



# **Systems modelling and simulation of regional variation in the effectiveness of suicide prevention strategies**

**Preliminary report: 15 December 2020**

**Research team: Dr Adam Skinner, Assoc. Professor Jo-An Atkinson, Dr Yun (Christine) Song, Professor Ian Hickie**



THE UNIVERSITY OF  
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Brain and Mind  
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## **What did we do?**

This report presents an analysis of the potential impact of independent regional planning on the effectiveness of suicide prevention programs in the state of New South Wales (NSW). Using a system dynamics model of mental health services provision and suicidal behaviour in each of the state's 10 Primary Health Network (PHN) catchments, we ran a set of simulation analyses designed to address three principal aims: 1) to determine the extent to which significant regional variation in population and health system characteristics (e.g., prevalence of mental disorders, mental health services accessibility and rates of increase in services capacity) modifies the effects of individual suicide prevention measures on local suicide rates; 2) to quantify the potential impact of optimal regional planning (i.e., relative to centralised, state-level planning) on the effectiveness of suicide prevention programs comprising multiple interventions implemented in parallel; and 3) to assess the capacity of suboptimal commissioning decisions to limit (or reverse) any potential benefit of local program development.

Reductions in projected suicide mortality were calculated for intervention scenarios in which one or more of 13 suicide prevention and mental health services interventions are implemented in a single PHN catchment (intervention details are provided in Table S1). PHN-specific reductions in suicide mortality were calculated for the 10-year period from 1 January 2021 to the start of 2031 by subtracting total (cumulative) numbers of suicides projected under a given intervention scenario from the total number of suicides projected under a baseline scenario (corresponding to business as usual) in which existing suicide prevention policies and services remain in place and mental health services capacity continues to increase at current rates. State-level intervention effects were obtained by summing PHN-specific reductions in projected numbers of suicides across PHN catchments. The impact of optimal regional planning on the effectiveness of multi-component suicide prevention programs comprising four and five interventions was quantified by calculating differences between the maximum reduction in projected numbers of suicides for each PHN catchment (i.e., given the best

combination of interventions for the catchment) and PHN-specific reductions in projected numbers of suicides under the optimal state-level intervention scenario (the combination of interventions minimising state-level suicide mortality when implemented in all PHN catchments).

## **What did we find?**

### *Variation in the effectiveness of individual suicide prevention interventions*

- Post-suicide attempt care and social connectedness programs both yield generally similar reductions in suicide mortality across PHN catchments, preventing, respectively, 6.6–7.0% and 4.4–6.1% of suicides projected under the baseline (business as usual) scenario (Fig. 1).
- Percentage reductions in projected numbers of suicides for technology-enabled care coordination and family psychoeducation and support programs vary considerably among PHN catchments (technology-enabled care coordination, 3.0–6.7%; family psychoeducation and support, 2.7–8.3%), while safety planning yields substantially greater percentage reductions in suicide mortality in the Western NSW PHN catchment (9.9%) and Murrumbidgee PHN catchment (8.1%) than in other PHN catchments (3.0–4.1%).
- Psychiatrist and allied health services capacity increases have negligible (if any) impact on projected suicide mortality in the Western NSW PHN, Hunter New England and Central Coast PHN, North Coast PHN, and Murrumbidgee PHN catchments, but prevent 0.4–4.7% of projected suicides in the remaining PHN catchments. Awareness campaigns similarly have widely varying impacts on suicide mortality across PHN catchments, significantly increasing projected numbers of suicides (by up to 6.4%) in several catchments, while preventing up to 1.4% of suicides in other catchments.

### *Multi-component suicide prevention programs and the impact of regional planning*

- The optimal state-level combination of four interventions includes post-attempt care, technology-enabled care coordination, family psychoeducation and support, and social connectedness programs; this intervention combination prevents 20.3% of suicides projected under the baseline scenario over the period 2021–2031. Compared with the optimal state-level intervention combination, a combination of post-attempt care, safety planning, community-based acute care services, and social connectedness programs reduces projected numbers of suicides in the Western NSW PHN and Murrumbidgee PHN catchments by 6.0% and 5.2%, respectively (Fig. 1).

Murrumbidgee	6.8	8.1	3.2	2.2	3	2.7	0.1	-1	4.4	0.3	0	0.2	0.9	5.2	0.4
N Coast	6.8	3.1	1.2	0.6	5.4	5.3	0.3	-6.4	5.5	1.9	0	0	1.3	0	0
HNECC	6.8	3.3	1.3	0.6	4.4	4.2	0.1	-4.6	5.1	0.4	0.1	0.6	1.3	0	0
W NSW	6.6	9.9	3.8	2.3	4.2	3.5	0.1	-2.2	5.2	0.2	0	0.1	1.5	6	1.2
SE NSW	6.8	3	1.2	0.7	3.6	3.1	0	-2.3	5	0	0.4	0	0.6	0	2.5
SW Syd	7	3.5	1.3	0.5	3.5	4.3	-0.1	0.1	4.7	0.2	2.1	0	1	0	0
Nepean BM	6.8	4.1	1.6	0.6	4.3	5.3	-0.2	-1.8	5.1	0.1	2.3	0	0.8	0	0
W Syd	6.9	3.6	1.4	0.4	3.4	4.2	-0.1	0.3	4.7	0.2	2.6	0.3	0.5	0	0.9
N Syd	6.8	3.4	1.3	0.4	6.7	8.3	-0.1	1.4	6.1	0	4.7	0.7	1.3	0	0.4
Cen E Syd	6.8	4.1	1.6	0.4	5.4	6.7	-0.2	0.1	5.5	0	4	0	0.7	0	0
	Post-attempt care	Safety planning	Acute services	Safe space	Tech.-enabled care	Family edu./support	GP training	Awareness campaigns	Social connect.	GP capacity	Psych./allied capacity	Psychiatric hosp cap.	CMHC capacity	Regional planning (4 int.)	Regional planning (5 int.)

Fig. 1. Percentage reductions in cumulative numbers of suicides over the period 2021–2031 projected under scenarios in which the 13 interventions in Table S1 are implemented separately in each PHN catchment (left panel). The panel on the right shows percentage reductions in projected numbers of suicides observed when the optimal combinations of four and five interventions for each PHN catchment are compared with the optimal state-level intervention combinations (combinations of interventions minimising state-level suicide mortality when implemented in all PHN catchments). Where the optimal combination of interventions at the PHN level is the same as the optimal state-level intervention combination, the percentage reduction in suicide mortality due to regional planning is (necessarily) equal to zero.

- The most effective state-level combination of five interventions includes post-attempt care, safety planning, technology-enabled care coordination, family psychoeducation and support, and social connectedness programs; combined, these interventions prevent 22.9% of suicides projected under the baseline scenario. Compared with the optimal state-level intervention combination, a combination of post-attempt care,

technology-enabled care coordination, family psychoeducation and support, awareness campaigns, and social connectedness programs reduces the projected number of suicides in the South Eastern NSW PHN catchment by 2.5% (Fig. 1).

- More than 90% of all possible combinations of four interventions prevent fewer suicides than the optimal state-level intervention combination in the Western NSW PHN and Murrumbidgee PHN catchments (Fig. 2), while only one of all possible combinations of five interventions (0.08%) is more effective than the optimal state-level combination in the South Eastern NSW PHN catchment.

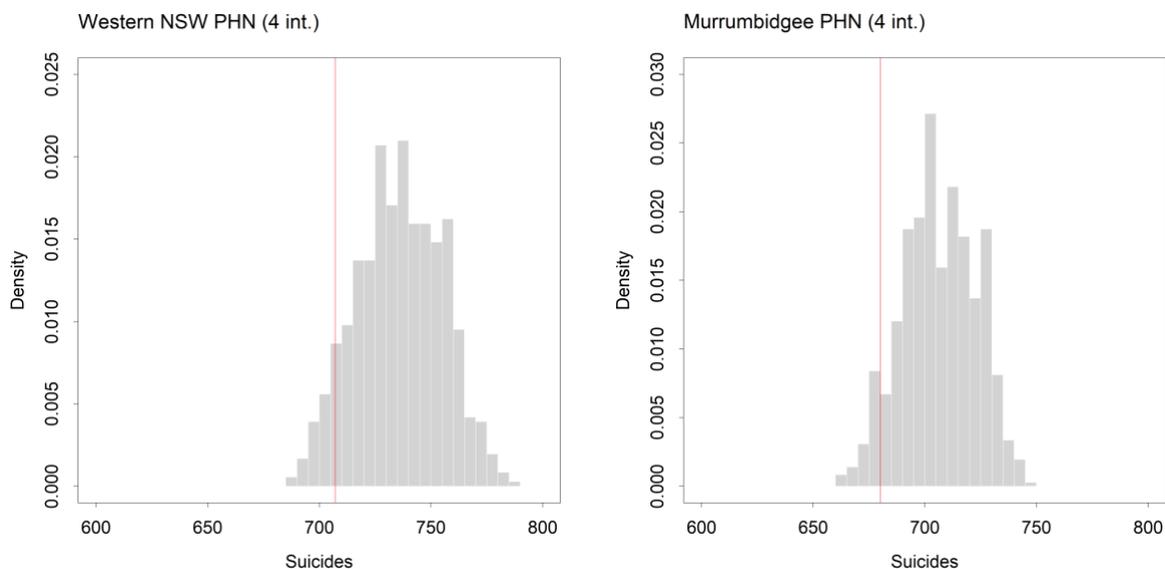


Fig. 2. Distributions of cumulative numbers of suicides projected over the period 2011–2031 under all (715) possible combinations of four interventions selected from the 13 interventions in Table S1. The red vertical lines correspond to total numbers of suicides projected under the optimal state-level combination of interventions (i.e., the combination of interventions minimising state-level suicide mortality when implemented in all PHN catchments).

## Policy implications

The results reported here indicate that although some suicide prevention interventions perform consistently well in reducing suicidal behaviour (e.g., post-attempt care, social connectedness programs), the effectiveness of other interventions varies considerably across PHN catchments. This potential dependence of intervention effects on local context entails that suicide prevention programs developed at state or national levels will not necessarily be optimal at a regional level. Our simulation analyses suggest that the potential impact of

independent regional planning (i.e., compared to state-level planning) on suicidal behaviour may be substantial, in some cases approaching that of implementing intensive post-attempt care (Fig. 1). Nevertheless, while regional planning may help to ensure that the specific programs and policies implemented as part of a suicide prevention strategy are aligned with the varying needs of local services and communities, the capacity of suboptimal commissioning decisions to limit (or reverse) the potential benefits of local program development is high; many possible combinations of interventions examined in our analyses prevent substantially fewer suicides than the optimal state-level intervention combinations (Fig. 2). Dynamic simulation models, codeveloped with diverse stakeholders using participatory modelling approaches, provide perhaps the most promising means of addressing the challenge of developing regional suicide prevention strategies that are consistent with the best available scientific evidence while also accommodating heterogeneity in local services and community needs.<sup>1,2</sup>

## References

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2. Atkinson, J., Skinner, A., Hackney, S., Mason, L., Heffernan, M., Currier, D., King, K., Pirkis, J., 2020. Systems modelling and simulation to inform strategic decision making for suicide prevention in rural New South Wales (Australia). *Aust. N. Z. J. Psychiatry* 54, 892–901.

Table S1. Suicide prevention and mental health services interventions included in the analyses. All interventions are introduced at the start of 2021.

Intervention	Description
Post-attempt care	An active outreach and enhanced contact program that aims to reduce re-attempts among patients presenting to services after a suicide attempt.
Safety planning	Safety planning aims to reduce suicidal behaviour through the provision of a specific plan for staying safe during crisis to suicidal patients presenting to an emergency department. The modelled intervention also includes up to 2 follow-up phone calls to monitor suicide risk and support treatment engagement.
Community-based acute care services	Responsive clinical mental health services delivered by community mental health teams. People in suicidal crisis may call and request either a home-based visit or a centre-based visit, depending on their level of functioning and risk.
Safe space services	Based on the United Kingdom's Safe Haven café model, this intervention provides an alternative point of contact with mental health services for people experiencing acute psychological distress who may otherwise present to an emergency department.
Technology-enabled care coordination	Technology-enabled care coordination involves the use of online technology to facilitate delivery of multidisciplinary team-based care, in which medical and allied health professionals consider all relevant treatment options and collaboratively develop an individual treatment and care plan for each patient. Online technology enables enhanced coordination of care and facilitates communication between medical and allied health professionals, since each health professional involved in the care of a patient has access to the same information about that patient's treatment history.
Family psychoeducation and support	Provision of education and support to families and carers of patients presenting to or engaged with mental health services, with the aim of supporting family or carer involvement in the management of diagnosed mental disorders.
General practitioner (GP) training	Short (1-2 days) training programs aimed at reducing suicidal ideation through referral to specialised psychiatric services. This includes people who may be thinking about suicide for the first time or have survived a previous attempt.
Awareness campaigns	Population-wide mental health education programs aimed at reducing stigma, improving recognition of suicide risk, and encouraging help-seeking. This intervention increases the per capita rates at which people perceive a need for mental health services and seek help from a general practitioner or online services.
Social connectedness programs	Programs designed to increase community connectedness, reducing isolation and enhancing resilience. No assumptions are made about the details of the particular programs implemented, and these may differ across communities.
GP services capacity increase	An increase in the annual rate of growth in general practitioner services capacity (i.e., the maximum number of services that can be provided per week) equal to 5% of capacity at the start of 2011.
Psychiatrist and allied services capacity increase	An increase in the annual rate of growth in psychiatrist and allied health services capacity (i.e., the maximum number of services that can be provided per week) equal to 5% of capacity at the start of 2011.
Psychiatric hospital capacity increase	An increase in the annual rate of growth in public psychiatric hospital capacity (i.e., the maximum number of admissions per week) equal to 5% of capacity at the start of 2011.
Community mental health care services capacity increase	An increase in the annual rate of growth in community mental health care services capacity (i.e., the maximum number of services that can be provided per week) equal to 5% of capacity at the start of 2011.