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BMJ Open

Connecting the Dots and the VicHealth Local Government Partnership: systems science in a broad municipal health approach: a qualitative study.

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3 1 Connecting the Dots and the VicHealth Local Government Partnership: systems science in a
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5 2 broad municipal health approach: a qualitative study.
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32 14 **Keywords:** Systems dynamics, Systems thinking, Community based systems dynamics,
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34 15 Obesity prevention, Public Health, Group Model Building, Children, Communities, Capacity
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36 16 Building
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3 24 **ABSTRACT**
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6 25 **Objective:** To present an approach to build capacity for the use of systems science to support
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9 26 local communities in municipal public health and wellbeing planning.
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11
12 27 **Design:** Qualitative study
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15 28 **Setting:** Local government authorities
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18
19 29 **Participants:** Thirteen local governments were trained in community-based system dynamics
20
21 30 (CBSD), and specifically group model building (GMB) techniques to mobilise local
22
23 31 community efforts. Local government facilitation teams delivered GMB workshops to
24
25 32 community stakeholder groups from 13 communities.
26
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28
29 33 **Main Outcomes:** Stakeholders developed causal loop diagrams (CLD) representing localised
30
31 34 drivers of mental wellbeing, healthy eating, active living or general health and wellbeing of
32
33 35 children and young people. After which locally tailored action plans were developed.
34
35
36 36 Training in CBSD was implemented with facilitation teams in 13 local government areas,
37
38 37 followed by the local delivery of GMB workshops.
39
40

41 38 **Results:** Overall, 110 local government staff participated in training in CBSD to develop
42
43 39 causal loop diagrams, with stakeholders, children, young people, community members and
44
45 40 other stakeholders participated in the GMB workshops across all 13 sites. All 13 council sites
46
47 41 developed CLDs where participants identified themes that included healthy eating and
48
49 42 positive mental health.
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54 43 **Conclusions:** Local facilitation of the CBSD process has developed community informed
55
56 44 and locally relevant CLDs that have been used to lead local action to improve the wellbeing
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3 45 of children and young people. Training employees in CBSD is one approach to increase
4
5 46 systems thinking capacity within local government.
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8 9 47 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

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11
12 48 This paper represents one of the first efforts to build systems thinking capacity within local
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14 49 government staff.
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18 50 This paper shows that there is an opportunity for a trained labour force to become systems
19
20 51 thinkers and for stakeholder informed actions to enhance the health and wellbeing of youth.
21

22 52 The framework presented in this paper may provide the means to gain insight into causal loop
23
24 53 diagrams, not just for common drivers of public health concerns, but for all complex
25
26 54 problems.
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28 55 There is a knowledge gap about the sustainability of health and wellbeing whole-of-
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30 56 community systems-based prevention and community-led change.
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66 INTRODUCTION

67 Obesity is a worldwide health priority ¹. Obesity prevalence has continued to increase over
68 recent decades and is conservatively estimated to cost \$2 trillion per year or 2.8% of global
69 GDP ². In Australia 25% of children (aged 5-17 years of age) are overweight or obese ³ and
70 are at greater risk of lower self-rated health-related quality of life (HRQoL), depression ⁴⁻⁶,
71 and experience comorbidities such as type 2 diabetes and hypertension ⁷. Obesity prevention
72 among children is critical as obesity strongly tracks into adulthood, highlighting the need for
73 early intervention ⁸.

74 A key challenge for chronic disease prevention is to address the complex relationships
75 between the societal causes of preventable disease ⁹. Historically, prevention efforts have
76 centred on small groups of actors in single sectors targeting individualistic behavioural
77 outcomes with limited success ⁹. Implementation at scale has been further challenged by the
78 need for adaption across settings, without which intervention effects are reduced by
79 inflexibility to heterogeneity in community resources, readiness and environments, amongst
80 other potential reasons ¹⁰⁻¹¹.

81 Whole-of-community approaches to prevention are likely to succeed and be sustained where
82 systems-based methods support understanding the community, environmental, social and
83 economic drivers of disease, and by focusing on capacity-building within communities to
84 address this challenge ¹¹⁻¹². Methods from system science, like GMB and causal loop
85 diagramming, provide means to understand the complex drivers of preventable disease by
86 describing non-linear relationships of cause and effect, feedback loops and adaption ¹³.
87 Several examples of whole-of-community systems-based prevention trials exist in the
88 literature at a multi-community scale ¹⁴⁻¹⁶. Scaling and embedding these methods at the local
89 government level, to support regulatory intervention and build capacity to support

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3 90 government health planning remains an important next step¹⁷. Local government is a
4
5 91 particularly desirable setting for systems-based approaches due to council's regulatory remit
6
7 92 over a range of environmental and policy levers, and the potential for regulatory interventions
8
9 93 to create sustainable, equitable changes, and to ameliorate the impacts of harmful system
10
11 94 drivers (e.g., the built environment, marketing)^{12,17}.

12
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15 95 Development of frameworks to embed these methods within local government are emerging
16
17 96 internationally, examples include Public Health England's (PHE) local government whole
18
19 97 systems approach to address obesity¹⁸. Several councils and boroughs across England have
20
21 98 utilised the programme to operationalise local-led approaches to obesity by engaging with
22
23 99 their local stakeholders to implement systems change across the community¹⁸. In 2019, PHE
24
25 100 launched the *Whole Systems Approach to Obesity: a guide to support local approaches to*
26
27 101 *promoting a healthy weight programme for local governments across England* which
28
29 102 includes systems mapping of obesity drivers with community stakeholders as a central tool¹⁸.
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35 103 In 2020, VicHealth initiated the 'VicHealth Local Government Partnership - Young people
36
37 104 leading healthier communities' (VLGP). The partnership aims to create community
38
39 105 environments where children and young people aged 0-25 years could become physically
40
41 106 active, socially connected, and mentally healthy¹⁹. VLGP currently includes 13
42
43 107 metropolitan, regional and rural Victorian Local Governments, using systems thinking
44
45 108 methods to direct, and guide municipal chronic disease prevention in young people¹⁹.

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49 109 This paper describes the design of a framework to embed systems thinking as a guiding
50
51 110 principle for the delivery of municipal prevention of chronic disease in children and young
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53 111 people. The specific approach to systems dynamics is outlined, alongside the processes used
54
55 112 to initially build councils' capacity, and ongoing support mechanisms to guide continued use
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3 113 of the systems thinking methods. Some results reflecting early outcomes from the local
4
5 114 communities are provided.
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8 9 115 **PARTICIPANTS AND METHOD**

10 11 12 116 **Study Design and data collection**

13 14 15 117 **Study context**

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18 118 The state of Victoria, south-eastern Australia, has a population of ~6.7 million people and is
19
20 119 comprised of 79 Local Government Areas (LGA) [20]. Individual LGAs vary broadly across
21
22 120 various measures including geographical size, population density, rurality and cultural and
23
24 121 linguistic diversity²⁰. Overall, 28% of Victorians were born overseas and 26% speak a
25
26 122 language other than English²⁰.
27
28

29 30 31 123 **VLGP overview and modules**

32
33
34 124 The VLGP represents a partnership approach to building capacity for evidence-based
35
36 125 prevention at the local government level. Councils were invited to apply to join the VLGP
37
38 126 through a competitive process, initially open to the 39 Victorian councils with an Index of
39
40 127 Relative Social Disadvantage (IRSD) of 1-5 and with health and wellbeing needs, between
41
42 128 the lower and higher IRSD LGAs²¹. Sixteen councils were selected to take part in the
43
44 129 partnership, with three in a modified partnership arrangement, which allowed one of the
45
46 130 VLGP foundation modules to be omitted from their programme.
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49
50
51 131 The VLGP provides support to the 13 partner councils to develop and deliver evidence-based
52
53 132 action to improve children and young people's health and wellbeing through the mechanism
54
55 133 of councils' Municipal Public Health and Wellbeing Plans (MPHWP)¹⁹. In Victoria, the
56
57 134 State Government mandates that councils develop 4-year MPHWP, that guide strategic
58
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60

135 direction and priorities for municipal health promotion relative to a locally tailored set of
 136 priorities, taken from identified state-level drivers of poor health and health inequity ²².

137 The key outcomes of VLGP are to foster improvements in the capacity of councils to deliver
 138 evidence-based action in the implementation of their MPHWP, the promotion of the voices of
 139 children and young people into local government policy decisions and action, and improved
 140 rates of healthy eating, physical activity and social connectedness amongst young people
 141 aged 0-25 by the end of 2025 ¹⁹.

142 Eight evidenced-informed health promotion modules were developed to serve as a series of
 143 practical, 'how-to guides' for policy, program development/delivery and practice change.

144 These guides were devised to support councils to implement action at the local level to create
 145 healthier communities for children and young people ¹⁹. The eight modules were designed to
 146 consolidate the practice knowledge, experience and research developed from the close
 147 collaboration between VicHealth, local governments and expert partners. Each module
 148 included several impact streams, each of which included a number of evidence-informed
 149 implementation actions or key policy, program and practice changes relative to the theme of
 150 the module. The modules were divided into three categories; Foundation, Core and Stretch
 151 (Table 1) ¹⁹.

152 Table 1 The Victorian Local Government Partnership (VLGP) modules and impact streams ¹⁹

Modules and impact streams	
Foundation Modules	Connecting the Dots - creating solutions for lasting change
Compulsory modules that provided the basic building blocks to develop staff capabilities and skills in systems-thinking and engagement with children and young people in planning, policies and programs	Big picture thinking for better solutions
	Leading the Way - engaging young voices for change
	Including children and young people in policy creation
	Including children and young people in planning

Core Modules

Evidence based activities, designed to address childhood obesity

Building Active Communities

Increasing active travel to and from school
Increasing walking and bike riding in council strategies

Creating opportunities for all Victorians to be active

Including gender equity in council sport and recreation policy

Empowering and enabling women to get active through local promotion of ‘This Girl Can-Victoria’

Creating connected and supportive communities

Co-designing with young people for better community wellbeing

Building proud and inclusive communities

Addressing social determinants of mental wellbeing

Building Better Food Systems for Healthier Communities

Creating thriving local food systems

Embedding healthy food and drink options in council owned and operated places

Using healthy rewards and sponsorships in community activities

Enabling healthy partnerships

Stretch modules

Optional modules that built on essential health policy priorities to promote healthy environments for children and young people

Increasing alcohol harm prevention at a local level

Adopting alcohol harm prevention actions to protect children and young people

Strengthening tobacco control at a local level

Adoption tobacco control actions to protect children and young people

Promoting everyday creativity at a local level

Increasing equity in creative strategies

Embracing opportunities for children to inform creative programs

Improving opportunities for young people to lead creative programs

153

154 **Connecting the Dots** ¹⁹

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3 155 The Connecting the Dots (CtD) foundation module contained one impact stream with two
4
5 156 required implementation actions which consisted of structured training workshops and the
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7 157 delivery of systems thinking approaches (Table 2).
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10
11 158 Table 2 VicHealth Local Government Partnership (VLGP) Connecting the Dots foundation
12
13 159 module ¹⁹
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Connecting the Dots – Creating solutions for lasting change

Impact stream	Implementation action	Formal training & support
Big picture thinking for better solutions	Understanding systems thinking approaches	Block 1 – Fundamentals in systems thinking & facilitation
	Actioning new systems thinking approaches	Block 2 – Workshop preparation & delivery support

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Understanding systems thinking approaches: Fundamentals in Systems Thinking & Facilitation

162
163 This stream consisted of a series of training sessions (Block 1) designed to quickly upskill
164 (~10hrs pivoted to online learning in some cases due to COVID-19, work from home and
165 travel restrictions) council core facilitation teams on; 1) the basics of systems thinking
166 including the fundamental skills around concepts and language; 2) community based systems
167 dynamics (CBSD) and GMB workshop facilitation process via participation in facilitated
168 demonstrations and guided facilitation practice ¹⁹.
169

170 Initial plans for local delivery of the workshop process, including context/framing,
171 facilitation team membership, key participant groups, and engagement/workshop timelines
172 were also covered. The use of the Systems Thinking in Community Knowledge Exchange (STICKE) systems mapping software program (STICKE Version 3 © Deakin University)

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3 173 was used throughout the training as it allows council and community members to build causal
4
5 174 loop diagrams (CLDs) using a supported online process²³.

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9 175 Regional advisors and a central coordination team comprising of academic and practitioner
10
11 176 experts in systems thinking methodologies and local government representatives comprised
12
13 177 the CtD team. The regional advisors worked closely with their nominated councils (2-3
14
15 178 councils each) to deliver training and provide continued implementation support and
16
17 179 guidance. Partner councils established core facilitation teams to lead and deliver the actioning
18
19 180 of new systems thinking approaches. Each team consisted of a VicHealth funded project
20
21 181 officer based at the local councils and other council employees overseeing the MPHWP
22
23 182 Additional staff involved in child/youth health and community engagement and non-council
24
25 183 staff were also nominated for training. Approximately, 2-10 persons undertook the training
26
27 184 sessions within each council. The Fundamentals in Systems Thinking & Facilitation impact
28
29 185 stream was completed in full before councils began delivering participatory GMB workshops
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31 186 with the community.

32 33 34 35 36 37 187 **Actioning new systems thinking approaches: workshop preparation & delivery**

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40 188 This impact stream included a series of online seminars (~10 hrs) designed to support council
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42 189 teams scheduled alongside the delivery of community based GMB workshops (Block 2). The
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44 190 preparation seminars covered various topics and focused closely on supporting council teams
45
46 191 as they negotiated the tasks and preparations relative to the stages of GMB workshop delivery
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48 192¹⁹.

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53 193 Council core facilitation teams delivered at least three participatory GMB workshops of ~1-3
54
55 194 hours to groups of community stakeholders from each of the 13 partner councils (Table 3).
56
57 195 Stakeholders included young people, children, community leaders, and diverse community
58
59 196 members drawn from across all sectors including local government, non-government

197 organisations, small business, commercial sector, education, community organisations and
 198 healthcare providers.

199 Table 3 Summary of the Victorian Local Government Partnership (VLGP) Group Model
 200 Building (GMB) workshop process

Workshop	Duration	Participant capacity	Objectives
1	120 minutes	5-25 participants	Orientation of participants to VLGP project, local context for work and GMB process to be undertaken. Development of initial systems map.
2	120 minutes	5-25 participants	Refinement of systems map based on revisions since workshop 1 and further conversation and consideration of health and wellbeing determinants. Optionally: Discussion of preliminary insights on potential focal points on systems map for community-led action, and potential additional invitees and recruitment strategies for workshop 3.
3	180 minutes	5-25 participants (with option to extend up to 100 participants)	Introduction and orientation to systems map for new participants if required. Further discussion of revisions to systems map since workshop 2. Facilitated discussion and prioritisation of potential community-led actions identified in response to insights from systems map.

201

202 Together council core facilitation teams and workshop participants created a CLD of the
 203 locally relevant drivers of health and wellbeing of children or young people in their
 204 community and determined the highest-priority leverage points for action. The method used
 205 to generate the systems map in the form of CLD was the GMB technique, which is a

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3 206 structured collaborative CBSD methodology, designed to guide participants through
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5 207 developing hypotheses about the connections between various contributing factors in
6
7 208 complex problems¹³. The CLD highlighted drivers of childhood health and the complex,
8
9 209 non-linear relationships between those drivers. The structured process then resulted in a CLD
10
11 210 which represented a view on the systems components, relationships and boundaries (Figure
12
13 211 1)¹³. CLDs were de-identified.

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17 212 Following the completion of the participatory systems mapping and community engagement
18
19 213 process, councils were supported by the CtD team to use the CLD developed by the group to
20
21 214 guide the identification and prioritisation of stakeholder informed actions that can be applied
22
23 215 in the community to support children and young people health during 2022 - 2025. These will
24
25 216 be driven by their own CLD and informed by evidence including case studies from previous
26
27 217 successful interventions²⁴. Action will be recorded throughout the duration of the project,
28
29 218 including tracking against the systems map in STICKE. Forthcoming publications will
30
31 219 examine the implications of local community contexts and priorities on the precise
32
33 220 adaptations to process undertaken by individual councils.

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39 221 **Patient and public involvement** Patients and/or the public were not involved in the design,
40
41 222 or conduct, or reporting, or dissemination plans of this research.

42 43 44 45 223 **RESULTS**

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48 224 All 13 councils had participated in the initial systems training, with 110 total staff (>18 year
49
50 225 of age) attending the training across all councils. Individual facilitation teams based at the
51
52 226 councils included a funded project officer and between three and 12 additional staff including
53
54 227 council employees involved in child/youth health and community engagement, and staff from
55
56 228 external community organisations collaborating with councils, such as sports facilities or
57
58 229 health services.

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3 230 All councils successfully created CLDs (Figure 1), with council stakeholders including:
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5 231 children and young people, the local prevention workforce, service providers, policy and
6
7 232 decision makers, and grass-roots community members from sectors including local
8
9 233 government, non-government organisations, small business, education, community
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11 234 organisations and healthcare providers. The systems maps resulting from the workshop
12
13 235 process were similar in range and scope to other prevention efforts which have used these
14
15 236 methods across multiple community sites in Victoria ²⁴. Identified themes by communities
16
17 237 included healthy eating and positive mental health.
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22
23 238 Fig. 1 An example of a casual loop diagram from the Victorian Local Government
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25 239 Partnership (VLGP)
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28 240 **DISCUSSION**

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31 241 This paper describes the capacity building of local councils to use systems thinking and
32
33 242 participatory methods within local governments to inform the implementation of MPHWP.
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35 243 Councils demonstrated complex systems science practice to develop CLD with community
36
37 244 stakeholders (with an understanding of systems theory) which can then act as basic logic
38
39 245 models for community led action and implementation.
40
41
42

43 246 The logic underpinning the approach used in CtD has been published previously and posits
44
45 247 that building and sustaining capacity for work informed by CBSD methods increases
46
47 248 leadership and organisational engagement with prevention, and collaboration across
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49 249 community organisations, which generates higher quality, more sustainable outcomes within
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51 250 communities ²⁵. We observed that local stakeholder informed prevention designs allowed for
52
53 251 differences between communities and adaption to the local context rather than a predefined
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55 252 program of work. The effectiveness of this locally informed prevention approach and
56
57 253 community capacity building has been reported in previous trials e.g., Whole of Systems
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3 254 Trial of Prevention Strategies for Childhood Obesity (WHO STOPS)²⁴, Romp and Chomp²⁶,
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5 255 It's Your Move²⁷, Be Active Eat Well²⁸.

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9 256 There is an increased focus using systems thinking at local community level to improve
10
11 257 population health. Recent examples include PHE's support for whole of systems change,
12
13 258 given to all 408 UK local authorities and potentially impacting 55M people¹⁸. The UK's
14
15 259 guidance also calls for action at local communities and emphasises the development of shared
16
17 260 models of the complexity within community, using a range of techniques from group model
18
19 261 building. Our systems guidance incorporated into the CtD module has arisen from several
20
21 262 trials of systems thinking in obesity prevention results, notably trials in schools (e.g., 'It's
22
23 263 Your Move 2'²⁹) and local communities³⁰. These trials began with a heavy investment of
24
25 264 researcher support in assisting doing systems science¹⁵ and then moved to building capacity
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27 265 and supporting people within local communities to deliver and evolve systems thinking in
28
29 266 situ³⁰. These types of approaches also look promising in Aboriginal and Torres Strait
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31 267 Islander People rural communities³¹.

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37 268 Our results, and these implications for practice parallel early trials of systems thinking in
38
39 269 health. For example, Healthy Together Victoria (HTV), was a large-scale initiative that
40
41 270 applied a 'complex whole of systems approach' to the prevention of chronic disease³². HTV
42
43 271 provides many pointers to future practice and built a workforce of system thinkers from
44
45 272 across the state in local government, community health and non-government organisations to
46
47 273 implement a range of actions at the community and state level³²⁻³³. The VLGP builds on one
48
49 274 of the key lessons from HTV: the challenge to identify the most effective ways to support
50
51 275 communities to deliver a systems approach at a local level^{32,34}. This project shows providing
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53 276 capacity building in systems thinking, via CtDs, can support council staff to access and apply
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55 277 knowledge from >20 years' experience in complex systems thinking, obesity prevention and
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3 278 CLDs observed that the strong organisational and structural factors such as regional advisors
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5 279 who provided continued support allowed the novice facilitation teams to build confidence
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8 280 while developing their practical know-how for systems thinking in the community setting.
9

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11 281 Building local capacity likely creates positive change within communities. This is shown in
12
13 282 outcomes of previous trials like WHO STOPS, which catalysed >300 community members to
14
15 283 drive >400 actions ranging from council food policy, soft drink bans and active transport
16
17
18 284 strategies²⁴. As a result, WHO STOPS showed initial reductions in overweight and obesity
19
20 285 in the first two years of intervention, compared to no change in the control group²⁴, however,
21
22 286 these were not sustained. The longer-term outcomes (four years) demonstrated significant
23
24
25 287 maintenance of health-related quality of life, reduced takeaway, nutrient-poor snack
26
27 288 consumption (boys only), and water consumption (girls only) favouring intervention children
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29 289 compared to controls. Highlighting for the first time that long-term behavioural and HRQoL
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31 290 improvements are possible using a whole of community systems approach to childhood
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34 291 obesity²⁴.

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37 292 The CtD module represents one of the first efforts to build systems thinking capacity amongst
38
39 293 local government staff, which provided the opportunity for the trained labour force to become
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41
42 294 systems thinkers and identified stakeholder informed actions for their communities to
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44 295 enhance the health and wellbeing of children and young people. This was demonstrated by
45
46 296 their ability to observe the interconnected determinants of health and wellbeing through the
47
48
49 297 use of CLDs. A well scripted systematic and rigorous approach to using systems science was
50
51 298 applied during the CtD workshops and GMB sessions.

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53
54 299 There is limited evidence about the sustainability of health and wellbeing, community-led
55
56 300 change. As noted with the 4-year WHOSTOPS trial which positively impacted children's
57
58 301 health, the long term (>2 years) sustainability of community-based action is still understudied
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2
3 302 ²⁴. A key knowledge gap is the quality and effectiveness of the training materials used in the
4
5 303 delivery of systems thinking facilitation, teaching of specific skills and knowledge, the
6
7 304 training methods and participant's use of the online platform. For example, there may have
8
9
10 305 been gaps in participants' knowledge as they progressed from workshop training to systems
11
12 306 thinking facilitation. The use of STICKE enabled participants to create CLDs online and has
13
14 307 been considered to be useful by participants ²³. However, it is possible the functionality
15
16 308 requires updating to accommodate upscaling. Pivoting to online following COVID-19
17
18 309 restrictions, appears to be efficient in facilitating GMB rather than in person delivery,
19
20 310 although there is little evidence to support this approach, and this may differ across the
21
22 311 metropolitan, regional, and rural LGAs.
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26

27 312 **Future research**

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29
30 313 The future of chronic disease prevention is pointing to the co-creation of systemic change
31
32 314 supporting communities using techniques to address complexity; a move from single
33
34 315 behaviour, individual focus to a consideration of wholistic relations of cause and effect across
35
36 316 multiple levels of community action ¹¹. As the Lancet Commission on Obesity shows, this
37
38 317 has implications for science, as the approach is less amenable to randomized controlled trials
39
40 318 and more suited to implementation and hybrid studies, as it places the control of the effort in
41
42 319 the hands of communities, at the agreed expense of intervention fidelity and generalisability
43
44 320 ¹¹.
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50 321 This paper and our broader community behaviour intervention research ^{24, 28, 30} raises some
51
52 322 questions for future studies: What should the user interface and user experience look like?
53
54 323 Could gamification, where the use of game thinking in a non-game context to engage users
55
56 324 and to solve problems, be included as part of the systems thinking toolkit? Could an
57
58 325 accreditation system where the recognition of communities that meet the requirements of
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3 326 certain standards be applied? Does this systems approach improve health? Can this approach
4
5 327 be transferred to tackle other complex issues beyond obesity prevention? Can prior
6
7 328 experience with community-based action on childhood obesity provide communities with the
8
9 329 fundamentals to apply systems science thinking to other areas of community concern such as
10
11 330 recovery plans from major disasters like bushfire, floods, and COVID-19 and the
12
13 331 development of strategies for climate change resilience?
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18 332 **CONCLUSION**

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20
21 333 This paper has provided an example of establishing the capacity of a government workforce
22
23 334 by developing their knowledge and understanding of systems theories tools and practice. An
24
25 335 emphasis on the process to create change, but not at the expense of local empowerment and
26
27 336 adaptability should be considered when planning the implementation of systems science at
28
29 337 the local government level.
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52
53 346 literature search and led the drafting and the revision of the manuscript. SA supervised the
54
55 347 study and provided overall guidance. JH contributed significantly to the revision of the
56
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20
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27 360 This study was approved by the Deakin University Human Research Ethics Committee
28
29 361 (HEAG-H-121_2022). This study was carried out in accordance with the National Health and
30
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32
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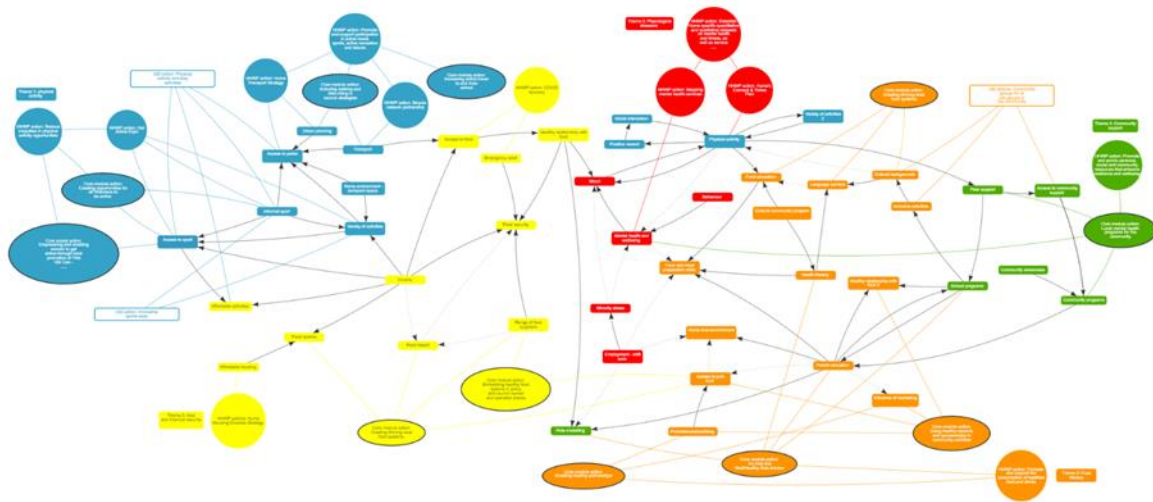


Fig. 1 An example of a casual loop diagram from the Victorian Local Government Partnership (VLGP)

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Standards for Reporting Qualitative Research: A Synthesis of Recommendations (SRQR)

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Problem Formulation	4-5
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Methods	
Qualitative approach and research paradigm	9
Researcher characteristics and reflexivity	6
Context	6-7
Sampling strategy	7
Ethical issues pertaining to human subjects	12
Data collection methods	9-12
Data collection instruments and technologies	9-12
Units of study	9-12
Data processing	12
Data analysis	12
Techniques to enhance trustworthiness	12
Results/findings	
Synthesis and interpretation	12-13
Links to empirical data	12-13
Discussion	
Integration with prior work, implications, transferability, and contribution(s) to the field	13-17
Limitations	15-16
Other	
Conflicts of interest	18
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BMJ Open

Building capacity for the use of systems science to support local government public health planning: a case study of the VicHealth Local Government Partnership in Victoria, Australia

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3 1 Building capacity for the use of systems science to support local government public health
4 planning: a case study of the VicHealth Local Government Partnership in Victoria, Australia

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29 15 **Keywords:** Systems dynamics, Systems thinking, Community based systems dynamics,
30 16 Obesity prevention, Public Health, Group Model Building, Children, Communities, Capacity
31 17 Building

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46 23 **ABSTRACT**

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3 24 **Objective:** To present an approach to build capacity for the use of systems science to support
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5 25 local communities in municipal public health and wellbeing planning.
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9 26 **Design:** Case study.
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12 27 **Setting:** Local government authorities participating in the VicHealth Local Government
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14 28 Partnership Victoria, Australia.
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18 29 **Participants:** Local government staff members were trained in community-based system
19
20 30 dynamics (CBSD), and group model building (GMB) techniques to mobilise local
21
22 31 community efforts. The trained local government facilitation teams then delivered GMB
23
24 32 workshops to community stakeholder groups from 13 local government areas (LGA)s.
25
26

27
28 33 **Main Outcomes:** Training in CBSD was conducted with council facilitation teams in 13
29
30 34 LGAs, followed by the local delivery of GMB workshops 1-3 to community stakeholders.
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32 35 Causal loop diagrams (CLD) representing localised drivers of mental wellbeing, healthy
33
34 36 eating, active living or general health and wellbeing of children and young people were
35
36 37 developed by community stakeholders. Locally tailored action ideas were generated such as
37
38 38 wellbeing classes in school, faster active transport and access to free and low-cost sporting
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40 39 programmes
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45 40 **Results:** Overall, 111 local government staff participated in CBSD training. Thirteen CLDs
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47 41 were developed, with the stakeholders that included children, young people and community
48
49 42 members, who had participated in the GMB workshops across all 13 council sites. Workshop
50
51 43 3 had the highest total number of participants (n=301), followed by workshop 1 (n=287) and
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53 44 workshop 2 (n=171).
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57 45 **Conclusions:** Local facilitation of the CBSD process has developed community informed
58
59 46 and locally relevant CLDs that will be used to lead local action to improve the wellbeing of
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3 47 children and young people. Training employees in CBSD is one approach to increase systems
4
5 48 thinking capacity within local government.
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8 49 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

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12 50
- 15 51 • We trained a labour force to become systems thinkers to develop community
16 stakeholder informed actions to improve the health and wellbeing of children and
17 52 young people.
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19 53
 - 24 55 • It is unknown if there were gaps in council facilitation teams' knowledge as they
25 56 progressed from workshop training to systems thinking facilitation.
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29 57
 - 31 58 • We used a systems mapping software program that enabled participants to develop
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34 59 CLDs online and to observe the interconnected determinants of health and wellbeing.
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 - 37 60 • The utility of the systems mapping software used to develop CLDs was not measured
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40 61 **INTRODUCTION**

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43 62 Obesity is a worldwide health priority [1]. Obesity prevalence has continued to increase over
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45 63 recent decades and is conservatively estimated to cost \$2 trillion per year or 2.8% of global
46
47 64 GDP [2]. In Australia 25% of children (aged 5-17 years of age) are overweight or obese [3]
48
49 65 and are at greater risk of lower self-rated health-related quality of life (HRQoL), depression
50
51 66 [4-6], and experience comorbidities such as type 2 diabetes and hypertension [7]. Obesity
52
53 67 prevention among children is critical as obesity strongly tracks into adulthood, highlighting
54
55 68 the need for early intervention [8].
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3 69 A key challenge for chronic disease prevention is to address the complex relationships
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5 70 between the societal causes of preventable disease [9]. Historically, prevention efforts have
6
7 71 centred on small groups of actors in single sectors targeting individualistic behavioural
8
9 72 outcomes with limited success [9]. Implementation at scale has been further challenged by
10
11 73 the need for adaption across settings, without which intervention effects are reduced by
12
13 74 inflexibility to heterogeneity in community resources, readiness and environments, amongst
14
15 75 other potential reasons [10-11].
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20 76 Whole-of-community approaches [12] to prevention are more likely to succeed and be
21
22 77 sustained where systems-based methods support understanding the community,
23
24 78 environmental, social and economic drivers of disease, and by focusing on capacity-building
25
26 79 within communities to address this challenge [13-14]. Methods from system science, like
27
28 80 GMB and causal loop diagramming, provide means to understand the complex drivers of
29
30 81 preventable disease by describing non-linear relationships of cause and effect, feedback loops
31
32 82 and adaption [14-15]. Several examples of whole-of-community systems-based prevention
33
34 83 trials (e.g., communities randomised to intervention or control [12]) exist in the literature at a
35
36 84 multi-community scale [16-18]. Scaling and embedding these methods at the local
37
38 85 government level, to support regulatory intervention and build capacity to support
39
40 86 government health planning remains an important next step [18]. Local government is a
41
42 87 particularly desirable setting for systems-based approaches due to council's regulatory remit
43
44 88 over a range of environmental and policy levers, and the potential for regulatory interventions
45
46 89 to create sustainable, equitable changes, and to ameliorate the impacts of harmful system
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48 90 drivers (e.g., the built environment, marketing) [13,18].
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56 91 Development of frameworks to embed these methods within local government are emerging
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58 92 internationally, examples include Public Health England's (PHE) local government whole
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3 93 systems approach to address obesity [19]. Several councils and boroughs across England
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5 94 have utilised the programme to operationalise local-led approaches to obesity by engaging
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7
8 95 with their local stakeholders to implement systems change across the community [19]. In
9
10 96 2019, PHE launched the *Whole Systems Approach to Obesity: a guide to support local*
11
12 97 *approaches to promoting a healthy weight programme for local governments across England*
13
14 98 which includes systems mapping of obesity drivers with community stakeholders as a central
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16
17 99 tool [19].

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20 100 In 2020, VicHealth initiated the ‘VicHealth Local Government Partnership - Young people
21
22 101 leading healthier communities’ (VLGP). The partnership aims to create community
23
24 102 environments where children and young people aged 0-25 years could become physically
25
26 103 active, socially connected, and mentally healthy [20]. VLGP currently includes 13
27
28 104 metropolitan, regional and rural Victorian Local Governments, using systems thinking
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30 105 methods to direct, and guide municipal chronic disease prevention in young people [20].
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34
35 106 This paper describes the design of a framework to embed systems thinking as a guiding
36
37 107 principle for the delivery of municipal prevention of chronic disease in children and young
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39 108 people. The specific approach to systems dynamics is outlined, alongside the processes used
40
41 109 to initially build councils’ capacity, and ongoing support mechanisms to guide continued use
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43 110 of the systems thinking methods. Some results reflecting early outcomes from the local
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45 111 communities are provided.
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49 112 **METHODS**

50 113 **Study Design and data collection**

51 114 **Study context**

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3 115 The state of Victoria, south-eastern Australia, has a population of ~6.7 million people and is
4
5 116 comprised of 79 Local Government Areas (LGA)[21] . Individual LGAs vary broadly across
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7 117 various measures including geographical size, population density, rurality and cultural and
8
9 118 linguistic diversity [21]. Overall, 28% of Victorians were born overseas and 26% speak a
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11 119 language other than English [21].
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15 120 **VicHealth Local Government Partnership overview and modules**

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19 121 The VLGP represents a partnership approach to building capacity for evidence-based
20
21 122 prevention at the local government level. Councils were invited to apply to join the VLGP
22
23 123 through a competitive process, initially open to the 39 Victorian councils with an Index of
24
25 124 Relative Social Disadvantage (IRSD) of 1-5 and with health and wellbeing needs, between
26
27 125 the lower and higher IRSD LGAs [22]. The 21 submitted applications then underwent a
28
29 126 scoring process, followed by an assessment panel discussion. Of the 21 council applications,
30
31 127 16 were selected to take part in the partnership, with three in a modified partnership
32
33 128 arrangement, which allowed one of the VLGP foundation modules to be omitted from their
34
35 129 programme.
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41 130 The VLGP provides support to the 13 partner councils to develop and deliver evidence-based
42
43 131 action to improve children and young people's health and wellbeing through the mechanism
44
45 132 of councils' Municipal Public Health and Wellbeing Plans (MPHWP) [20]. In Victoria, the
46
47 133 State Government mandates that councils develop 4-year MPHWP, that guide strategic
48
49 134 direction and priorities for municipal health promotion relative to a locally tailored set of
50
51 135 priorities, taken from identified state-level drivers of poor health and health inequity [23].
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55 136 The key outcomes of VLGP are to foster improvements in the capacity of councils to deliver
56
57 137 evidence-based action in the implementation of their MPHWP, the promotion of the voices of
58
59 138 children and young people into local government policy decisions and action, and improved
60

139 rates of healthy eating, physical activity and social connectedness amongst young people
 140 aged 0-25 by the end of 2025 [20].

141 Eight evidenced-informed health promotion modules were developed to serve as a series of
 142 practical, 'how-to guides' for policy, program development/delivery and practice change.
 143 These guides were devised to support councils to implement action at the local level to create
 144 healthier communities for children and young people [20]. The eight modules were designed
 145 to consolidate the practice knowledge, experience and research developed from the close
 146 collaboration between VicHealth, local governments and expert partners. Each module
 147 included several impact streams, each of which included a number of evidence-informed
 148 implementation actions or key policy, program and practice changes relative to the theme of
 149 the module. The modules were divided into three categories: Foundation, Core and Stretch
 150 (Table 1) [20].

151 Table 1 The VicHealth Local Government Partnership (VLGP) modules and impact streams
 152 [20]

Modules and impact streams	
Foundation Modules	Connecting the Dots - creating solutions for lasting change
Compulsory modules that provided the basic building blocks to develop staff capabilities and skills in systems-thinking and engagement with children and young people in planning, policies and programs	Big picture thinking for better solutions Leading the Way - engaging young voices for change Including children and young people in policy creation Including children and young people in planning
Core Modules	Building Active Communities
Evidence based activities, designed to address childhood obesity	Increasing active travel to and from school Increasing walking and bike riding in council strategies Creating opportunities for all Victorians to be active Including gender equity in council sport and recreation policy

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Empowering and enabling women to get active through local promotion of ‘This Girl Can-Victoria’

Creating connected and supportive communities

Co-designing with young people for better community wellbeing

Building proud and inclusive communities

Addressing social determinants of mental wellbeing

Building Better Food Systems for Healthier Communities

Creating thriving local food systems

Embedding healthy food and drink options in council owned and operated places

Using healthy rewards and sponsorships in community activities

Enabling healthy partnerships

Stretch modules

Optional modules that built on essential health policy priorities to promote healthy environments for children and young people

Increasing alcohol harm prevention at a local level

Adopting alcohol harm prevention actions to protect children and young people

Strengthening tobacco control at a local level

Adopting tobacco control actions to protect children and young people

Promoting everyday creativity at a local level

Increasing equity in creative strategies

Embracing opportunities for children to inform creative programs

Improving opportunities for young people to lead creative programs

153

154 **Connecting the Dots [20]**

155 The Connecting the Dots (CtD) foundation module contained one impact stream with two
156 required implementation actions which consisted of structured training workshops (Block1)
157 and the delivery of systems thinking approaches (Block 2) (Table 2).

158 Table 2 VicHealth Local Government Partnership (VLGP) Connecting the Dots foundation
159 module [20]

Connecting the Dots – Creating solutions for lasting change

Impact stream	Implementation action	Formal training & support
Big picture thinking for better solutions	Understanding systems thinking approaches	Block 1 – Fundamentals in systems thinking & facilitation
	Actioning new systems thinking approaches	Block 2 – Workshop preparation & delivery support

160

161 **Understanding systems thinking approaches: Fundamentals in Systems Thinking &**

162 **Facilitation**

163 This stream consisted of a series of training sessions (Block 1) designed to quickly upskill

164 (~10hrs pivoted to online learning in some cases due to COVID-19, work from home and

165 travel restrictions) council core facilitation teams on; 1) the basics of systems thinking

166 including the fundamental skills around concepts and language; 2) community-based systems

167 dynamics (CBSD) and GMB workshop facilitation process via participation in facilitated

168 demonstrations and guided facilitation practice [20].

169 Initial plans for local delivery of the workshop process, including context/framing,

170 facilitation team membership, key participant groups, and engagement/workshop timelines

171 were also covered. The use of the Systems Thinking in Community Knowledge Exchange

172 (STICKE) systems mapping software program (STICKE Version 3 © Deakin University)

173 was used throughout the training as it allows council and community members to build causal

174 loop diagrams (CLDs) using a supported online process [24]

175 Regional advisors and a central coordination team comprising of academic and practitioner

176 experts in systems thinking methodologies from Deakin University and local government

177 representatives comprised the CtD team. The regional advisors worked closely with their

1
2
3 178 nominated councils (2-3 councils each) to deliver training and provide continued
4
5 179 implementation support and guidance. Partner councils established core facilitation teams to
6
7 180 lead and deliver the actioning of new systems thinking approaches. Each team consisted of a
8
9 181 VicHealth funded project officer based at the local councils and other council employees
10
11 182 overseeing the MPHWP. Additional staff involved in child/youth health and community
12
13 183 engagement and non-council staff were also nominated for training. Approximately, 2-10
14
15 184 persons undertook the training sessions within each council. The Fundamentals in Systems
16
17 185 Thinking & Facilitation impact stream was completed in full before councils began delivering
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19 186 participatory GMB workshops with the community.
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25 187 **Actioning new systems thinking approaches: workshop preparation & delivery**

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28 188 This impact stream included a series of online seminars (~10 hrs) designed to support council
29
30 189 teams scheduled alongside the delivery of community based GMB workshops (Block 2). The
31
32 190 preparation seminars covered various topics and focused closely on supporting council teams
33
34 191 as they negotiated the tasks and preparations relative to the stages of GMB workshop delivery
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36 192 [20].
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40 193 Council core facilitation teams delivered at least three participatory GMB workshops of ~1-3
41
42 194 hours to groups of community stakeholders from each of the 13 partner LGAs (Table 3).
43
44 195 Stakeholders included young people, children, community leaders, and diverse community
45
46 196 members drawn from across all sectors including local government, non-government
47
48 197 organisations, small business, commercial sector, education, community organisations and
49
50 198 healthcare providers. Stakeholders were recruited by partner councils through existing
51
52 199 networks, emails, expressions of interest, and advertisements.
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57 200 Table 3 Summary of the Victorian Local Government Partnership (VLGP) Group Model
58
59 201 Building (GMB) workshop process
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GMB Workshop	Duration	Participant capacity	Objectives
1	120 minutes	5-25 participants	Orientation of participants to VLGP project, local context for work and GMB process to be undertaken. Development of initial systems map.
2	120 minutes	5-25 participants	Refinement of systems map based on revisions since workshop 1 and further conversation and consideration of health and wellbeing determinants. Optionally: Discussion of preliminary insights on potential focal points on systems map for community-led action, and potential additional invitees and recruitment strategies for workshop 3.
3	180 minutes	5-25 participants (with option to extend up to 100 participants)	Introduction and orientation to systems map for new participants if required. Further discussion of revisions to systems map since workshop 2. Facilitated discussion and prioritisation of potential community-led actions identified in response to insights from systems map.

202

203 Together council core facilitation teams and workshop participants created a CLD of the
 204 locally relevant drivers of health and wellbeing of children or young people in their
 205 community and determined the highest-priority leverage points for action. The method used
 206 to generate the systems map in the form of a CLD was the GMB technique, which is a
 207 structured collaborative CBSD methodology, designed to guide participants through
 208 developing hypotheses about the connections between various contributing factors in
 209 complex problems [14]. A set of scripts used in the GMB workshops (graphs over time,
 210 connection circles, and action ideas) were used to guide workshop content and help
 211 stakeholders develop CLDs [25] The CLDs highlighted drivers of childhood health and the

1
2
3 212 complex, non-linear relationships between those drivers. The structured workshop process
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5 213 resulted in a CLD which represented a view on the systems components, relationships and
6
7 214 boundaries (Figure 1) [14]. (online supplemental file 1).
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11 215 Following the completion of the participatory systems mapping and community engagement
12
13 216 process, council facilitation teams were supported by the CtD team to use the CLD developed
14
15 217 by the group to guide the identification and prioritisation of stakeholder informed actions
16
17 218 ideas that can be applied in the community to support children and young people health
18
19 219 during 2022 - 2025. These will be driven by their own CLD and informed by evidence
20
21 220 including case studies from previous successful interventions [26]. Community actions will
22
23 221 be recorded throughout the duration of the project, including tracking against the systems
24
25 222 map in STICKE. Forthcoming publications will examine the implications of local community
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27 223 contexts and priorities on the precise adaptations to process undertaken by individual
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29 224 councils.
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35 225 **Patient and public involvement** None.
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38 226 **RESULTS**

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41 227 All 13 partner councils had participated in the initial systems training, with 111 total staff
42
43 228 (>18 year of age) attending the training across all councils. Individual facilitation teams based
44
45 229 at the councils included a funded project officer and between three and 12 additional staff
46
47 230 including council employees involved in child/youth health and community engagement, and
48
49 231 staff from external community organisations collaborating with councils, such as sports
50
51 232 facilities or health services. All 13 partner councils delivered GMB workshops 1-3 face-to-
52
53 233 face and online (due to COVID-19, and travel restrictions). In some instances, workshops
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55 234 were combined e.g., workshop 1 combined with workshop 2 and delivered together as one
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59 235 session (due to time constraints and capacity of council staff). The workshop participants
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236 included either young people or stakeholders with the exception of workshop 3, which
 237 included young people and stakeholders together (conducted by three councils) (Table 4).
 238 Table 4 Total number of participants who attended the Group Model Building workshops
 239 from the 13 partner local government authorities

240

241

	Workshop 1	Workshop 2	Workshop 3	Combined workshop 1 &2	Combined workshop 2 & 3
Participants (n)					
Young people	174	99	128	52	9
Stakeholders	113	72	90	7	20
Combination of both young people and stakeholders	-	-	83	-	-
Total Participants	287	171	301	59	29

242 All councils successfully created CLDs , with community stakeholders including: children
 243 and young people, the local prevention workforce, service providers, policy and decision
 244 makers, and grass-roots community members from sectors including local government, non-
 245 government organisations, small business, education, community organisations and
 246 healthcare providers. The diagrams resulting from the workshop process were similar in
 247 range and scope to other prevention efforts which have used these methods across multiple
 248 community sites in Victoria [26]. For example, each council's diagram included the typical
 249 elements of a CLD: variables (determined by stakeholders as influencing the health and
 250 wellbeing of children and young people in the community e.g., junk food), the connections
 251 between the variables, actions (e.g., banning sugary drinks from sporting clubs) and
 252 overarching themes. An example of a council CLD with five themes (e.g., relationships,
 253 physical activity) and nine action ideas (e.g., wellbeing classes in school, faster

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3 254 transportation, access to free and low-cost sporting programmes) identified by communities
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5 255 stakeholders is shown in Figure 1. ...
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7

8 256 Fig. 1 An example of a casual loop diagram showing the variables, themes and the actions
9
10 257 ideas generated by stakeholders from one of the VicHealth Local Government Partnership
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12
13 258 (VLGP) councils.
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16 259 **DISCUSSION**

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19 260 This paper describes the capacity building of local councils to use systems thinking and
20
21 261 participatory methods within local governments to inform the implementation of MPHWP.
22
23 262 The council facilitation teams demonstrated complex systems science practice to develop
24
25 263 CLDs with community stakeholders (with an understanding of systems theory) which can
26
27 264 then act as basic logic models for community led action and implementation.
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31 265 The logic underpinning the approach used in CtD has been published previously and posits
32
33 266 that building and sustaining capacity for work informed by CBSD methods increases
34
35 267 leadership and organisational engagement with prevention, and collaboration across
36
37 268 community organisations, which generates higher quality, more sustainable outcomes within
38
39 269 communities [27]. We observed that local stakeholder informed prevention designs allowed
40
41 270 for differences between communities and adaption to the local context rather than a
42
43 271 predefined program of work. The effectiveness of this locally informed prevention approach
44
45 272 and community capacity building has been reported in previous trials e.g., Whole of Systems
46
47 273 Trial of Prevention Strategies for Childhood Obesity (WHO STOPS) [26], Romp and Chomp
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49 274 [28], It's Your Move [29], Be Active Eat Well [30].
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55 275 There is an increased focus using systems thinking at local community level to improve
56
57 276 population health. Recent examples include PHE's support for whole of systems change,
58
59 277 given to all 408 UK local authorities and potentially impacting 55M people [19]. The UK's
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3 278 guidance also calls for action at local communities and emphasises the development of shared
4
5 279 models of the complexity within community, using a range of techniques from group model
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8 280 building. Our systems guidance incorporated into the CtD module has arisen from several
9
10 281 trials of systems thinking in obesity prevention results, notably trials in schools (e.g., ‘It’s
11
12 282 Your Move 2 [31]) and local communities [32]. These trials began with a heavy investment
13
14 283 of researcher support in assisting doing systems science [12] and then moved to building
15
16 284 capacity and supporting people within local communities to deliver and evolve systems
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18 285 thinking in situ [32]. These types of systems thinking approaches may also support First
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21 286 Nation rural communities [33].
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25 287 Our results, and these implications for practice parallel early trials of systems thinking in
26
27 288 health. For example, Healthy Together Victoria (HTV), was a large-scale initiative that
28
29 289 applied a ‘complex whole of systems approach’ to the prevention of chronic disease [34].
30
31 290 HTV provides many pointers to future practice and built a workforce of system thinkers from
32
33 291 across the state in local government, community health and non-government organisations to
34
35 292 implement a range of actions at the community and state level [34-5]. The VLGP builds on
36
37 293 one of the key lessons from HTV: the challenge to identify the most effective ways to support
38
39 294 communities to deliver a systems approach at a local level [34-36]. This project shows that
40
41 295 providing capacity building in systems thinking, can support council staff to access and
42
43 296 apply knowledge from Deakin University’s >20 years’ experience in complex systems
44
45 297 thinking and community-based obesity prevention [26,28-30]. We observed that the strong
46
47 298 organisational and structural factors such as researcher support and regional advisors who
48
49 299 provided continued support allowed the novice council facilitation teams to build confidence
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51 300 while developing their practical know-how for systems thinking in the community setting.
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3 301 Building local capacity likely creates positive change within communities. This is shown in
4
5 302 outcomes of previous trials like WHO STOPS, which catalysed >300 community members to
6
7 303 drive >400 actions ranging from council food policy, soft drink bans and active transport
8
9 304 strategies [26]. As a result, WHO STOPS showed initial reductions in overweight and
10
11 305 obesity in the first two years of intervention, compared to no change in the control group
12
13 306 [26], however, these were not sustained. The longer-term outcomes (four years) demonstrated
14
15 307 significant maintenance of health-related quality of life, reduced takeaway, nutrient-poor
16
17 308 snack consumption (boys only), and water consumption (girls only) favouring intervention
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19 309 children compared to controls. Highlighting for the first time that long-term behavioural and
20
21 310 HRQoI improvements are possible using a whole of community systems approach to
22
23 311 childhood obesity [26].
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29 312 The CtD module represents one of the first efforts to build systems thinking capacity amongst
30
31 313 local government staff, which provided the opportunity for the trained labour force to become
32
33 314 systems thinkers and identified stakeholder informed actions for their communities to
34
35 315 enhance the health and wellbeing of children and young people. This was demonstrated by
36
37 316 their ability to observe the interconnected determinants of health and wellbeing through the
38
39 317 use of CLDs. A well scripted systematic and rigorous approach to using systems science was
40
41 318 applied during the CtD workshops and GMB sessions. A well-structured training manual
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43 319 written by our CtD team and based on a similar format to our previous community-based
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45 320 interventions allowed for the training to be standardised across the 13 partner councils.
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51 321 There is limited evidence about the sustainability of health and wellbeing, community-led
52
53 322 change. As noted with the 4-year WHOSTOPS trial which positively impacted children's
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55 323 health, the long term (>2 years) sustainability of community-based action is still understudied
56
57 324 [26]. A key limitation is the assessment of the quality and effectiveness of the training
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3 325 materials used in the delivery of systems thinking facilitation, teaching of specific skills and
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5 326 knowledge, the training methods and participant's use of the online platform. For example, it
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7 327 is unknown if there were gaps in participants' knowledge as they progressed from workshop
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9 328 training to systems thinking facilitation. The use of STICKE enabled participants to create
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11 329 CLDs online and has been considered to be useful by participants [24]. However, we did not
12
13 330 measure the utility of the STICKE software. It is possible that the functionality of the
14
15 331 STICKE software requires updating to accommodate upscaling to larger interventions across
16
17 332 numerous geographical areas. Pivoting to online learning (following COVID-19 restrictions),
18
19 333 for the staff training ensured good participation and appears to be efficient in facilitating
20
21 334 GMB rather than in person delivery, although this may differ across the metropolitan,
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23 335 regional, and rural LGAs. However, we did not gather evidence to support this approach,
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29 336 **Future research**

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32 337 The future of chronic disease prevention is pointing to the co-creation of systemic change
33
34 338 supporting communities using techniques to address complexity; a move from single
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36 339 behaviour, individual focus to a consideration of wholistic relations of cause and effect across
37
38 340 multiple levels of community action [11]. As the Lancet Commission on Obesity shows, this
39
40 341 has implications for science, as the approach is less amenable to randomized controlled trials
41
42 342 and more suited to implementation and hybrid studies, as it places the control of the effort in
43
44 343 the hands of communities, at the agreed expense of intervention fidelity and generalisability
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46 344 [11].
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52 345 This paper and our broader community behaviour intervention research [26,30-32] raises
53
54 346 some questions for future studies: What should the user interface and user experience look
55
56 347 like? For example, could gamification, where the use of game thinking in a non-game context
57
58 348 to engage users and to solve problems, be included as part of the systems thinking toolkit?
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3 349 Could an accreditation system where the recognition of communities that meet the
4
5 350 requirements of certain standards be applied? Does this systems approach improve health?
6
7
8 351 Can this approach be transferred to tackle other complex issues beyond obesity prevention?
9
10 352 Can prior experience with community-based action on childhood obesity provide
11
12 353 communities with the fundamentals to apply systems science thinking to other areas of
13
14 354 community concern such as recovery plans from major disasters like bushfire, floods, and
15
16
17 355 COVID-19 and the development of strategies for climate change resilience?
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19

20 356 **CONCLUSION**

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23 357 This paper has provided an example of establishing the capacity of a government workforce
24
25 358 by developing their knowledge and understanding of systems theories tools and practice. An
26
27 359 emphasis on the process to create change, but not at the expense of local empowerment and
28
29 360 adaptability should be considered when planning the implementation of systems science at
30
31 361 the local government level.
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40
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50
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53

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55
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57
58 371 literature search, led the drafting and the revision of the manuscript and prepared the
59
60

1
2
3 372 manuscript for publication. SA supervised the study and provided overall guidance. JH
4
5 373 contributed significantly to the revision of the manuscript with inputs from SA, TF, CN, SK,
6
7 374 ER, JP, PF, ADM, CS All authors contributed to subsequent revisions and approved the
8
9 375 manuscript prior to submission.

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23
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26
27 383 **Competing interests** None declared.

28
29 384 **Patient consent for publication** Not applicable.

30
31 385 **Ethics approval**

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33
34 386 This study was approved by the Deakin University Human Research Ethics Committee
35
36 387 (HEAG-H-121_2022). This study was carried out in accordance with the National Health and
37
38 388 Medical Research Council's National Statement on Ethical Conduct in Human Research
39
40 389 2018. Informed consent was obtained from participants.

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46 391 **Data availability statement.** The data are available from the corresponding author upon
47
48 392 reasonable request.

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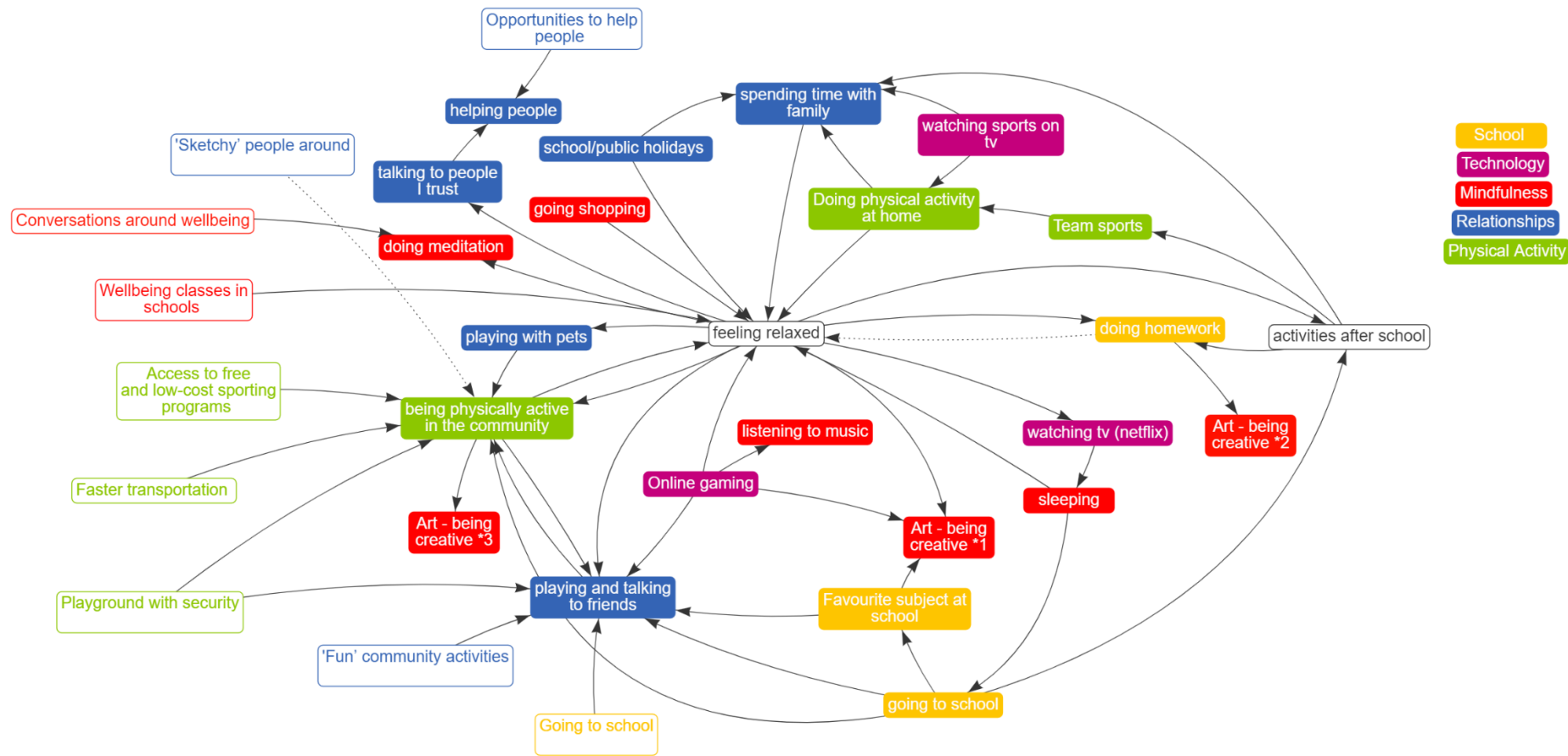
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The VicHealth Local Government Partnership (VLGP) Connecting the Dots framework.

The Connecting the Dots framework provides the basic building blocks to develop staff capabilities and skills in systems-thinking and engagement with children and young people in planning, policies and programs. It consists of structured training workshops (Block 1) and the delivery of systems thinking approaches (Block 2).

Connecting the Dots foundation module training workshops for council facilitation teams – Block 1

Block 1: Understanding systems thinking approaches: Fundamentals in Systems Thinking & Facilitation

Training sessions on; 1) Basics of systems thinking including the fundamental skills around concepts and language; 2) community-based systems dynamics and GMB workshop facilitation process via participation in facilitated demonstrations and guided facilitation practice.



Connecting the Dots foundation module delivering of systems thinking approaches – Block 2

Block 2: Actioning new systems thinking approaches: workshop preparation & delivery

The preparation seminars covered various topics and focussed closely on supporting council teams as they negotiated the tasks and preparations relative to the stages of the 3 GMB workshop delivery facilitation practice with community stakeholders (outlined

GMB workshop 1: Orientation of participants to VLGP project, local context for work and GMB process to be undertaken. Development of initial systems map.

GMB workshop 2: Refinement of systems map based on revisions since workshop 1 and further conversation and consideration of health and wellbeing determinants. Discussion of preliminary insights on potential focal points on systems map for community-led action, and potential additional invitees and recruitment strategies for workshop 3.

GMB workshop 3: Introduction and orientation to systems map for new participants if required. Further discussion of revisions to systems maps since workshop 2. Facilitated discussion and prioritisation of potential community-led actions identified in response to insights from systems map.



During GMB workshops 1-3 council facilitation teams and community stakeholders will together create a CLD of the locally relevant drivers of health and wellbeing of children or young people in their community and determined the highest-priority leverage points for action.

Standards for Reporting Qualitative Research: A Synthesis of Recommendations (SRQR)

Checklist item	Page number in Manuscript
Title and abstract	
Title	1
Abstract	2-3
Introduction	
Problem Formulation	4-5
Purpose or research question	5-6
Methods	
Qualitative approach and research paradigm	9
Researcher characteristics and reflexivity	6
Context	6-7
Sampling strategy	7
Ethical issues pertaining to human subjects	12
Data collection methods	9-12
Data collection instruments and technologies	9-12
Units of study	9-12
Data processing	12
Data analysis	12
Techniques to enhance trustworthiness	12
Results/findings	
Synthesis and interpretation	12-13
Links to empirical data	12-13
Discussion	
Integration with prior work, implications, transferability, and contribution(s) to the field	13-17
Limitations	15-16
Other	
Conflicts of interest	18
Funding	18

BMJ Open

Building capacity for the use of systems science to support local government public health planning: a case study of the VicHealth Local Government Partnership in Victoria, Australia

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3 1 **Building capacity for the use of systems science to support local government public**
4 **health planning: a case study of the VicHealth Local Government Partnership in**
5 **Victoria, Australia**
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9 4 O'Halloran, Siobhan¹., Hayward, Joshua¹., Strugnell, Claudia¹., Felmingham, Tiana¹.,
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37 19 **Keywords:** Systems dynamics, Systems thinking, Community based systems dynamics,
38 20 Obesity prevention, Public Health, Group Model Building, Children, Communities, Capacity
39 21 Building
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46 23 **ABSTRACT**
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49 24 **Objective:** To present an approach to build capacity for the use of systems science to support
50 25 local communities in municipal public health and wellbeing planning.
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55 26 **Design:** Case study.
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3 27 **Setting:** Local government authorities participating in the VicHealth Local Government
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5 28 Partnership in Victoria, Australia.
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9 29 **Participants:** Local government staff members were trained in community-based system
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11 30 dynamics (CBSD), and group model building (GMB) techniques to mobilise local
12
13 31 community efforts. The trained local government facilitation teams then delivered GMB
14
15 32 workshops to community stakeholder groups from 13 local government areas (LGA)s.
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19 33 **Main Outcomes:** Training in CBSD was conducted with council facilitation teams in 13
20
21 34 LGAs, followed by the local delivery of GMB workshops 1-3 to community stakeholders.
22
23 35 Causal loop diagrams (CLD) representing localised drivers of mental wellbeing, healthy
24
25 36 eating, active living or general health and wellbeing of children and young people were
26
27 37 developed by community stakeholders. Locally tailored action ideas were generated such as
28
29 38 wellbeing classes in school, faster active transport and access to free and low-cost sporting
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31 39 programmes
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36 40 **Results:** Overall, 111 local government staff participated in CBSD training. Thirteen CLDs
37
38 41 were developed, with the stakeholders that included children, young people and community
39
40 42 members, who had participated in the GMB workshops across all 13 council sites. Workshop
41
42 43 3 had the highest total number of participants (n=301), followed by workshop 1 (n=287) and
43
44 44 workshop 2 (n=171).
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49 45 **Conclusions:** Local facilitation of the CBSD process has developed community informed
50
51 46 and locally relevant CLDs that will be used to lead local action to improve the wellbeing of
52
53 47 children and young people. Training employees in CBSD is one approach to increase systems
54
55 48 thinking capacity within local government.
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50 STRENGTHS AND LIMITATIONS OF THIS STUDY

- 51 • We trained a labour force to become systems thinkers to develop community
52 stakeholder informed actions to improve the health and wellbeing of children and
53 young people.
- 54 • We used a systems mapping software program that enabled participants to develop
55 Causal Loop Diagrams (CLDs) online and to observe the interconnected determinants
56 of health and wellbeing.
- 57 • It is unknown if there were gaps in council facilitation teams' knowledge as they
58 progressed from workshop training to systems thinking facilitation.
- 59 • The utility of the systems mapping software used to develop CLDs was not measured.
60

61 INTRODUCTION

62 Obesity is a worldwide health priority [1]. Obesity prevalence has continued to increase over
63 recent decades and is conservatively estimated to cost \$2 trillion per year or 2.8% of global
64 GDP [2]. In Australia 25% of children (aged 5-17 years of age) are overweight or obese [3]
65 and are at greater risk of lower self-rated health-related quality of life (HRQoL), depression
66 [4-6], and experience comorbidities such as type 2 diabetes and hypertension [7]. Obesity
67 prevention among children is critical as obesity strongly tracks into adulthood, highlighting
68 the need for early intervention [8].

69 A key challenge for chronic disease prevention is to address the complex relationships
70 between the societal causes of preventable disease [9]. Historically, prevention efforts have
71 centred on small groups of actors in single sectors targeting individualistic behavioural
72 outcomes with limited success [9]. Implementation at scale has been further challenged by
73 the need for adaption across settings, without which intervention effects are reduced by
74 inflexibility to heterogeneity in community resources, readiness and environments, amongst
75 other potential reasons [10-11].

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3 76 Whole-of-community approaches [12] to prevention are more likely to succeed and be
4
5 77 sustained where systems-based methods support understanding the community,
6
7 78 environmental, social and economic drivers of disease, and by focusing on capacity-building
8
9 79 within communities to address this challenge [13-14]. Methods from system science, like
10
11 80 Group Model Building (GMB) and causal loop diagramming, provide means to understand
12
13 81 the complex drivers of preventable disease by describing non-linear relationships of cause
14
15 82 and effect, feedback loops and adaptation [14-15]. Several examples of whole-of-community
16
17 83 systems-based prevention trials (e.g., communities randomised to intervention or control
18
19 84 [12]) exist in the literature at a multi-community scale [16-18]. Scaling and embedding these
20
21 85 methods at the local government level, to support regulatory intervention and build capacity
22
23 86 to support government health planning remains an important next step [18]. Local
24
25 87 government is a particularly desirable setting for systems-based approaches due to council's
26
27 88 regulatory remit over a range of environmental and policy levers, and the potential for
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29 89 regulatory interventions to create sustainable, equitable changes, and to ameliorate the
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31 90 impacts of harmful system drivers (e.g., the built environment, marketing) [13,18].
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39 91 Development of frameworks to embed these methods within local government are emerging
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41 92 internationally, examples include Public Health England's (PHE) local government whole
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43 93 systems approach to address obesity [19]. Several councils and boroughs across England
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45 94 have utilised the programme to operationalise local-led approaches to obesity by engaging
46
47 95 with their local stakeholders to implement systems change across the community [19]. In
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49 96 2019, PHE launched the *Whole Systems Approach to Obesity: a guide to support local*
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51 97 *approaches to promoting a healthy weight programme for local governments across England*
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53 98 which includes systems mapping of obesity drivers with community stakeholders as a central
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55 99 tool [19].
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3 100 In 2020, VicHealth initiated the ‘VicHealth Local Government Partnership - Young people
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5 101 leading healthier communities’ (VLGP). The partnership aims to create community
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7 102 environments where children and young people aged 0-25 years could become physically
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9 103 active, socially connected, and mentally healthy [20]. VLGP currently includes 13
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11 104 metropolitan, regional and rural Victorian Local Governments, using systems thinking
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13 105 methods to direct, and guide municipal chronic disease prevention in young people [20].
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18 106 This paper describes the design of a framework to embed systems thinking as a guiding
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20 107 principle for the delivery of municipal prevention of chronic disease in children and young
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22 108 people. The specific approach to systems dynamics is outlined, alongside the processes used
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24 109 to initially build councils’ capacity, and ongoing support mechanisms to guide continued use
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26 110 of the systems thinking methods. Some results reflecting early outcomes from the local
27
28 111 communities are provided.
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32 112 **METHODS**

33 113 **Study design and data collection**

34 114 **Study context**

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36 115 The state of Victoria, south-eastern Australia, has a population of ~6.7 million people and is
37
38 116 comprised of 79 Local Government Areas (LGA)[21]. Individual LGAs vary broadly across
39
40 117 various measures including geographical size, population density, rurality and cultural and
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42 118 linguistic diversity [21]. Overall, 28% of Victorians were born overseas and 26% speak a
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44 119 language other than English [21].
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54 120 **VicHealth Local Government Partnership overview and modules**

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3 121 The VLGP represents a partnership approach to building capacity for evidence-based
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5 122 prevention at the local government level. Councils were invited to apply to join the VLGP
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7 123 through a competitive process, initially open to the 39 Victorian councils with an Index of
8
9 124 Relative Social Disadvantage (IRSD) of 1-5 and with health and wellbeing needs, between
10
11 125 the lower and higher IRSD LGAs [22]. The 21 submitted applications then underwent a
12
13 126 scoring process, followed by an assessment panel discussion. Of the 21 council applications,
14
15 127 16 were selected to take part in the partnership, with three in a modified partnership
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17 128 arrangement, which allowed one of the VLGP foundation modules to be omitted from their
18
19 129 programme.

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25 130 The VLGP provides support to the 13 partner councils to develop and deliver evidence-based
26
27 131 action to improve children and young people's health and wellbeing through the mechanism
28
29 132 of councils' Municipal Public Health and Wellbeing Plans (MPHWP) [20]. In Victoria, the
30
31 133 State Government mandates that councils develop 4-year MPHWP, that guide strategic
32
33 134 direction and priorities for municipal health promotion relative to a locally tailored set of
34
35 135 priorities, taken from identified state-level drivers of poor health and health inequity [23].
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39 136 The key outcomes of VLGP are to foster improvements in the capacity of councils to deliver
40
41 137 evidence-based action in the implementation of their MPHWP, the promotion of the voices of
42
43 138 children and young people into local government policy decisions and action, and improved
44
45 139 rates of healthy eating, physical activity and social connectedness amongst young people
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47 140 aged 0-25 by the end of 2025 [20].
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52 141 Eight evidenced-informed health promotion modules were developed to serve as a series of
53
54 142 practical, 'how-to guides' for policy, program development/delivery and practice change.
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57 143 These guides were devised to support councils to implement action at the local level to create
58
59 144 healthier communities for children and young people [20]. The eight modules were designed
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3 145 to consolidate the practice knowledge, experience and research developed from the close
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5 146 collaboration between VicHealth, local governments and expert partners. Each module
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7 147 included several impact streams, each of which included a number of evidence-informed
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9 148 implementation actions or key policy, program and practice changes relative to the theme of
10
11 149 the module. The modules were divided into three categories: Foundation, Core and Stretch
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15 150 (Table 1) [20].

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18 151 **Table 1. The VicHealth Local Government Partnership (VLGP) modules and impact**
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20 152 **streams [20]**

Modules and impact streams

Foundation modules Compulsory modules that provided the basic building blocks to develop staff capabilities and skills in systems-thinking and engagement with children and young people in planning, policies and programs

Core modules Evidence based activities, designed to address childhood obesity

Connecting the Dots - creating solutions for lasting change

Big picture thinking for better solutions

Leading the Way - engaging young voices for change Including children and young people in policy creation; Including children and young people in planning

Building active communities Increasing active travel to and from school; Increasing walking and bike riding in council strategies; Creating opportunities for all Victorians to be active; Including gender equity in council sport and recreation policy; Empowering and enabling women to get active through local promotion of 'This Girl Can-Victoria'

Creating connected and supportive communities Co-designing with young people for better community wellbeing; Building proud and inclusive communities; Addressing social determinants of mental wellbeing

Building better food systems for healthier communities Creating thriving local food systems; Embedding healthy food and drink options in council owned and operated places; Using healthy rewards and sponsorships in community activities
Enabling healthy partnerships

Stretch modules Optional modules that built on essential health policy priorities to promote healthy environments for children and young people

Increasing alcohol harm prevention at a local level

Adopting alcohol harm prevention actions to protect children and young people

Strengthening tobacco control at a local level

Adopting tobacco control actions to protect children and young people

Promoting everyday creativity at a local level

Increasing equity in creative strategies; Embracing opportunities for children to inform creative programs; Improving opportunities for young people to lead creative programs

153

154 **Connecting the Dots [20]**

155 The Connecting the Dots (CtD) foundation module contained one impact stream with two
 156 required implementation actions which consisted of structured training workshops (Block1)
 157 and the delivery of systems thinking approaches (Block 2) (Table 2).

158 **Table 2. VicHealth Local Government Partnership (VLGP) Connecting the Dots**
 159 **foundation module [20]**

Connecting the Dots – creating solutions for lasting change

Impact stream	Implementation action	Formal training & support
Big picture thinking for better solutions	Understanding systems thinking approaches	Block 1 – Fundamentals in systems thinking & facilitation
	Actioning new systems thinking approaches	Block 2 – Workshop preparation & delivery support

160

161 **Understanding systems thinking approaches: fundamentals in systems thinking &**
 162 **facilitation**

163 This stream consisted of a series of training sessions (Block 1) designed to quickly upskill
 164 (~10hrs pivoted to online learning in some cases due to COVID-19, work from home and

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3 165 travel restrictions) council core facilitation teams on; 1) the basics of systems thinking
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5 166 including the fundamental skills around concepts and language; 2) community-based systems
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7 167 dynamics (CBSD) and GMB workshop facilitation process via participation in facilitated
8
9 168 demonstrations and guided facilitation practice [20].
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13 169 Initial plans for local delivery of the workshop process, including context/framing,
14
15 170 facilitation team membership, key participant groups, and engagement/workshop timelines
16
17 171 were also covered. The use of the Systems Thinking in Community Knowledge Exchange
18
19 172 (STICKE) systems mapping software program (STICKE Version 3 © Deakin University)
20
21 173 was used throughout the training as it allows council and community members to build causal
22
23 174 loop diagrams (CLDs) using a supported online process [24].
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28 175 Regional advisors and a central coordination team comprising academic and practitioner
29
30 176 experts in systems thinking methodologies from Deakin University and local government
31
32 177 representatives comprised the CtD team. The regional advisors worked closely with their
33
34 178 nominated councils (2-3 councils each) to deliver training and provide continued
35
36 179 implementation support and guidance. Partner councils established core facilitation teams to
37
38 180 lead and deliver the actioning of new systems thinking approaches. Each team consisted of a
39
40 181 VicHealth funded project officer based at the local councils and other council employees
41
42 182 overseeing the MPHWP. Additional staff involved in child/youth health and community
43
44 183 engagement and non-council staff were also nominated for training. Approximately, 2-10
45
46 184 persons undertook the training sessions within each council. The Fundamentals in Systems
47
48 185 Thinking & Facilitation impact stream was completed in full before councils began delivering
49
50 186 participatory GMB workshops with the community.
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57 **Actioning new systems thinking approaches: workshop preparation & delivery**
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3 188 This impact stream included a series of online seminars (~10 hrs) designed to support council
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5 189 teams scheduled alongside the delivery of community based GMB workshops (Block 2). The
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8 190 preparation seminars covered various topics and focused closely on supporting council teams
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10 191 as they negotiated the tasks and preparations relative to the stages of GMB workshop delivery
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12 192 [20].

13
14
15 193 Council core facilitation teams delivered at least three participatory GMB workshops of ~1-3
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17 194 hours to groups of community stakeholders from each of the 13 partner LGAs (Table 3).
18
19 195 Stakeholders included young people, children, community leaders, and diverse community
20
21 196 members drawn from across all sectors including local government, non-government
22
23 197 organisations, small business, commercial sector, education, community organisations and
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25 198 healthcare providers. Stakeholders were recruited by partner councils through existing
26
27 199 networks, emails, expressions of interest, and advertisements.

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33 200 **Table 3. Summary of the Victorian Local Government Partnership (VLGP) Group**
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35 201 **Model Building (GMB) workshop process**

GMB workshop	Duration (minutes)	Participant capacity	Objectives
1	120	5-25 participants	Orientation of participants to VLGP project, local context for work and GMB process to be undertaken. Development of initial systems map.

2	120	5-25 participants	Refinement of systems map based on revisions since workshop 1 and further conversation and consideration of health and wellbeing determinants. Optionally: Discussion of preliminary insights on potential focal points on systems map for community-led action, and potential additional invitees and recruitment strategies for workshop 3.
3	180	5-25 participants (with option to extend up to 100 participants)	Introduction and orientation to systems map for new participants if required. Further discussion of if required. Further discussion of workshop 2. Facilitated discussion and prioritisation of potential community-led actions identified in response to insights from systems map.

202

203 Together, council core facilitation teams and workshop participants created a CLD of the
 204 locally relevant drivers of health and wellbeing of children or young people in their
 205 community and determined the highest-priority leverage points for action. The method used
 206 to generate the systems map in the form of a CLD was the GMB technique, which is a
 207 structured collaborative CBSD methodology, designed to guide participants through
 208 developing hypotheses about the connections between various contributing factors in
 209 complex problems [14]. A set of scripts used in the GMB workshops (graphs over time,
 210 connection circles, and action ideas) were used to guide workshop content and help
 211 stakeholders develop CLDs [25] The CLDs highlighted drivers of childhood health and the
 212 complex, non-linear relationships between those drivers. The structured workshop process
 213 resulted in a CLD which represented a view on the systems components, relationships and

1
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3 214 boundaries (Figure 1) [14]. (see online supplemental file 1 for a summary of Connecting the
4
5 215 Dots framework).

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9 216 Following the completion of the participatory systems mapping and community engagement
10
11 217 process, council facilitation teams were supported by the CtD team to use the CLD developed
12
13 218 by the group to guide the identification and prioritisation of stakeholder informed actions
14
15 219 ideas that can be applied in the community to support children and young people health
16
17 220 during 2022 - 2025. These will be driven by their own CLD and informed by evidence
18
19 221 including case studies from previous successful interventions [26]. Community actions will
20
21 222 be recorded throughout the duration of the project, including tracking against the systems
22
23 223 map in STICKE. Forthcoming publications will examine the implications of local community
24
25 224 contexts and priorities on the precise adaptations to process undertaken by individual
26
27 225 councils.

226 **Patient and public involvement**

227 None.

228 **RESULTS**

229 All 13 partner councils had participated in the initial systems training, with 111 total staff
230 (>18 year of age) attending the training across all councils. Individual facilitation teams based
231 at the councils included a funded project officer and between three and 12 additional staff
232 including council employees involved in child/youth health and community engagement, and
233 staff from external community organisations collaborating with councils, such as sports
234 facilities or health services. All 13 partner councils delivered GMB workshops 1-3 face-to-
235 face and online (due to COVID-19, and travel restrictions). In some instances, workshops
236 were combined e.g., workshop 1 combined with workshop 2 and delivered together as one

237 session (due to time constraints and capacity of council staff). The workshop participants
 238 included either young people or stakeholders with the exception of workshop 3, which
 239 included young people and stakeholders together (conducted by three councils) (Table 4).

240 **Table 4. Total number of participants who attended the Group Model Building**
 241 **workshops from the 13 partner local government authorities**

	Workshop 1	Workshop 2	Workshop 3	Combined workshop 1 & 2	Combined workshop 2 & 3
Participants (n)					
Young people	174	99	128	52	9
Stakeholders	113	72	90	7	20
Combination of both young people and stakeholders	–	–	83	–	–
Total participants	287	171	301	59	29

242
 243 All councils successfully created CLDs , with community stakeholders including: children
 244 and young people, the local prevention workforce, service providers, policy and decision
 245 makers, and grass-roots community members from sectors including local government, non-
 246 government organisations, small business, education, community organisations and
 247 healthcare providers. The diagrams resulting from the workshop process were similar in
 248 range and scope to other prevention efforts which have used these methods across multiple
 249 community sites in Victoria [26]. For example, each council’s diagram included the typical
 250 elements of a CLD: variables (determined by stakeholders as influencing the health and
 251 wellbeing of children and young people in the community e.g., junk food), the connections
 252 between the variables, actions (e.g., banning sugary drinks from sporting clubs) and
 253 overarching themes. An example of a council CLD with five themes (e.g., relationships,
 254 physical activity) and nine action ideas (e.g., wellbeing classes in school, faster

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3 255 transportation, access to free and low-cost sporting programmes) identified by stakeholders is
4
5 256 shown in Figure 1.
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7

8 257 **DISCUSSION**

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11 258 This paper describes the capacity building of local councils to use systems thinking and
12
13 259 participatory methods within local governments to inform the implementation of MPHWP.

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16 260 The council facilitation teams demonstrated complex systems science practice to develop
17
18 261 CLDs with community stakeholders (with an understanding of systems theory) which can
19
20 262 then act as basic logic models for community led action and implementation.
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23
24 263 The logic underpinning the approach used in CtD has been published previously and posits
25
26 264 that building and sustaining capacity for work informed by CBSD methods increases
27
28 265 leadership and organisational engagement with prevention, and collaboration across
29
30 266 community organisations, which generates higher quality, more sustainable outcomes within
31
32 267 communities [27]. We observed that local stakeholder informed prevention designs allowed
33
34 268 for differences between communities and adaption to the local context rather than a
35
36 269 predefined program of work. The effectiveness of this locally informed prevention approach
37
38 270 and community capacity building has been reported in previous trials e.g., Whole of Systems
39
40 271 Trial of Prevention Strategies for Childhood Obesity (WHO STOPS) [26], Romp and Chomp
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42 272 [28], It's Your Move [29], Be Active Eat Well [30].
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48 273 There is an increased focus using systems thinking at local community level to improve
49
50 274 population health. Recent examples include PHE's support for whole of systems change,
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52 275 given to all 408 UK local authorities and potentially impacting 55M people [19]. The UK's
53
54 276 guidance also calls for action at local communities and emphasises the development of shared
55
56 277 models of the complexity within community, using a range of techniques from GMB. . Our
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58 278 systems guidance incorporated into the CtD module has arisen from several trials of systems
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3 279 thinking in obesity prevention results, notably trials in schools (e.g., ‘It’s Your Move 2 [31])
4
5 280 and local communities [32]. These trials began with a heavy investment of researcher support
6
7 281 in assisting doing systems science [12] and then moved to building capacity and supporting
8
9 282 people within local communities to deliver and evolve systems thinking in situ [32]. These
10
11 283 types of systems thinking approaches may also support First Nation rural communities [33].
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15 284 Our results, and these implications for practice, parallel early trials of systems thinking in
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17 285 health. For example, Healthy Together Victoria (HTV), was a large-scale initiative that
18
19 286 applied a ‘complex whole of systems approach’ to the prevention of chronic disease [34].
20
21 287 HTV provides many pointers to future practice and built a workforce of system thinkers from
22
23 288 across the state in local government, community health and non-government organisations to
24
25 289 implement a range of actions at the community and state level [34-5]. The VLGP builds on
26
27 290 one of the key lessons from HTV: the challenge to identify the most effective ways to support
28
29 291 communities to deliver a systems approach at a local level [34-36]. This project shows that
30
31 292 providing capacity building in systems thinking, can support council staff to access and apply
32
33 293 knowledge from Deakin University’s >20 years’ experience in complex systems thinking and
34
35 294 community-based obesity prevention [26,28-30]. We observed that the strong organisational
36
37 295 and structural factors such as researcher support and regional advisors who provided
38
39 296 continued support allowed the novice council facilitation teams to build confidence while
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41 297 developing their practical know-how for systems thinking in the community setting.
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49 298 Building local capacity likely creates positive change within communities. This is shown in
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51 299 outcomes of previous trials like WHO STOPS, which catalysed >300 community members to
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53 300 drive >400 actions ranging from council food policy, soft drink bans and active transport
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55 301 strategies [26]. As a result, WHO STOPS showed initial reductions in overweight and obesity
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57 302 in the first two years of intervention, compared to no change in the control group [26],
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3 303 however, these were not sustained. The longer-term outcomes (four years) demonstrated
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5 304 significant maintenance of health-related quality of life, reduced takeaway, nutrient-poor
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7 305 snack consumption (boys only), and water consumption (girls only) favouring intervention
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9
10 306 children compared to controls. Highlighting for the first time that long-term behavioural and
11
12 307 HRQoL improvements are possible using a whole of community systems approach to
13
14 308 childhood obesity [26].

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18 309 The CtD module represents one of the first efforts to build systems thinking capacity amongst
19
20 310 local government staff, which provided the opportunity for the trained labour force to become
21
22 311 systems thinkers and identified stakeholder informed actions for their communities to
23
24 312 enhance the health and wellbeing of children and young people. This was demonstrated by
25
26 313 their ability to observe the interconnected determinants of health and wellbeing through the
27
28 314 use of CLDs. A well scripted systematic and rigorous approach to using systems science was
29
30 315 applied during the CtD workshops and GMB sessions. A well-structured training manual
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32 316 written by our CtD team and based on a similar format to our previous community-based
33
34 317 interventions allowed for the training to be standardised across the 13 partner councils.

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39 318 There is limited evidence about the sustainability of health and wellbeing, community-led
40
41 319 change. As noted with the 4-year WHOSTOPS trial which positively impacted children's
42
43 320 health, the long term (>2 years) sustainability of community-based action is still understudied
44
45 321 [26]. A key limitation is the assessment of the quality and effectiveness of the training
46
47 322 materials used in the delivery of systems thinking facilitation, teaching of specific skills and
48
49 323 knowledge, the training methods and participant's use of the online platform. For example, it
50
51 324 is unknown if there were gaps in participants' knowledge as they progressed from workshop
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53 325 training to systems thinking facilitation. The use of STICKE enabled participants to create
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55 326 CLDs online and has been considered to be useful by participants [24]. However, we did not
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3 327 measure the utility of the STICKE software. It is possible that the functionality of the
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5 328 STICKE software requires updating to accommodate upscaling to larger interventions across
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7 329 numerous geographical areas. Pivoting to online learning (following COVID-19 restrictions),
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9 330 for the staff training ensured good participation and appears to be efficient in facilitating
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11 331 GMB rather than in person delivery, although this may differ across the metropolitan,
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13 332 regional, and rural LGAs. However, we did not gather evidence to support this approach,
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18 333 **Future research**

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21 334 The future of chronic disease prevention is pointing to the co-creation of systemic change
22
23 335 supporting communities using techniques to address complexity; a move from single
24
25 336 behaviour, individual focus to a consideration of wholistic relations of cause and effect across
26
27 337 multiple levels of community action [11]. As the Lancet Commission on Obesity shows, this
28
29 338 has implications for science, as the approach is less amenable to randomized controlled trials
30
31 339 and more suited to implementation and hybrid studies, as it places the control of the effort in
32
33 340 the hands of communities, at the agreed expense of intervention fidelity and generalisability
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35 341 [11].
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40 342 This paper and our broader community behaviour intervention research [26,30-32] raises
41
42 343 some questions for future studies: What should the user interface and user experience look
43
44 344 like? For example, could gamification, where the use of game thinking in a non-game context
45
46 345 to engage users and to solve problems, be included as part of the systems thinking toolkit?
47
48 346 Could an accreditation system where the recognition of communities that meet the
49
50 347 requirements of certain standards be applied? Does this systems approach improve health?
51
52 348 Can this approach be transferred to tackle other complex issues beyond obesity prevention?
53
54 349 Can prior experience with community-based action on childhood obesity provide
55
56 350 communities with the fundamentals to apply systems science thinking to other areas of
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3 351 community concern such as recovery plans from major disasters like bushfire, floods, and
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5 352 COVID-19 and the development of strategies for climate change resilience?
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8

9 353 **CONCLUSION**

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11
12 354 This paper has provided an example of establishing the capacity of a government workforce
13
14 355 by developing their knowledge and understanding of systems theories tools and practice. An
15
16 356 emphasis on the process to create change, but not at the expense of local empowerment and
17
18 357 adaptability should be considered when planning the implementation of systems science at
19
20
21 358 the local government level.
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24 359 *** **

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38
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40
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42
43 366 supervised the study and provided overall guidance. JH contributed significantly to the
44
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46
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8 376 reported.

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10 377 **Competing interests**

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12
13 378 None declared.

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15 379 **Patient consent for publication**

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18 380 Not applicable.

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21 381 **Ethics approval**

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23
24 382 This study was approved by the Deakin University Human Research Ethics Committee
25
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27
28 384 Medical Research Council's National Statement on Ethical Conduct in Human Research
29
30 385 2018. Informed consent was obtained from participants.

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35
36
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38
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40
41 389 author upon reasonable request.

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45 390 **Open access**

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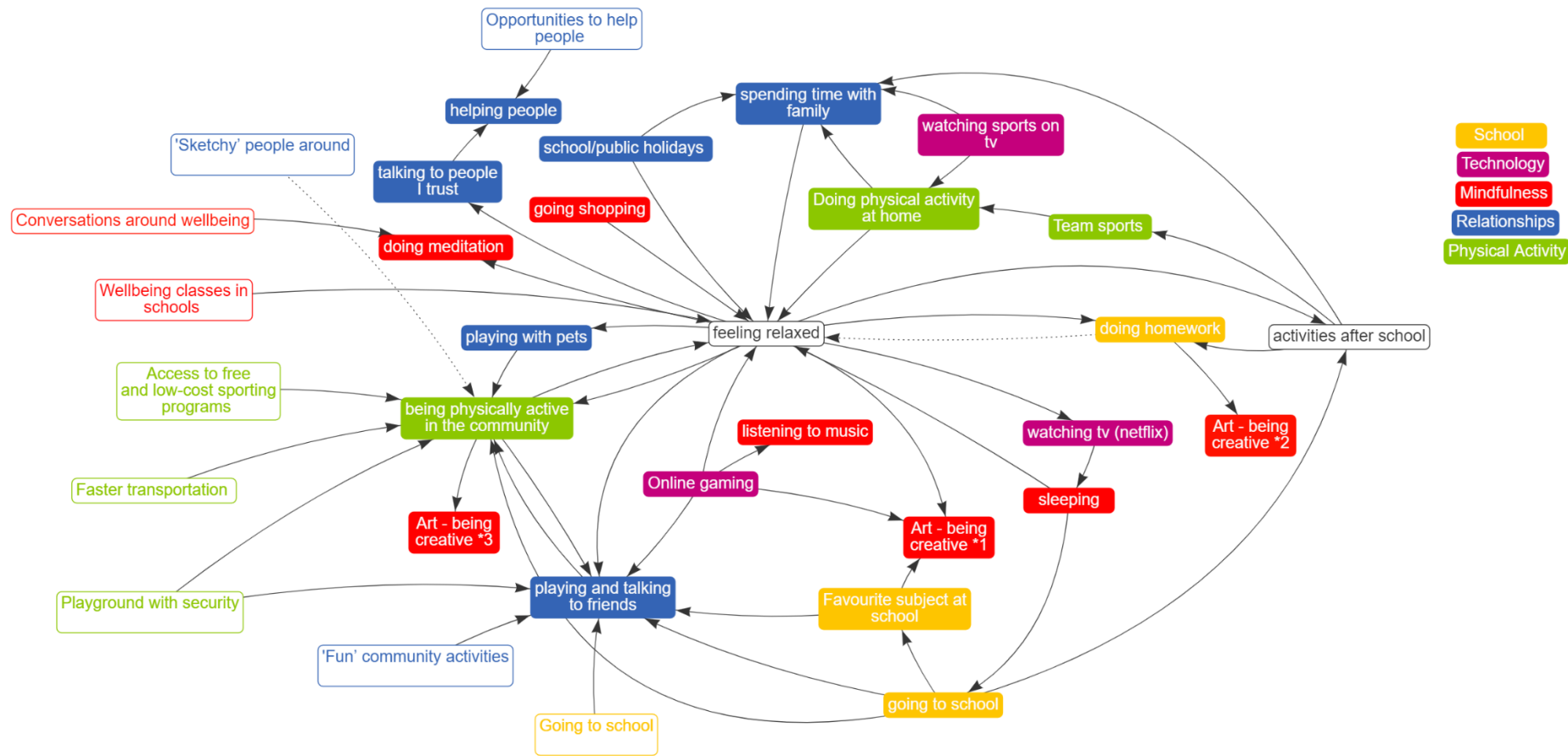
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3 496
4 497 **Figure. 1 An example of a casual loop diagram showing the variables, themes and the**
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7 498 **actions ideas generated by stakeholders from one of the VicHealth Local Government**
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9 499 **Partnership (VLGP) councils**
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The VicHealth Local Government Partnership (VLGP) Connecting the Dots framework.

The Connecting the Dots framework provides the basic building blocks to develop staff capabilities and skills in systems-thinking and engagement with children and young people in planning, policies and programs. It consists of structured training workshops (Block 1) and the delivery of systems thinking approaches (Block 2).

Connecting the Dots foundation module training workshops for council facilitation teams – Block 1

Block 1: Understanding systems thinking approaches: Fundamentals in Systems Thinking & Facilitation

Training sessions on; 1) Basics of systems thinking including the fundamental skills around concepts and language; 2) community-based systems dynamics and GMB workshop facilitation process via participation in facilitated demonstrations and guided facilitation practice.



Connecting the Dots foundation module delivering of systems thinking approaches – Block 2

Block 2: Actioning new systems thinking approaches: workshop preparation & delivery

The preparation seminars covered various topics and focussed closely on supporting council teams as they negotiated the tasks and preparations relative to the stages of the 3 GMB workshop delivery facilitation practice with community stakeholders (outlined

GMB workshop 1: Orientation of participants to VLGP project, local context for work and GMB process to be undertaken. Development of initial systems map.

GMB workshop 2: Refinement of systems map based on revisions since workshop 1 and further conversation and consideration of health and wellbeing determinants. Discussion of preliminary insights on potential focal points on systems map for community-led action, and potential additional invitees and recruitment strategies for workshop 3.

GMB workshop 3: Introduction and orientation to systems map for new participants if required. Further discussion of revisions to systems maps since workshop 2. Facilitated discussion and prioritisation of potential community-led actions identified in response to insights from systems map.



During GMB workshops 1-3 council facilitation teams and community stakeholders will together create a CLD of the locally relevant drivers of health and wellbeing of children or young people in their community and determined the highest-priority leverage points for action.

Standards for Reporting Qualitative Research: A Synthesis of Recommendations (SRQR)

Checklist item	Page number in Manuscript
Title and abstract	
Title	1
Abstract	2-3
Introduction	
Problem Formulation	4-5
Purpose or research question	5-6
Methods	
Qualitative approach and research paradigm	9
Researcher characteristics and reflexivity	6
Context	6-7
Sampling strategy	7
Ethical issues pertaining to human subjects	12
Data collection methods	9-12
Data collection instruments and technologies	9-12
Units of study	9-12
Data processing	12
Data analysis	12
Techniques to enhance trustworthiness	12
Results/findings	
Synthesis and interpretation	12-13
Links to empirical data	12-13
Discussion	
Integration with prior work, implications, transferability, and contribution(s) to the field	13-17
Limitations	15-16
Other	
Conflicts of interest	18
Funding	18