Title	Country of research	ST methods used	Study	Results	Key elements	Domain(s) involved
Systematic Reviews						
The application of systems thinking concepts, methods, and tools to global health practices: An analysis of case studies doi:10.1111/jep.12842 (Wilkinson et al., 2018)	United States, United Kingdom, Ghana, Canada, China, Australia, Uganda, Bosnia and Herzegovina	Agent based modelling, social network analysis, scenario planning, systems dynamics modeling (stock and flow diagrams, CLD), innovation/change history, participatory impact pathways analysis, process mapping, stock and flow diagrams, systems archetypes	Review	Common ST methods and tools were largely underutilized. Four themes were identified: the importance of interconnectedness of a system, attributes of leaders in CAS, and the benefits and barriers of using ST	Systematic review of 36 case studies that used ST	Global health
Thinking about complexity in health: A systematic review of the key systems thinking and complexity ideas in health doi: 10.1111/jep.12856 (Rusoja et al., 2018)	Various	Systems dynamics modeling, CLD, agent-based modeling, social network analysis, concept mapping, scenario technique	Review	ST remains largely a theoretical approach and there is a need for further practical application of it.	A systematic review that aimed to identify key terms, concepts, and methods in ST literature.	Healthcare
Reviews						
Systems science and oral health: Implications for Dental Public Health? doi:10.1922/CDH_4470Broomhead08 (Broomhead, 2019)	Not specified	System dynamics simulations, agent-based models, network analysis, soft-systems analysis, Markov modelling, policy relevant analysis	Review	ST offers another dimension to the dental field and can be beneficial in addressing complexity and advancing knowledge of key mechanisms and evolving properties of understanding and promoting dental health.	An overview of how systems science can be used to address complexity problems in the field of dental health and the benefits that ST approaches can have	Dental Health

Applications of systems modelling in obesity research doi: 10.1111/obr.12695 (Xue et al., 2018)	Not specified	Agent based modelling and systems dynamics modelling	Review	Found that there is still a gap between theory and application of systems approaches in public health.	Studied the uses of systems modelling and agent-based modelling in obesity research.	Obesity research
Evaluation of public health interventions from a complex systems perspective: A research methods review doi: 10.1016/j.socscimed.2021.113697 (McGill et al., 2021)	Not specified	CLD, concept mapping, stock and flow diagrams, viable systmes model, sociogram, multi-media models, network diagram and spatial patterning image	Review	Found a wide range of methods used in complex systems and categorized them into mapping, modelling, network analysis and system framing.	Conducted a review of public health interventions to classify and describe methods used in complex public health systems.	Public health
Individual studies						
A systems approach to assessing complexity in health interventions: an effectiveness decay model for integrated community case management doi:10.1080/16549716.2020.1794106 (Karim et al., 2020)	Low and middle income countries	Decision tree modelling, process mapping, CLD, soft systems methodology	Intervention	The approach provided insights on many aspects of the program it studied and how its elements interacted with each other, and how it fit within the overall health system	A robust systems approach that proposes the use if system thinking frameworks, concepts and tools	Child health
Advancing the application of systems thinking in health: understanding the dynamics of neonatal mortality in Uganda doi:10.1186/1478-4505-12-36 (Rwashana et al., 2014)	Uganda	CLD and systems dynamics modeling	Analysis	The CLDs revealed feedback loops and high leverage points to be seen	Devleoped CLDs to display the demand and supply side issues in health services	Neonatal mortality and maternal health

Understanding a successful obesity prevention initiative in children under 5 from a systems perspective doi:10.1371/journal.pone.0195141 (Owen et al., 2018)	Australia	CLD	Analysis	The CLD allowed for the complexity of a community based intervention to be represented and understood from feedback loops	Developed a CLD to represent stakeholder perceptions of an intervention	Childhood obesity prevention
Advancing the application of systems thinking in health: realist evaluation of the Leadership Development Programme for district manager decision-making in Ghana doi:10.1186/1478-4505-12-29 (Prashanth et al., 2014)	Ghana	CLD and causal tree diagram	Evaluation	The CLD showed that the program did not deviate much from the predicted implementation of the program.	An evaluation of a leadership program, using a CLD to explain the interactions between contexts, outcomes and mechanisms of the program	Leasdership development in Healthcare
Advancing the application of systems thinking in health: advice seeking behavior among primary health care physicians in Pakistan doi: 10.1186/1478-4505-12-43 (Malik et al., 2014)	Pakistan	Social network analysis	Analysis	The use of the social network analysis showed that doctors did not contact the correct representative when facing a difficult case and the key stakeholder interviews revealed gaps and problems in the system from different stakeholder point of views.	Cross-sectional study that analysed the existing primary health care system and explore how it could be strengthened	Primary Healthcare
Advancing the application of systems thinking in health: understanding the growing complexity governing immunization services in Kerala, India doi: 10.1186/1478-4505-12-47 (Varghese et al., 2014)	India	CLD	Analysis	The CLD assisted in the identification and interpretation of the feedback loops that emerged in the analysis. It also helped identify unintended consequences	Explored underlying factors in vaccination coverage and carried out content analysis of the data by looking at	Immunization services

				and unexpected phenomena.	features of the complex adaptive systems. With this data, a CLD was created to show the interactions among the key actors and elements of the system.	
Building a systems thinking prevention workforce doi:10.1002/hpja.325 (Bensberg et al., 2020)	Australia	CLD	Analysis	The CLD revleaded how cause-effect relationships were drawn from the findings and how they contributed to systems thinking capacty building.	Conducted semi-structured interviews on particpants understanding of the ST, the data from the interviews were used to create a CLD.	Workforce systems thinking development in healthcare
Using a 'rich picture' to facilitate systems thinking in research coproduction doi:10.1186/s12961-019-0514-2 (Conte & Davidson, 2020)	Australia	Rich pictures	Analysis	The rich picture allowed for the whole system to be seen and for key stakeholders to take part in the inquiry process and to express data in a way that might not be possible through speech and writing.	Used systems thinking principals to examine the dynamics between an IT system and the intevention it was designed to monitor.	Research coproduction
Systems thinking for health emergencies: use of process mapping during outbreak response doi:10.1136/bmjgh-2020-003901	Sierra Leone, the Democratic Republic of	Process mapping	Intervention	In all three case studies, the time for reporting the specific disease to the intended audience was	Used a four-step process mapping methodology for disease outbreaks	Disease outbreaks

(Durski et al., 2020)	Congo (DRC) and Nigeria			drastically lowered after the process mapping exercise was implemented and the time for reporting data was also decreased.	in three different case studies	
Systems approaches to population health in Canada: how have they been applied, and what are the insights and future implications for practice? doi:10.17269/s41997-019-00230-3 (Zukowski et al., 2019)	Canada	Soft systems methodology, CLD, scenario planning, multi-stakeholder dialogue, systems dynamics modelling	Analysis	Qualitative methods are effective involving diverse perspectives to develop a complete hypothesis of a system and quantitative models can help determine where the best place in the system is to intervene.	A rapid review of literature to identify case studies of systems thinking in Canada.	Population health
Using systems thinking in state health policymaking: an educational initiative doi: 10.1057/hs.2013.17 (Minyard et al., 2014)	USA	Behavior over time graphs, stock and flow maps, systems dynamics models	Intervention	93 legislators participated in the course, where the participants were receptive to the systems thinking tools.	A systems thinking certificate program to improve policymaking processes in Georgias legislators.	Policymaking
Advancing the application of systems thinking in health: provider payment and service supply behaviour and incentives in the Ghana National Health Insurance Scheme – a systems approach doi: 10.1186/1478-4505-12-35 (Agyepong et al., 2014)	Ghana	CLD and causal tree diagrams	Analysis	There is a need for holistic designs and implementations, therefore a systems approach is needed rather than a linear approach.	Used mixed methods to evaluate the payment methods in the Ghana health system	Health system

A Systems Thinking approach for responding to the COVID-19 pandemic doi: 10.26719/emhj.20.090 (Hassan et al., 2020)	South Korea, New Zeeland and Jordon	Iceberg tool and biomatrix tool	Commentary	The systems thinking approach is supported through a review of literature and the COVID-19 measures taken in the countries observed.	Applied the Iceberg Tool and Systems Thinking Biomatrix Tool to identify leverage points in the COVID-19 response	COVID-19
Systems thinking perspectives applied to healthcare transition for youth with disabilities: a paradigm shift for practice, policy and research doi: 10.1111/j.1365-2214.2011.01313.x (Hamdani et al., 2011)	Various	Systems dynamics model, CLD and stock and flow diagram	Intervention	The use of systems thinking can assist in determining areas leverage points for interventions and the intended and unintended impacts the interventions will have on the system.	Introduced several systems thinking concepts to healthcare transition for youth with disabilties	Health system
Advancing the application of systems thinking in health: exploring dual practice and its management in Kampala, Uganda doi: 10.1186/1478-4505-12-41 (Paina et al., 2014)	Uganda	CLD	Analysis	The CLD illustrated that dual practice occurs due to incentives within the public and private sector.	Conducted a document review, qualitaive interveiws and a qualitative survey to explore the use of dual practice in Uganda. From the data collected, a CLD was created to show the feedback loops in dual practice.	Health care providers
Emergency department crowding in Singapore: Insights from a systems thinking approach doi: 10.1177/2050312116671953	Singapore	CLD	Analysis	The CLD was a great tool to observe the structure of emergency department crowding in Singapore.	Created a CLD after consuting with emergency department	Emergency care

(Schoenenberger et al., 2016)					experts, a literature review and direct observation.	
Understanding the dynamics of obesity prevention policy decision-making using a systems perspective: A case study of Healthy Together Victoria doi: 10.1371/journal.pone.0245535 (Clarke et al., 2021)	Austrailia	CLD	Analysis	The CLD revealed recurrent associations and feedback mechanisms between the components of the policy systems.	Created a CLD from interviews and a document analysis from the Healthy Together Victoria Initiative	Obesity prevention policies
Using systems science to understand the determinants of inequities in healthy eating doi: 10.1371/journal.pone.0188872 (Friel et al., 2017)	Austrailia	CLD, agent-based models, network analysis and soft systems methodology	Analysis	The final CLD made it possible to organize and analyze comply information with a holistic system perspective.	Used a group of policy experts to build a systems model and mind maps to created a final CLD.	Healthy eating
Rethinking health systems strengthening: key systems thinking tools and strategies for transformational change doi: 10.1093/heapol/czs090 (Swanson et al., 2012)	Not specified	Concept mapping, social network analysis, agent-based modelling, system dynamics modelling, systemic policy analysis	Commentary	Suggests three overarching themes of using ST tools: collaboration across disciplines, sectors and organizations; ongoing, iterative learning; and transformational leadership	Agrues that key ST tools and strategies have the possibility to transform health systems.	Health systems
Systems Thinking as a Framework for Analyzing Commercial Determinants of Health doi: 10.1111/1468-0009.12339 (Knai et al., 2018)	Not specified	CLD, conceptual modeling, stakeholder analysis, document analysis, media analysis, group model building, logic models	Analysis	Found that applying a systems perspective was beneficial and can be used in other complex public health issues.	Examined how a systems perspective can be useful to analyzing the commercial	Determinants of health

					determinents of noncommunicable diseases.	
Application of systems thinking: 12-month postintervention evaluation of a complex health system intervention in Zambia: the case of the BHOMA doi: 10.1111/jep.12354 (Mutale et al., 2017)	Zambia	Systems-thinking guided analysis framework and CLD	Intervention	The ST approach used assisted in evaluating the complex intervention.	Conducted a qualitative study and used a systems thinking conceptual framework to analyze the intentional and unintentional consequences of the intervention.	Health system
Using Behavior Over Time Graphs to Spur Systems Thinking Among Public Health Practitioners doi:10.5888/pcd15.170254 (Calancie et al., 2018)	USA	Behavior over time graphs and group model building	Intervention	Most practitioners involved in the learning of behavior over time graphs found it a useful tool for engaging stakeholders.	Suggests the use of beheavior over time graphs to describe a variety of public health issues to public health practicioners	Public health
Understanding the Problem of Access to Public Health Insurance Schemes among Cross-Border Migrants in Thailand through Systems Thinking doi:10.3390/ijerph17145113 (Kunpeuk et al., 2020)	Thailand	Dynamic simulation model, CLD, stock and flow diagram	Application /Intervention?	The CLD and stock and flow diagram helped identify the dynamics of migrants accessing health insurance in Thailand.	Applied ST to explore the factors limiting public health insurance access to migrants in Thailand.	Health insurance
Moving towards culturally competent health systems for migrants? Applying systems thinking in a	Malaysia	CLD	Analysis	The CLDs helped identify four major themes affecting micro-level interactions in the health system.	Conducted key stakeholder interviews and a	Health system

qualitative study in Malaysia and Thailand doi: 10.1371/journal.pone.0231154 (Pocock et al., 2020)					document review to create CLDs .	
Applications of Systems Science to Understand and Manage Multiple Influences within Children's Environmental Health in Least Developed Countries: A Causal Loop Diagram Approach doi: 10.3390/ijerph18063010 (Brereton & Jagals, 2021)	LDC	CLD	Analysis	The CLD helped identify important feedback loops between different variables that effect children's environmental health.	A literature review was conducted to determine variables for a CLD.	Children's environmental health
Capturing complexity in work disability research: application of system dynamics modeling methodology doi: 10.3109/09638288.2015.1031291 (Jetha et al., 2016)	USA	Systems dynamics modeling	Application	The system dynamics model captured the complexity of work disability and shows a visual of the dynamic relationships that effect work disability.	Applied a systems thinking lens to work disability and created a system dynamics model.	Work disability research
Systems Thinking Tools as Applied to Community-Based Participatory Research: A Case Study doi: 10.1177/1090198111430708 (BeLue et al., 2012)	USA	CLD, behavior over time graphs, and concept mapping	Intervention Planning	The use of the tools may help understand the dynamics of a community and may help with sustainability and effectiveness of interventions.	Used case studies to demonstrate the use of systems thinking tools.	Community-based participatory research
Systems thinking and complexity: considerations for health promoting schools doi: 10.1093/heapro/dav109 (Rosas, 2017)	USA	Network analysis, group model building, and CLD	Analysis	Using ST can assist in addressing the challenges in promoting health in schools.	Used ST to determine challenges in promoting health in schools through the exploration of four system	School health

					thinking areas: knowledge, networks, models and organizing.	
Translating systems thinking into practice for community action on childhood obesity doi:10.1111/obr.12865 (Allender et al., 2019)	Austrailia	CLD	Intervention	The creation of CLDs allowed the community to visualize the community's systems and see where they feel action is possible.	Used a system lens to describe a obesity intevention, specifically the Fister-Fishman's systems frameowork.	Childhood obesity
A Systems Thinking Methodology for Studying Prevention Efforts in Communities doi:10.1007/s11213-020-09544-7 (Riley et al., 2021)	Australia	Social network analysis, system map, community workshop, group model building, CLD and system inventory	Intervention	Allowed for a wide range of ST methods to be applied, while allowing adaption for the specific contexts.	Created a methodolgy that combined ST tools and systematic inquiry processes. It included four domains of inquiry. ST tools were applied to investiagte each domain of inquiry.	Public health
Complex systems thinking and current impasses in health disparities research doi: 10.2105/AJPH.2011.300149 (Diez Roux, 2011)	USA	Concept mapping, agent-based models, and system dynamics models		ST can help health disparities research move beyond current impasses that are in place.	Provided illustrative examples of how ST tools can help to address unanswered questions in various examples.	Health disparities research
Systems Thinking in the Context of Road Safety: Can Systems Tools Help	USA	System map, CLD and 5 r's framework		ST tools can help to implement the Safe Systems	Suggests a Safe Systems approach	Road traffic safety

us Realize a True "Safe Systems" Approach? (Naumann et al., 2020)				concepts holistically. ST tools help produce a unified and cohesive view of the problem the multi-component factors and interactions of the underlying problem and the larger system we are working within.	for road safety practice using ST tools.	
Agent-Based Modeling in Public Health: Current Applications and Future Directions doi: 10.1146/annurev-publhealth-040617-014317 (Tracy et al., 2018)	Not specified	Agent-based modelling	Analysis	Using agent-based models in public health can improve model validation, and better inform research practice and policy.	Explored how agent-based models can improve public health	Public Health