Outreach of vaccine-critical content

on French-speaking Twitter

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Twitter data

Extracted only tweets in French merging 3 keyword searches:

- Vaccines
- COVID-19
- Hydroxychloroquine

From this dataset we extract tweets on both **vaccines** AND **COVID-19**.

Numbers	
3M	tweets
10M	retweets
840k	users
360	vaccine-critical URLs
382	news media URLs

Reach of vaccine-critical content?

Question

Does vaccine-critical advocates extended their reach during the COVID-19 pandemic?

Methods:

- Engagement analysis of users sharing a set of URLs.
- Community detection and their role in content spreading.

User engagement

Engagement

Engaged users share a URL from the set within a time window $\tau = 3$ days.

$$dE_t = \alpha_t \frac{E_t(N_t - E_t)}{N_t} - \beta_t E_t$$

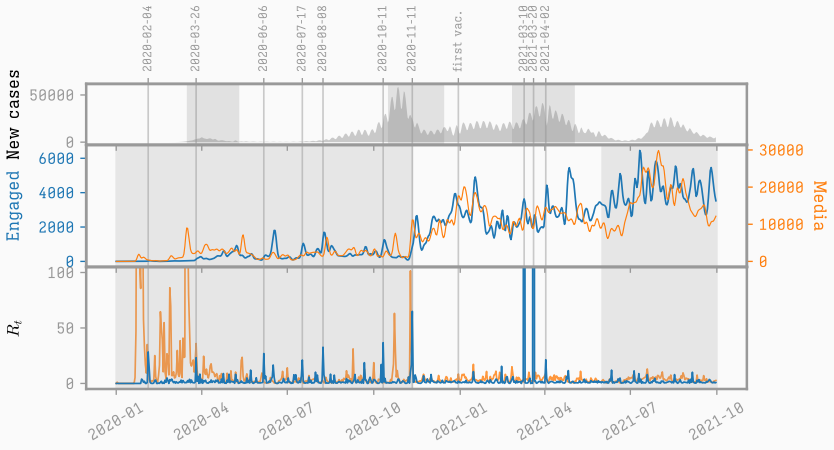
$$R_t = \frac{\alpha_t}{\beta_t}$$

α_t engagement rate

β_t disengagement rate

R_t reproduction number

Engagement evolution



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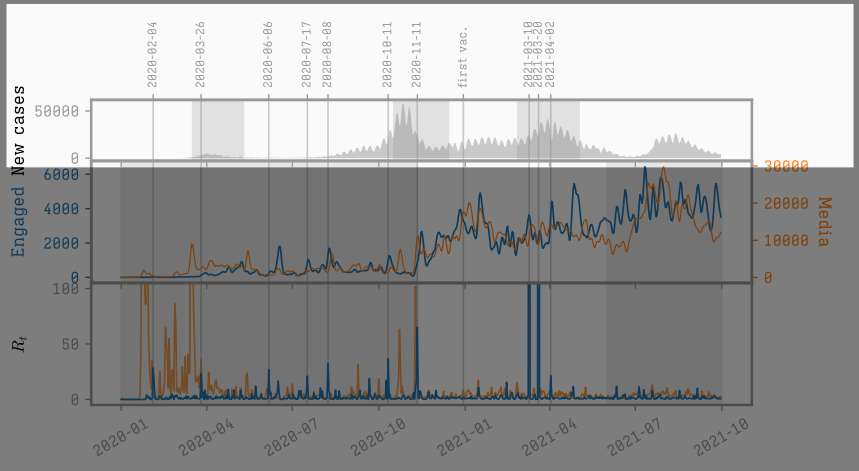

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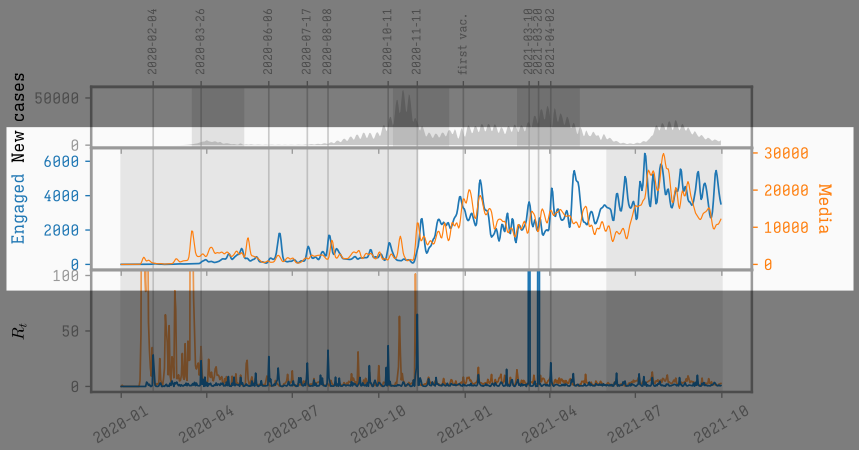

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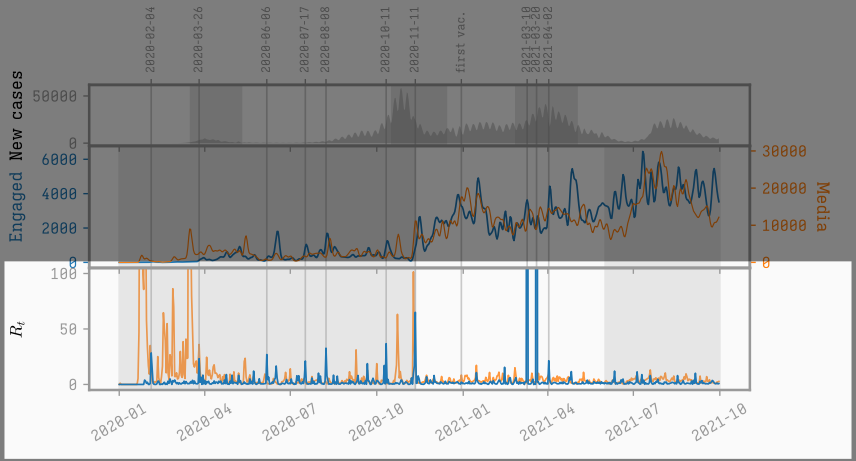

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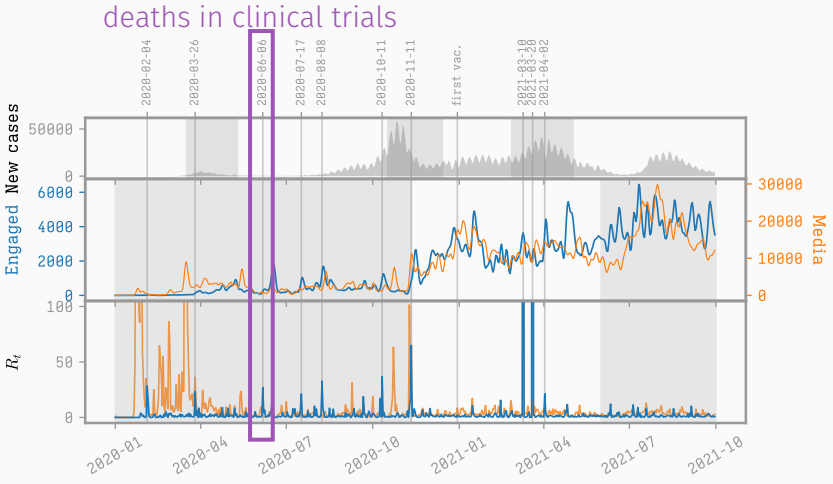

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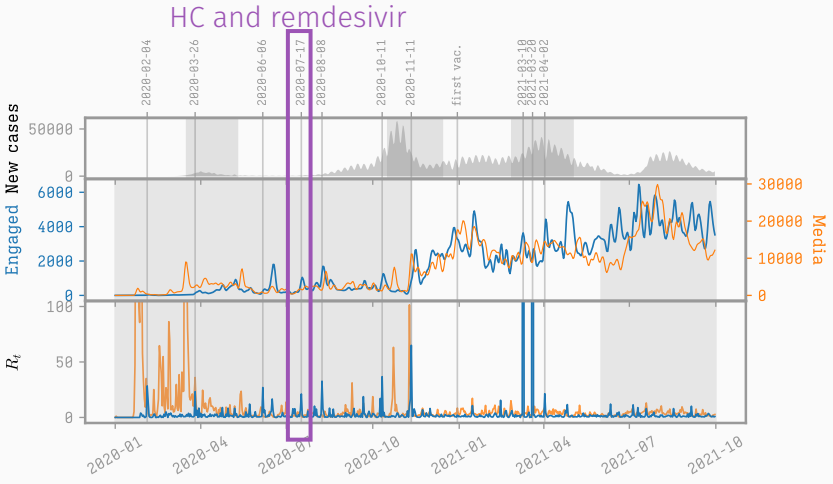

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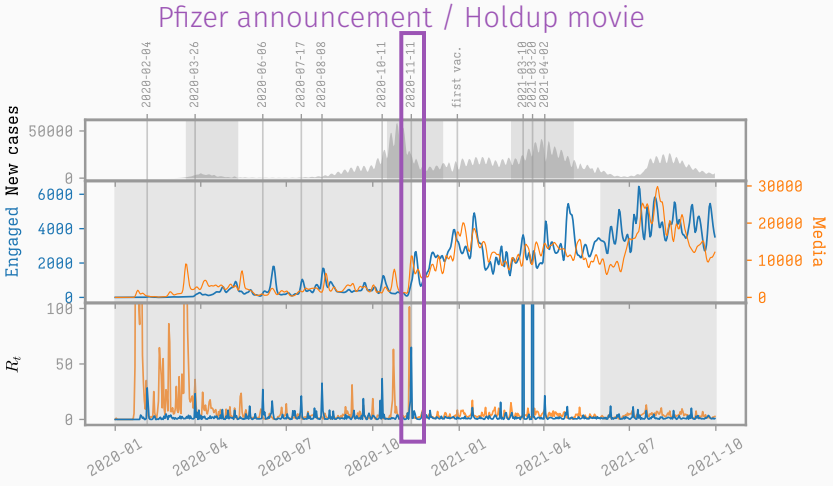

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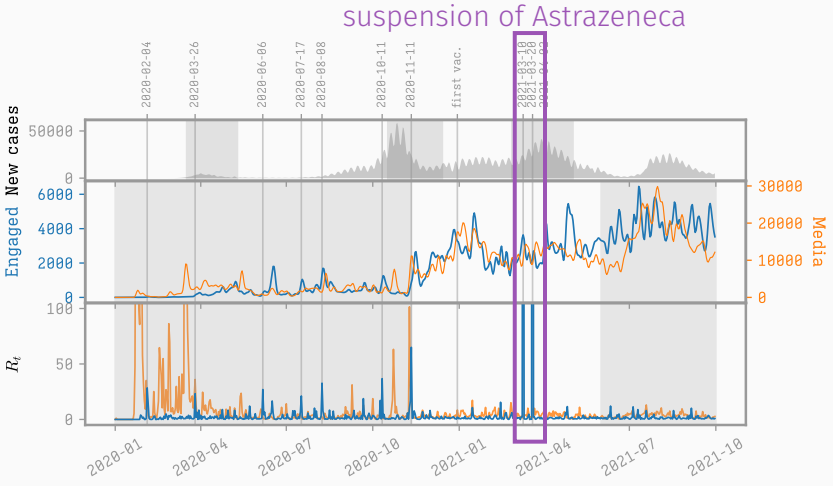
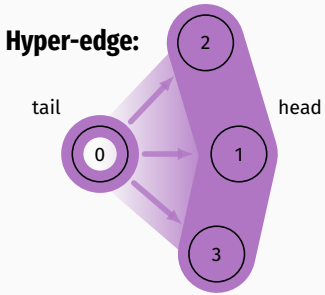


Community structure and role

Hypergraphs



node	role
0	tail
1, 2, 3	head

Hypergraph: $\{N, E\}$: nodes and hyperedges

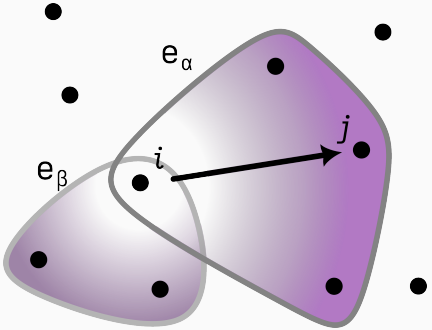
Nodes: same as before

Hyperedges: $e_\alpha = \{\text{tail}, \text{head}\} \in E$

Random walker on a hypergraph

The walker

- sits on a node i
- chooses a hyperedge e_α incident on i in its tail (user i tweeted α);
- chooses an exit node j from the head of e_α (α get retweeted by user j).



Yes but why?

Dynamics and Modularity

Modularity is a function of the dynamics:

$$Q = \sum_c \mathbf{Cov}\left(\chi_c(t), \chi_c(t+1)\right)$$

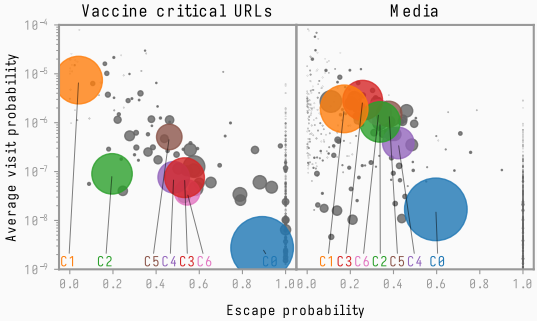
where χ_c is the characteristic function of class c.

Usual modularity:

$$Q = \frac{1}{2m} \sum_{ij} \left[A_{ij} - \frac{k_i k_j}{2m} \right] \delta(c_i, c_j)$$

Shen et al. (2010) PRE, 82, 016114

Communities and roles



Visiting probability probability of being visited by a random walker (a retweet)

Escape probability probability of reaching other communities (being retweeted outside one's bubble)

Comm.	Interpretation
C_0	media aggregators or web influencers.
C_1	Far right groups.
C_2	health institutions and MDs
C_3	French news media.
C_4	international news media.
C_5	Far left and trade unions.
C_6	government representatives.
C_7	Canada

C_1 and C_5 are the main actors in spreading vaccine-critical content (high visiting and escape probability).

Community URL usage pattern.

Clustering of communities by URL usage pattern.

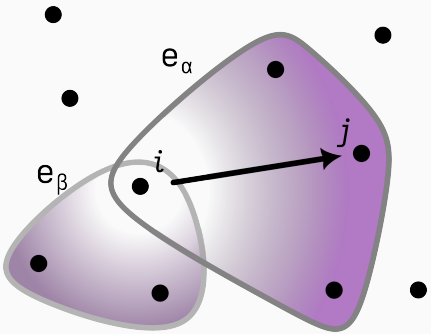
right wing C_1 use an original body of URLs.

left wing and news media use a similar set or sources.

health institutions use an original set of sources.

⏳ Finally...

Questions?



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arxiv:2202.10952 ←Vaccines and Covid

arxiv:2202.12810 ←Directed Hypergraphs