Population-Scale Study of Human Needs

During the COVID-19 Pandemic: Analysis and Implications

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MOTIVATION

Existing studies and datasets of the COVID-19 pandemic focus on biomedical and epidemiological aspects of the case and fatality rates. However, the pandemic also presents societal, economic, and psychosocial challenges.

Therefore, **we need to understand the impact of the pandemic on the system of human needs to inform pandemic preparedness and responses.**

SUMMARY

We present a computational framework for quantifying effects of the pandemic on human needs expressed through web search interactions.

Basic needs were elevated while growth needs were subdued.

Earlier and longer shelter-in-place mandates may have unintended consequences on social-emotional needs.

We exposed gaps between reported and expressed needs.

HUMAN NEEDS FRAMEWORK

Search interactions

Human needs are expressed and fulfilled through seeking information or obtaining tangible support or material items
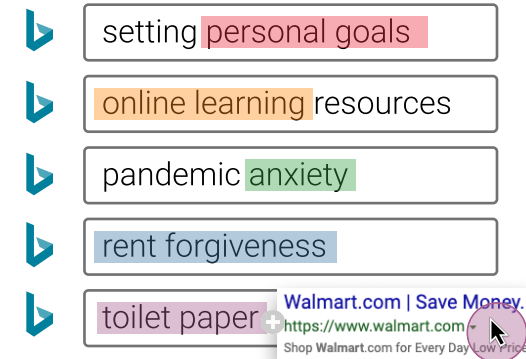

Categorization

We define five broad categories of needs that can be extracted from web searches, inspired by Maslow's hierarchy of needs.

Self Actualization
Cognitive
Love and belonging
Safety
Physiological
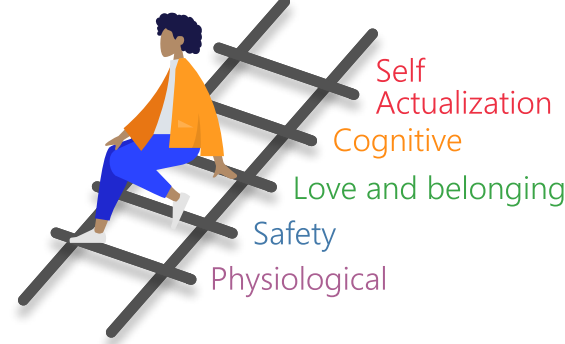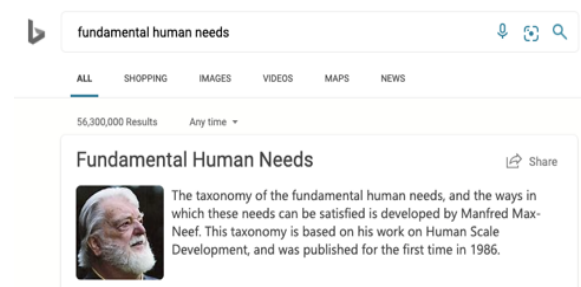
Detection

Each search interaction is tagged with one or more need categories using regular expressions and basic propositional logic.

setting personal goals

online learning resources

pandemic anxiety

rent forgiveness

toilet paper   Walmart.com | Save Money. L
https://www.walmart.com
Shop Walmart.com for Every Day

Quantification

We use difference-in-differences method to quantify the relative changes in needs expression, while accounting for weekly, seasonal, and query volume variations.

$$C(t_1; t_2, n) =$$

$$\log_2\left(\frac{E(t_2^{2020}, n)}{E(t_1^{2020}, n)}\right) - \log_2\left(\frac{E(t_2^{2019}, n)}{E(t_1^{2019}, n)}\right)$$

FINDINGS

1   How did human needs change over time?

A B C Physiological needs are the first rise with health condition interests and COVID-related purrchase intents.

D Online education interests start to dominate around the start of shelter-in-place mandates.

E Hobbies and online social activities gradually increase.

F Stimulus and unemployment queries dominate.

**G H** Second rise of health and economic concerns appear as COVID cases rise
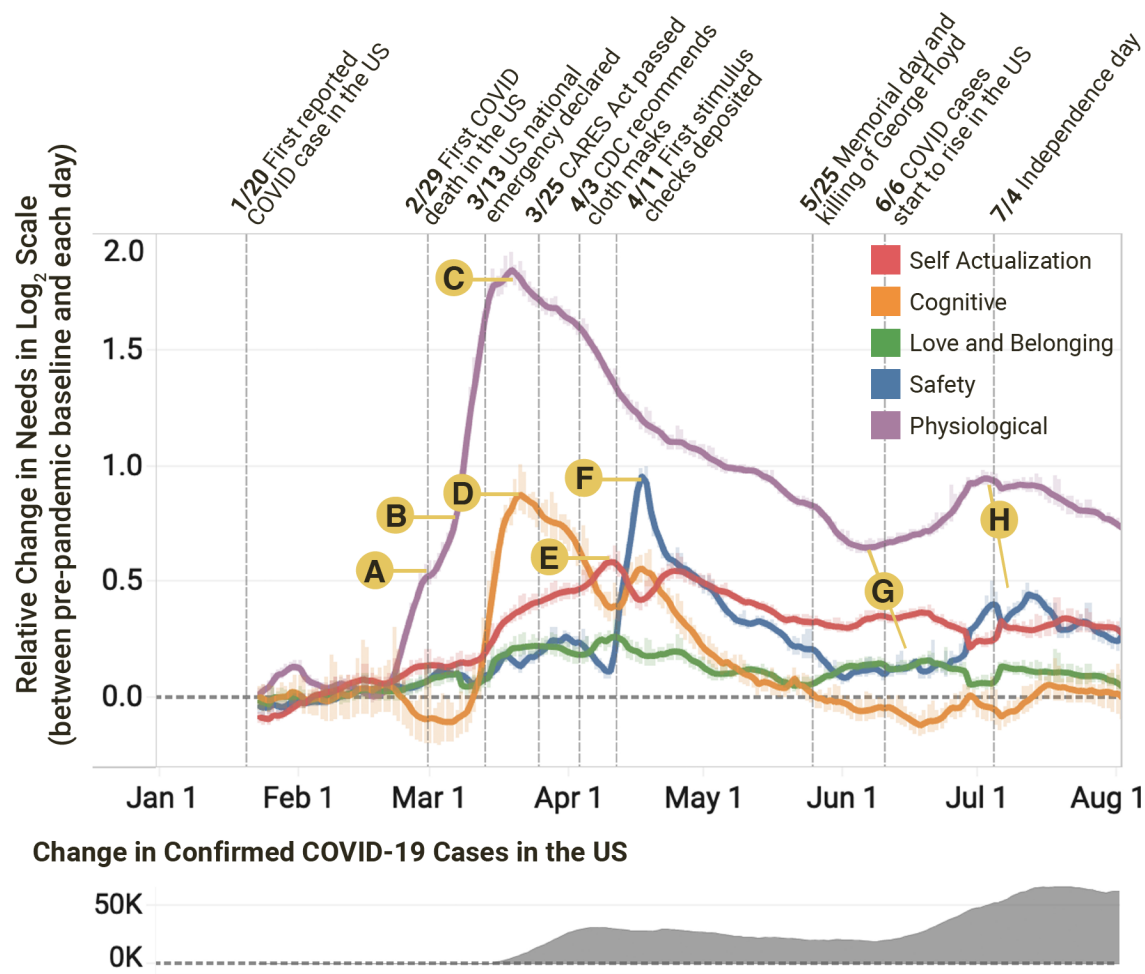
2   Which needs increased or decreased the most?

Basic needs are heightened, while growth needs are subdued.

A - D Unemployment, food assistance, and online social activity needs have not returned to pre-pandemic baseline indicating prolonged economic instability and social isolation.

**E - H** Growth needs indicative of positive outlook remain below pre-pandemic baseline.

Need	Need Subcategory	C_{mean}	C_{max}	$2^{C_{max}} - 1$
Phys	Toilet paper purchase	6.11±0.08	7.00	12691.1%
Safe	Stimulus related queries	5.69±0.03	8.17	28601.9%
Safe	Unemploy. related queries	4.88±0.02	5.72	5156.4%
Safe	State unemploy. site visits	4.81±0.04	6.26	7585.1%
Safe	COVID-19 prot. purchase	4.67±0.03	5.57	4634.0%
Phys	Health meas. equip. purchase	3.43±0.04	4.56	2257.2%
Phys	Health cond. related queries	3.12±0.01	3.54	1065.6%
Phys	Food assist. related queries	2.62±0.03	3.12	771.8%
Phys	Grocery related queries	2.05±0.01	2.54	480.8%
Phys	Food delivery queries	1.84±0.02	2.26	379.7%
L&B	Online social act. queries	1.77±0.09	2.98	688.4%
Phys	Food delivery site visits	1.7±0.01	2.26	379.3%

| Need	Need Subcategory	C_{mean}	C_{min}	$2^{C_{min}} - 1$
SA	Wedding related purchase	-1.49±0.03	-1.76	-70.4%
SA	Wedding site visits	-1.25±0.02	-1.56	-66.2%
Cog	Edu. degree related queries	-0.87±0.06	-1.09	-53.1%
Safe	Housing related queries	-0.71±0.05	-1.09	-53.2%
Safe	Job search related queries	-0.65±0.03	-0.91	-46.7%
Safe	Job search site visits	-0.61±0.02	-0.95	-48.1%
Phys	Apparel purchase	-0.60±0.01	-0.84	-44.1%
SA	Outdoor related queries	-0.59±0.01	-1.07	-52.3%
SA	Life goal related queries	-0.57±0.09	-1.23	-57.2%
Safe	Domestic violence queries	-0.54±0.04	-0.97	-49.0%
Safe	Rental related queries	-0.53±0.06	-0.82	-43.5%
L&B	Divorce related queries	-0.49±0.03	-0.93	-47.3%
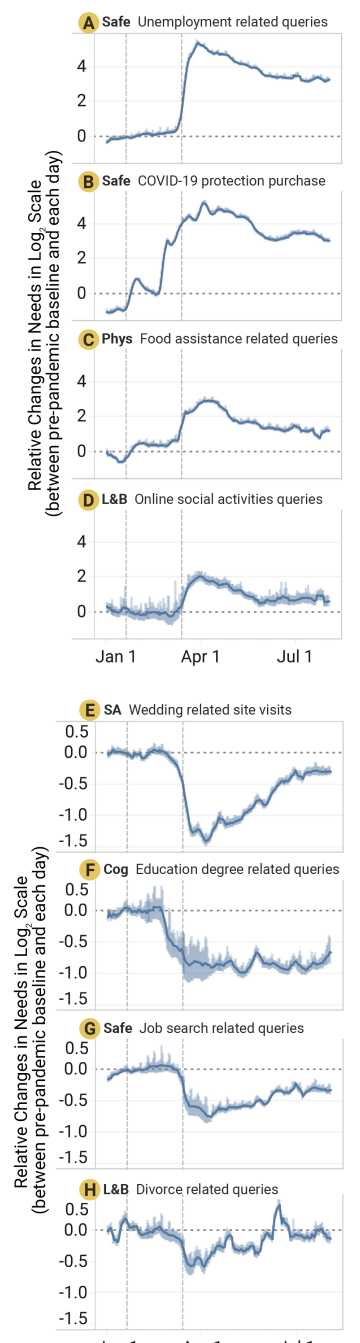
3   How do shelter-in-place (SIP) policies impact social-emotional and relationship needs?

A B Earlier SIP start dates are correlated with more mental health site visits and fewer online social activities queries.

C D Longer SIP durations are correlated with more negative mental health experiences and fewer wedding site visits or purchases.
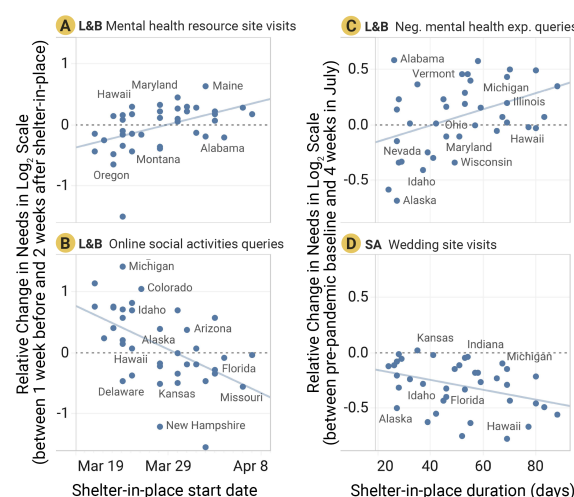
4   Are web needs expressed more than reports?

A Similar patterns between web and USDOL data can be seen, but discrepancies could indicate additional search needs for unemployment related information.

B Initial decrease in domestic violence needs match reports from national hotlines. Given increased risk of domestic violence during the pandemic and increased firearm purchase intents, additional investigation is necessary to understand potential barriers to online resources.
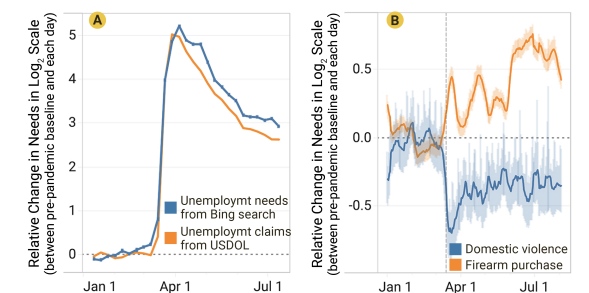
IMPLICATIONS

Resilience and vulnerability

Changes in needs can be an indication for a level of psychological and economic resilience and vulnerability. We need to understand how a community can endure social and economic distress and which communities are disportionally and negatively impacted.

Preparedness and resources

Changes in needs can guide efforts in preparing responses to future events and providing access to resources. Understanding the impact of differing policies or identifying potential barriers to expressing or fulfilling the needs can help prepare adequate support and increase access to critical resources and interventions.

For full appendix, check out

https://arxiv.org/abs/2008.07045

Thank you

We thank the reviewers and colleagues for their valuable feedback.