A systems view on national well-being and implications of COVID-19 on it

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National well-being – going beyond GDP

- **Well-being** refers to the state of feeling healthy and happy, or the state of being happy, healthy or prosperous (Merriam-Webster, 2019)

- The theoretical sociological literature also refers to **freedoms** (Sen 1993, Sen and Nussbaum 2005) and **capabilities** (Nussbaum 2011) when well-being is not only perceived as the attaining of pleasure, but as "the striving for perfection that represents the realization of one's true potential"

- **Multidimensional frameworks**
    - *UN Human Development Index (HDI)* covers life expectancy and education level in addition to the GDP (UNDP, 2018)
    - *OECD Better Life Index* and *OECD Well-being Framework* combine a wide variety of indicators from economy to housing and health (OECD, 2020).
    - Also used by some countries, e.g., Bhutan, New Zealand, UK

Impact of COVID-19 policies on national well-being

- Economic consequences are often in the focus. However, other consequences such as health (including emotional), happiness, psychological effects have also been found to be substantial

- Generally perceived as negative, however, national well-being is a complex system
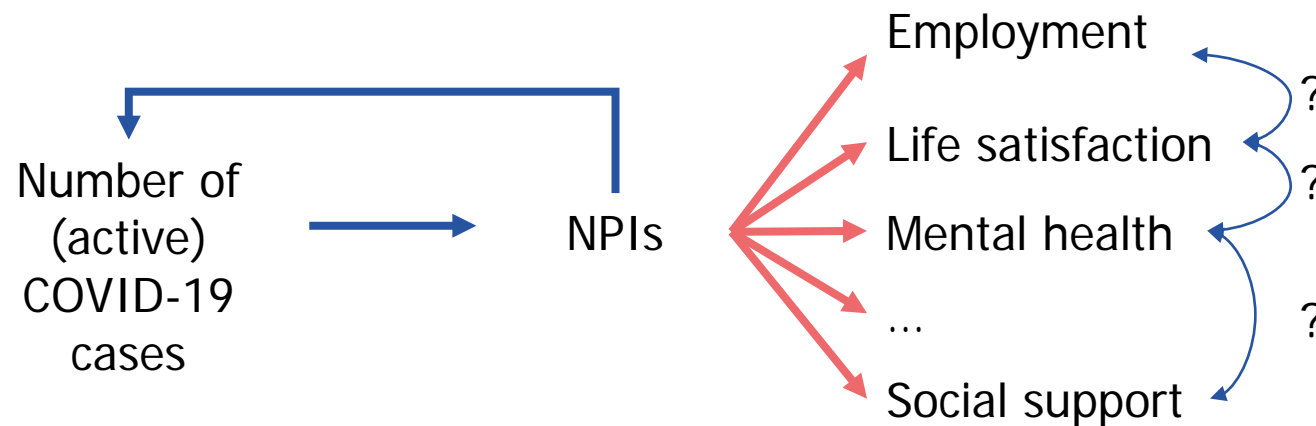
A complex system:

- Cannot be explained by breaking it down into components due to their strong interdependency

- Interdisciplinary in nature

Source: Cairney, 2012. Complexity Theory in Political Science and Public Policy, Political Studies Review, 10(3) 346-358

Systems thinking approach

- Systems thinking and holistic approach are needed to find effective nexus solutions and to reduce risks of unwanted consequences in complex systems

    "COVID-19 means systems thinking is no longer optional"

   Seth Reynolds, Principal Consultant, Systems Change: NPC

- Systems thinking is based on analyzing causal interconnections, indirect effects and feedback loops

- Decision makers can be assisted by formal tools of qualitative systems thinking, which can help reveal tradeoffs and synergies

- Formal tools can also help reduce "wickedness" of the problem and discipline a dialogue

Systems maps (causal loop diagrams)

A system map consists of **components** (elements, nodes) and directed links between components

A **link** represents a causal relation between two components. A link from A to B implies that if A changes, as a result B will change, too

A **link polarity** denotes the direction of the relationship between two components. A positive causality between A and B means that the change in B is in the same direction as A. A negative causality means that the change in B is in opposite direction

Link polarity

-

Component A   B

Causal link +
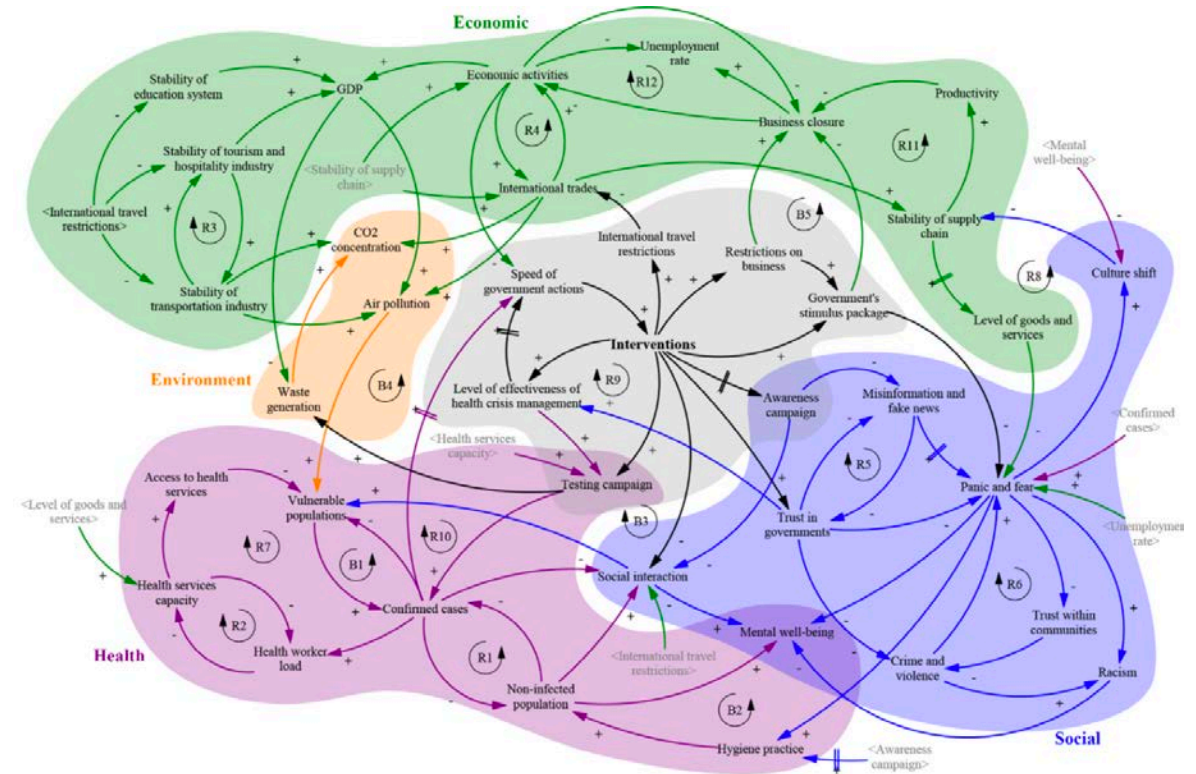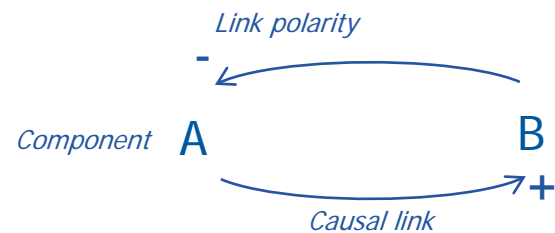
Source: Sahin, O.; Salim, H.; Suprun, E.; Richards, R.; MacAskill, S.; Heilgeist, S.; Rutherford, S.; Stewart, R.A.; Beal, C.D, 2020. Developing a Preliminary Causal Loop Diagram for Understanding the Wicked Complexity of the COVID-19 Pandemic. Systems, 8, 20, doi:10.3390/systems8020020.

Systems mapping has been rarely applied to national well-being issues, e.g., the PhD thesis of Forgie (2016) and contribution by Csutora et al. (2015)

National Well-being and COVID-19 policies system

System components

- National well-being system (31 components)
    - The OECD Well-being Framework
    - Complexity reducton:
        - Focus on current well-being indicators
        - Discardding some highly-correlated indicators

- COVID-19 policies (8 components)
    - Complexity Science Hub Vienna COVID-19 Control Strategies List (CCCSL): 48 policies clustered in 10 groups, 2 discarded

System links

- Collective assessment by six co-authors (169 links)

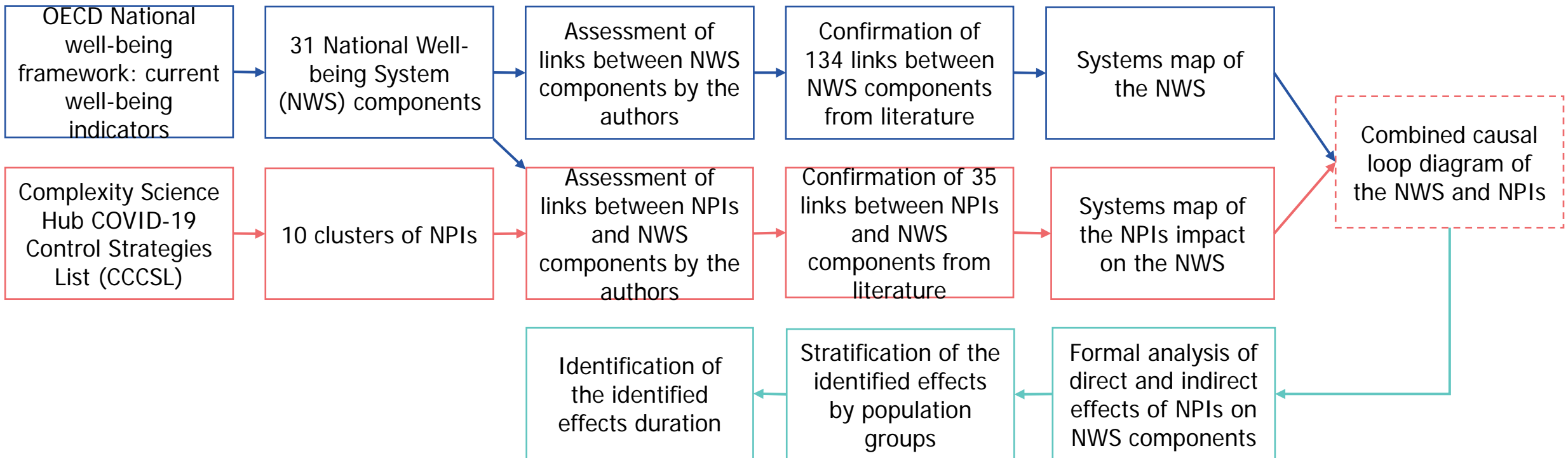- Confirmation from empirical literature (85 sources)

Source: OECD (2020), How's Life? 2020: Measuring Well-being, OECD Publishing, Paris

Policy Groups	Included in Analysis (+)
State of emergency	+
Medical capacity enhancement	+
International travel restrictions	+
Quarantines	+
Restrictions on population mobility	+
Enhancement of physical barriers	+
Gatherings restriction	+
Closures	+
Raising awareness	-
Government support	-

Methodology overview

| OECD National well-being framework: current well-being indicators | → | 31 National Well-being System (NWS) components | → | Assessment of links between NWS components by the authors | → | Confirmation of 134 links between NWS components from literature | → | Systems map of the NWS |

Combined causal loop diagram of the NWS and NPIs

| Complexity Science Hub COVID-19 Control Strategies List (CCCSL) | → | 10 clusters of NPIs | → | Assessment of links between NPIs and NWS components by the authors | → | Confirmation of 35 links between NPIs and NWS components from literature | → | Systems map of the NPIs impact on the NWS |

| Identification of the identified effects duration | ← | Stratification of the identified effects by population groups | ← | Formal analysis of direct and indirect effects of NPIs on NWS components |

Systems maps

Direct impact of the COVID-19 pandemic (red) and selected mitigation policies (orange) onto national well-being components (blue).

Too complex to oversee.
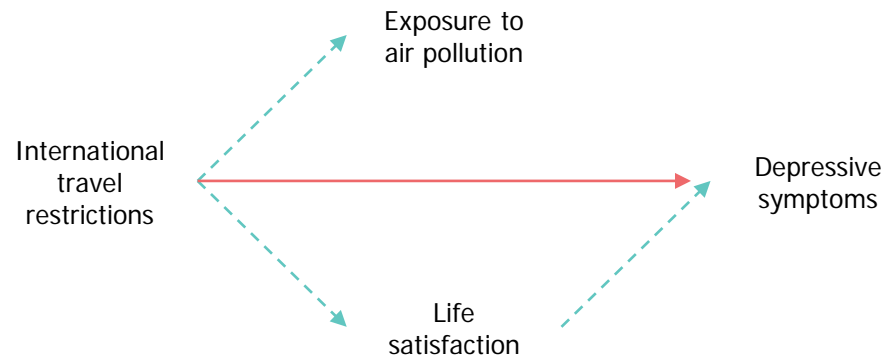Formal analysis tools are needed.

Systems map of the national well-being system (blue components) with direct effects of the COVID-19 pandemic (red component) and selected NPIs (orange components) included.
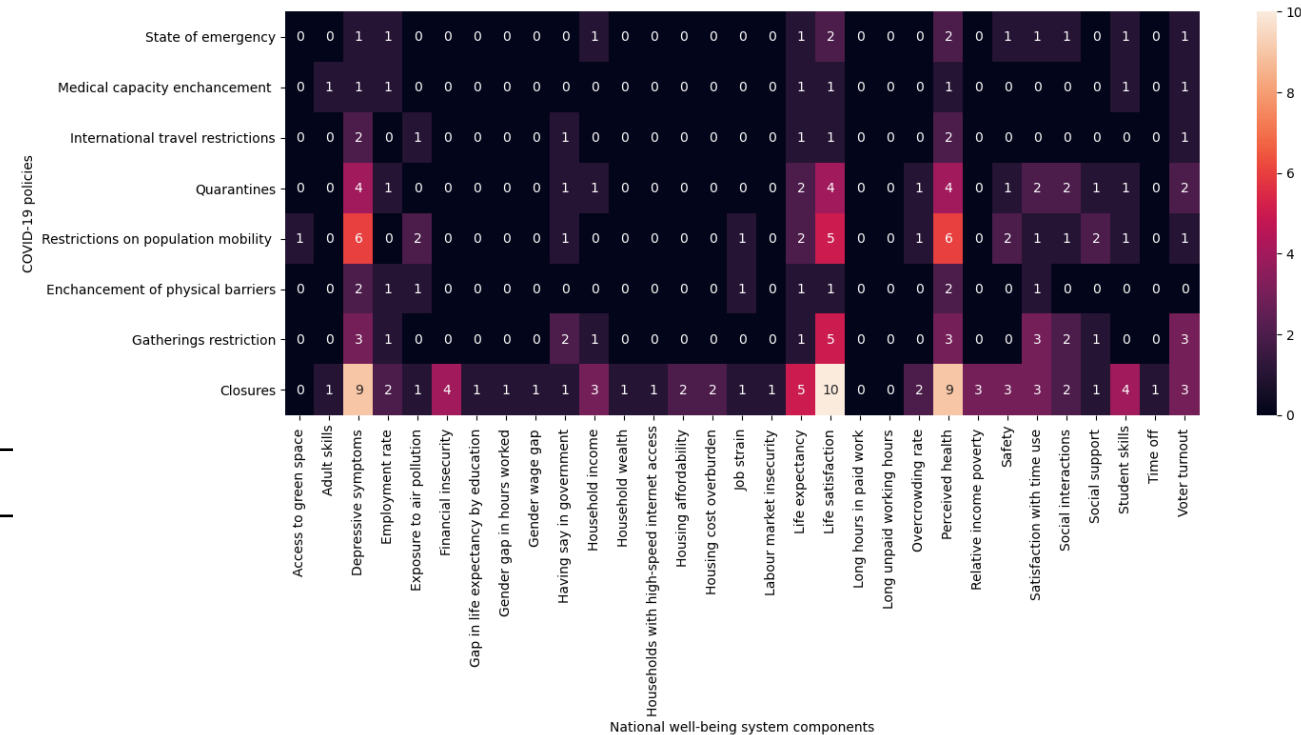
Direct and indirect effects of COVID-19 policies

Impact through other national well-being and intervening components

Exposure to air pollution

International travel restrictions

Depressive symptoms

Life satisfaction

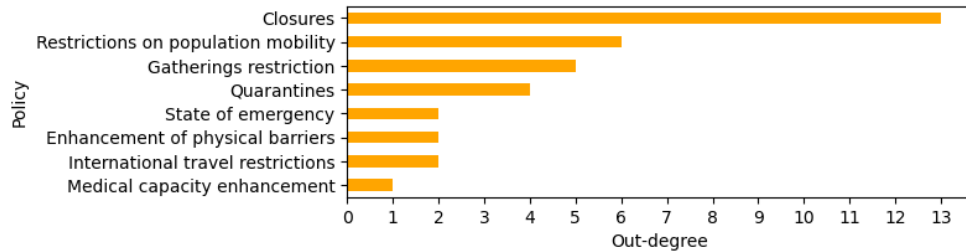| Mitigation Policy	Direct Effects	Indirect Effects	Total Effects	Indirect/Direct Ratio
State of emergency	2	11	13	5.5
Medical capacity enhancement	1	7	8	7
International travel restrictions	2	7	9	3.5
Quarantines	4	23	27	5.75
Restrictions on population mobility	6	27	33	4.5
Enhancement of physical barriers	2	8	10	4
Gatherings restriction	5	20	22	4
Closures	13	65	78	5

Total number of paths of length not greater than 2 (i.e., direct and first-order indirect effects) between COVID-19 policies (NPIs) & national well-being system components.
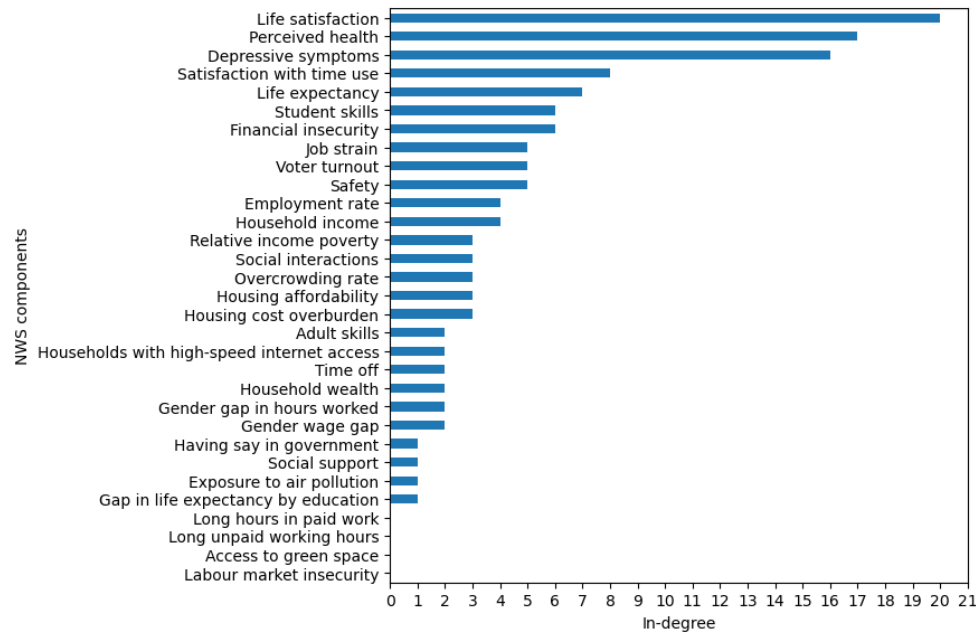
Direct and indirect effects of COVID-19 policies

Out-degrees of the selected COVID-19 mitigation policies.

In-degrees of the National Well-being System components

	Closures	Enhancement of Physical Barriers	Gatherings Restriction	International Travel Restrictions	Medical Capacity Enhancement	Quarantines	Restrictions on Population Mobility	State of Emergency
Access to green space	0	0	0	0	0	0	−1	0
Adult skills	−1	0	0	0	1	0	0	0
Depressive symptoms	?	?	1	?	−1	1	?	1
Employment rate	−1	−1	−1	0	1	−1	0	−1
Exposure to air pollution	−1	−1	0	−1	0	0	?	0
Financial insecurity	1	0	0	0	0	0	0	0
Gap in life expectancy by education	1	0	0	0	0	0	0	0
Gender gap in hours worked	−1	0	0	0	0	0	0	0
Gender wage gap	1	0	0	0	0	0	0	0
Having say in government	−1	0	−1	−1	0	−1	−1	0
Household income	−1	0	−1	0	0	−1	0	−1
Household wealth	−1	0	0	0	0	0	0	0
Households with high-speed internet access	−1	0	0	0	0	0	0	0
Housing affordability	−1	0	0	0	0	0	0	0
Housing cost overburden	1	0	0	0	0	0	0	0
Job strain	1	1	0	0	0	0	1	0
Labor market insecurity	1	0	0	0	0	0	0	0
Life expectancy	?	1	−1	1	1	−1	?	?
Life satisfaction	−1	−1	−1	−1	1	−1	−1	?
Long hours in paid work	0	0	0	0	0	0	0	0
Long unpaid working hours	0	0	0	0	0	0	0	0
Overcrowding rate	1	0	0	0	0	1	1	0
Perceived health	?	?	−1	?	1	−1	?	−1
Relative income poverty	1	0	0	0	0	0	0	0
Safety	−1	0	0	0	0	−1	−1	1
Satisfaction with time use	−1	−1	−1	0	0	−1	−1	−1
Social interactions	−1	0	−1	0	0	−1	−1	−1
Social support	−1	0	−1	0	0	−1	−1	0
Student skills	−1	0	0	0	1	−1	−1	1
Time off	−1	0	0	0	0	0	0	0
Voter turnout	−1	0	−1	−1	1	−1	−1	−1

|			
1 Direct positive effect	**−1** Direct negative effect	**?** Ambiguous effects (direct + indirect)	
1 Indirect positive effect(s)	**−1** Indirect negative effect(s)	**?** Ambiguous effects (only indirect)	

Feedback loops

- A **feedback loop** is a sequence of links connecting components by forming a cycle

- **Reinforcing** feedback loop – an initial increase/decrease of the state of any component further increases/decreases after every cycle

- **Balancing** feedback loop – an initial increase/decrease of the state of any component decreases/increases after every cycle.

- Identifying feedback loops is a **primary analysis method** of systems maps
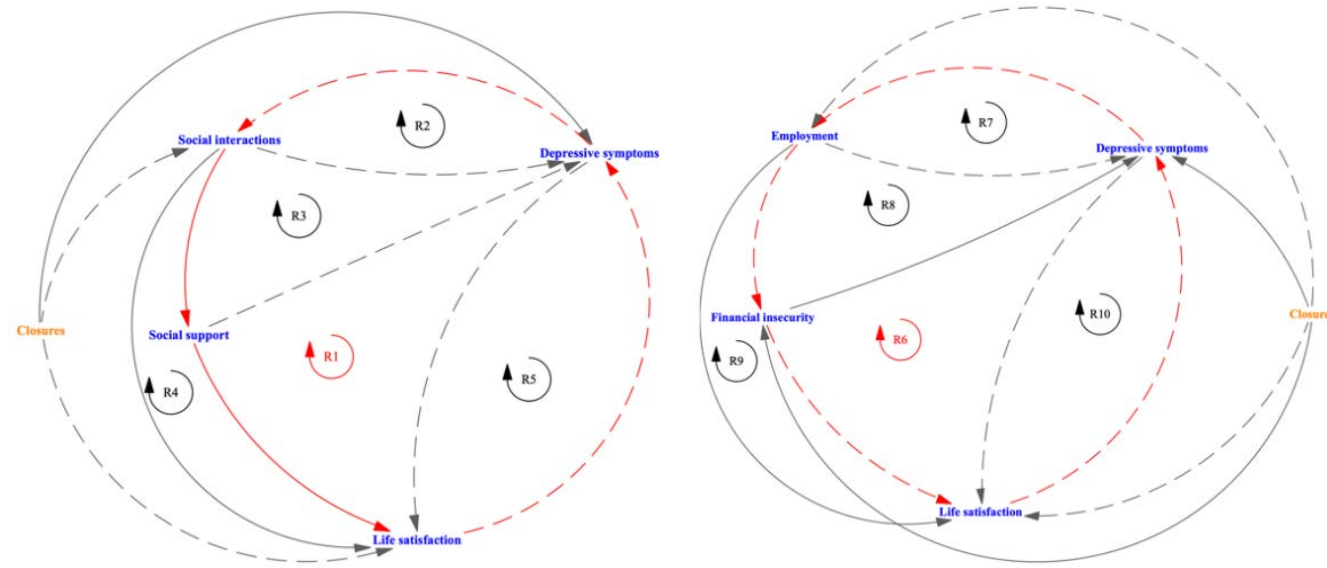
"social driver of life satisfaction"   "economic driver of life satisfaction"
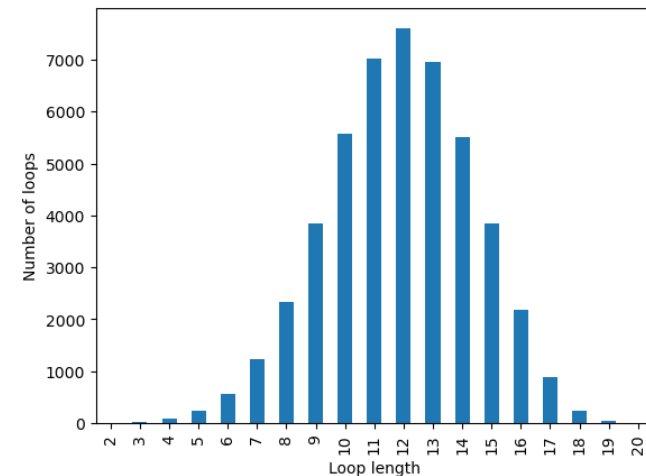
Number of feedback loops of different lengths in the National Well-being System. Loop length is the number of links it contains.

The Equity Effects of COVID-19 on Well-Being

- Group 1: Income and Employment Unaffected

- Group 2: Loss of Job Security and Possibly Some Income

- Group 3: Loss of Jobs

Well-Being Component	Duration of Effect	Group 1	Group 2	Group 3
Access to green space	s/m	−	−	−
Adult skills	l	0	0	(−) ***
Depressive symptoms	s/m/l	+	+	+
Employment rate	s	0	0	(−) ***
Exposure to air pollution	s/m/l	−	−	−
Financial insecurity	m/l	0	0/−	−
Gap in life expectancy by education	0	0	0	0
Gender gap in hours worked	s/m	(+) *	+	+
Gender wage gap	s/m	0	0	+
Having say in government	m/l	−	−	−
Household income	s	0	0/(−) **	−
Household wealth	m/l	0	0/−	−
Households with high−speed internet access	s	0 ****	0	0
Housing affordability	l	0	0	−
Housing cost overburden	l	0	0	+
Job strain	m/l	0	+	+
Labor market insecurity	s	0	+	+
Life expectancy	0	0	0	0
Life satisfaction	m/l	0	−	−
Long hours in paid work	0	0	0	0
Long unpaid working hours	s/m	(+) *	+	+
Overcrowding rate	s	+	+	+
Perceived health	s/m/l	−	−	−
Relative income poverty	s/m/l	0	0	+
Safety	s	0	0	−
Satisfaction with time use	s	−	−	−
Social interactions	s	−	−	−
Social support	s/m	−	−	−
Student skills	m/l	0	0	(−) ***
Time off	0	0	0	0
Voter turnout	m/l	−	−	−

* In cases where needed childcare was affected; ** Depending on the extent to which income affected; *** Affecting mainly those who are dependent on public transport; **** While this well-being component is not affected by the COVID-19 mitigation policies, it has been observed that the number of households with high-speed Internet access has increased to facilitate, among other things, remote work.

Source: Strelkovskii, N.; Rovenskaya, E.; Ilmola-Sheppard, L.; Bartmann, R.; Rein-Sapir, Y.; Feitelson, E. Implications of COVID-19 Mitigation Policies for National Well-Being: A Systems Perspective. *Sustainability* **2022**, *14*, 433. https://doi.org/10.3390/su14010433

Conclusions

- **Business closures (lockdowns)** directly and/or indirectly impact more national well-being components than any other policy

- The most affected national well-being components by all policies are **life satisfaction**, **perceived health**, and **prevalence of depressive symptoms**

- Various components of national well-being system are highly intertwined

- Impact of COVID-19 policies on national well-being components happens over multiple, often contradictory pathways; strength and timing of individual impacts define the overall impact

- Policy interventions to enhance resilience should be planned taking this multiplicity and heterogeneity of impacts into account, this can help minimize risks of unintended consequences

Applications and limitations of the systems approach

- Systemic (better) decision-making
  - Sense-making, understanding of indirect and feedback effects of policies
  - Identification of leverage points, tradeoffs and synergies ("triple win policies")
  - Development of simulation models, e.g., systems dynamics

- Human brains have limited ability to execute systems thinking (Levy et al., 2018)
- Systems maps might be biased by their authors' expertise, beliefs and values
  - Use external literature for validation
- Lack of quantitative perspective
  - Simulation or quantification nearly always adds value, even under uncertainties and difficulties related to the quantification of soft variables (Homer et al., 2001)

Possible ways forward

- Customize the systems map for concrete policy-relevant questions and/or countries and areas
  - Connecting to SDGs
- Use empirical data to confirm/reject the connections on the system map
  - Structural equation modeling, SEM
  - PVAR
- Use advanced methods for systems maps analysis (e.g., graph and network theory)
  - What is the net effect of a policy A on the outcome B – through all links connecting A and B directly and indirectly (higher orders)?
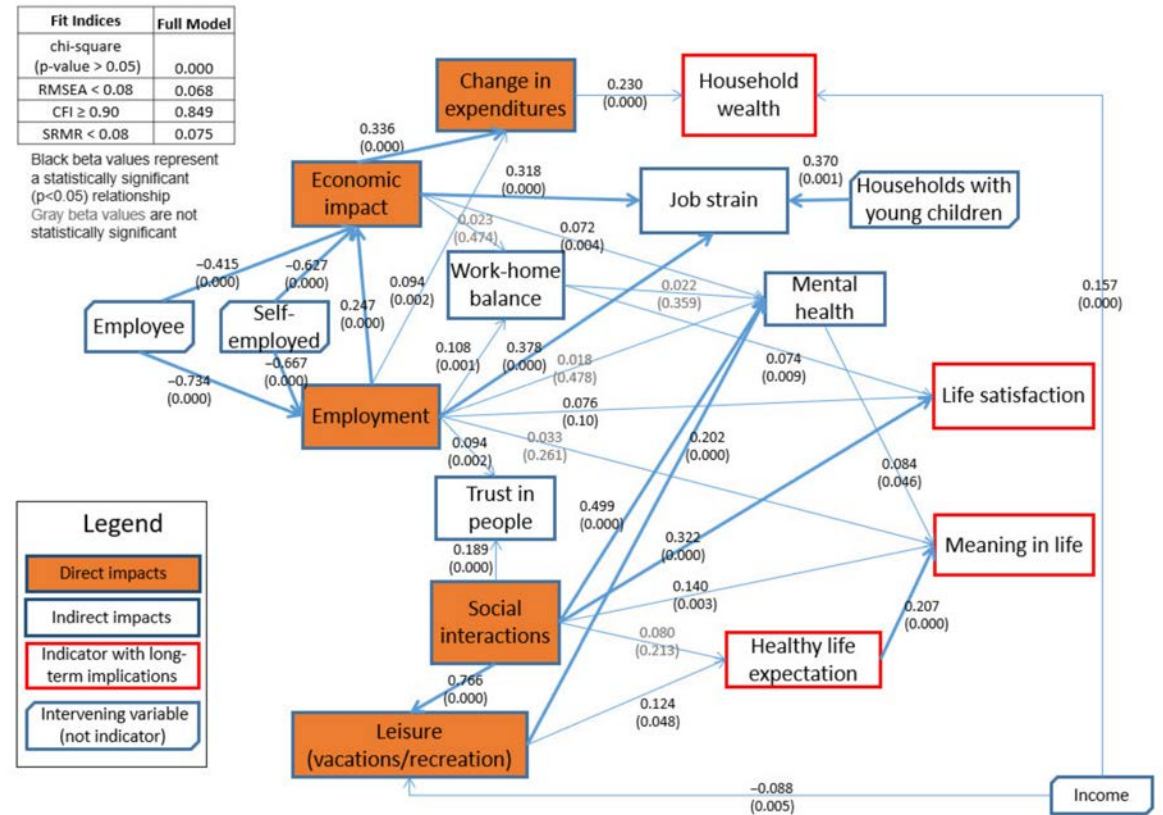
Source: Feitelson E, Plaut P, Salzberger E, Shmueli D, Altshuler A, Ben-Gal M, Israel F, Rein-Sapir Y, Zaychik D. The Effects of COVID-19 on Wellbeing: Evidence from Israel. *Sustainability*. 2022; 14(7):3750

PVAR WITH CONSTRAINT		Lagged variables						
		Neighbourhood safety	HH income	Higher education	Interpersonal trust	Life expectancy	Social support	Life satisfaction
Dependent variable	Neighbourhood safety		11.837***	0.751***				
	HH income			0.002				
	Higher education							
	Interpersonal trust	0.265***		-0.038				1.865**
	Life expectancy		0.903**	0.063***			0.028***	
	Social support			-0.017	0.136***			
	Life satisfaction	0.012***	1.907***				0.003	

Source: Murtin F. Unpublished note. 2021

Thank you for your time!

Questions?

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