0.02	0
Community capacity per 10^5 = 11.55				
10	1,942	4.23	2.30	6.87
15	1,913	2.84	1.16	4.77
20	1,876	0.44	−0.31	1.53
25	1,826	−1.90	−3.98	−1.01
30	1,820	−2.29	−4.11	−1.01
Community capacity per 10^5 = 12.55				
10	1,921	3.19	1.74	5.17
15	1,889	1.40	0.47	2.23
20	1,840	−1.34	−2.91	−0.42
25	1,786	−4.12	−8.11	−1.73
30	1,779	−4.42	−8.26	−1.73

**Numbers of suicides for the period 2018–2028 and change in the number of suicides compared with the baseline (expressed as a percentage) for varying numbers of psychiatric beds and community-based practitioners per 10^5 population. Medians and percentiles (pctl) are based on 100 simulations (see text).*

RESULTS

Under the baseline scenario, in which capacity was maintained at 27.86 psychiatric beds and 10.55 community-based practitioners per 10^5 population, 1,862 suicides (**Table 1**) in the Western Sydney catchment were forecast for the period 2018–2028. With no increases in the community-based service workforce, reductions in psychiatric beds to less than 26 beds per 10^5 population increased suicide deaths compared with the baseline (**Figure 1**). Under scenarios in which community-based service capacity was increased by one to two practitioners per 10^5 population, the threshold number of psychiatric beds that could be cut without adversely impacting suicide deaths increased from approximately 2 per 10^5 (with no additional community capacity) to 6–10 per 10^5 (i.e., the number of psychiatric beds could be reduced to 18–22 per 10^5 without increasing the cumulative number of suicides relative to the baseline scenario).

DISCUSSION

These findings suggest that i) not all reductions to psychiatric beds will result in increases in suicide deaths; ii) a threshold appears to exist beyond which cuts are likely to adversely impact suicides; and iii) the threshold can be significantly increased by strengthening community-based mental health services capacity. Given the moderating effect of community-based mental health services, setting a "safe minimum number of psychiatric beds" (3) cannot be standardized. Context-specific variations in population, behavioral, and service use dynamics will determine where a threshold lies and the extent to which reallocation of acute hospital funding to community-based psychosocial, primary, and community health services will deliver improved suicide prevention outcomes. Such dynamics are best captured using systems modeling approaches that deliver useful decision analytic tools to support service planning for suicide prevention. Given the implications of service balance this study has highlighted, regional level systems modeling and simulation should be undertaken to test service planning scenarios before they are implemented in the real world.

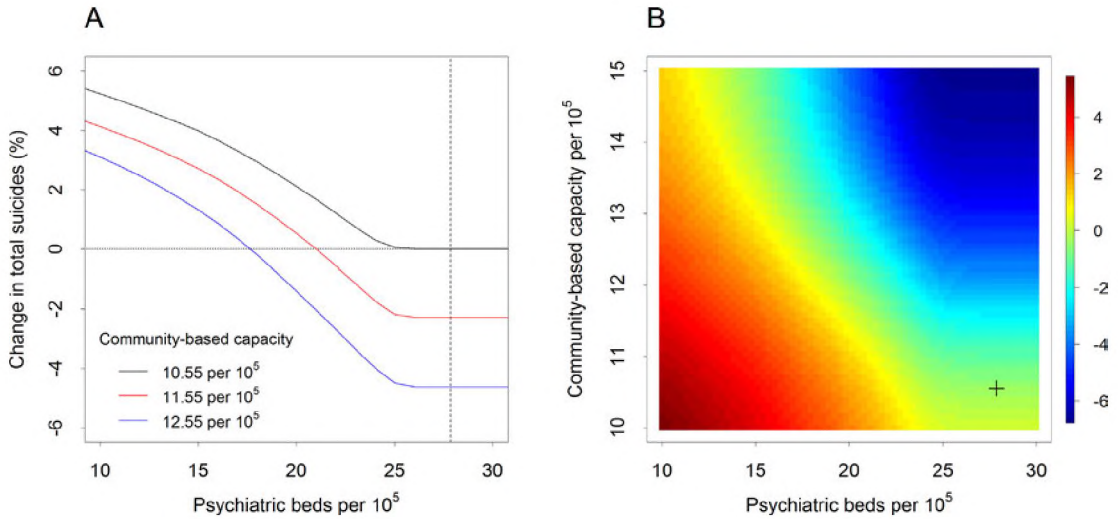

FIGURE 1 | Impact of changes in psychiatric bed availability and community-based mental health service capacity on forecast percentage changes in suicide (Western Sydney, 2018–2028) *(A) Change in the total number of suicides over the period 2018–2028 compared with the baseline scenario (expressed as a percentage of the baseline total) as a function of the number of psychiatric beds per 10^5 population assuming different levels of non-secondary services capacity (i.e., numbers of community-based practitioners per 10^5 population). The dashed vertical line indicates the baseline number of psychiatric beds per 10^5 population. **(B)** Percentage change in the number of suicides (compared with the baseline total) as a function of secondary and non-secondary services capacity. The cross in the lower right corner indicates the baseline capacity values (27.86 psychiatric beds and 10.55 community-based practitioners per 10^5 population).

AUTHOR CONTRIBUTIONS

Manuscript concept, design, and drafting: JA. Data acquisition, analysis, model development: AP, JA, MH, IH, AP. Statistical analysis: AS, JA. Critical revision of manuscript for important intellectual content: all authors.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2019.00448/full#supplementary-material

SUPPLEMENTARY FILE 1 | Key model assumptions.

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.