How COVID-19 has Impacted the Anti-Vaccine Discourse:
A Large-Scale Twitter Study Spanning Pre-COVID and Post-COVID Era

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ICWSM 2024

Motivation and Research Questions

- Even though the COVID-19 pandemic is behind us, still important to understand how the anti-vaccine discourse has changed due to the pandemic
  Especially important for several non-COVID vaccines that still need to be administered regularly

- How to identify people's specific anti-vaccine concerns from their social media posts? ▶ Proposed **CoV-Gen**, that leverages label descriptions
- How has the online anti-vaccine discourse changed due to the COVID19 pandemic? ▶ Much more diversity of concerns since the pandemic
- Has the discourse around non-COVID vaccines changed? ▶ Many people now associate COVID vaccine concerns with non-COVID vaccines
- Are the concerns of "Converted Anti-Vaxxers" same as the "Traditional Anti-Vaxxers"? ▶ No! More concerns about Ineffectiveness, Rushed, etc.

CAVES Dataset[1]

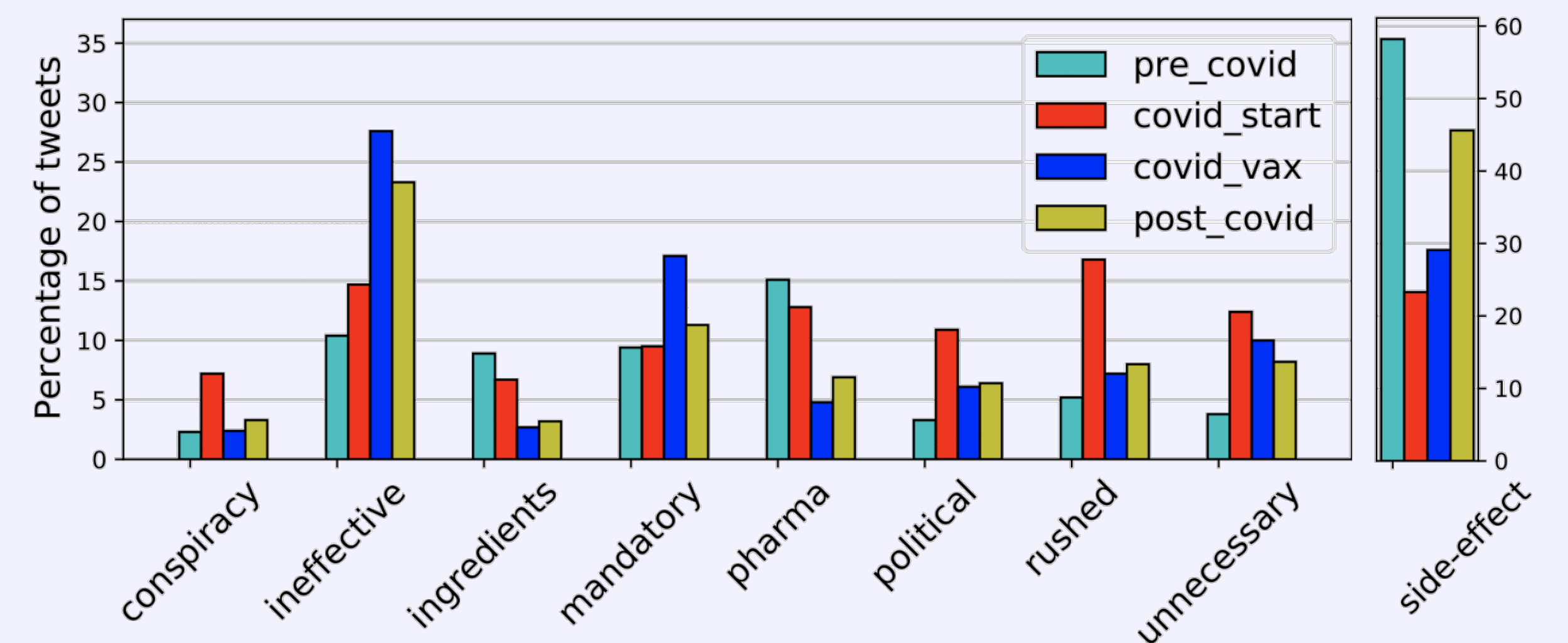A large-scale dataset of **10k Anti-Vax tweets** labelled with **12 vaccine concerns** in a **Multi-Label** setting.

Conspiracy	Country	Ineffective	Ingredients	Mandatory	Pharma
Political	Religious	Rushed	Side-effect	Unnecessary	None

> *The reason insurance companies won't pay out if you experience the inevitable **adverse reactions, including death** is because it is an "**Experimental Vaccine**"*
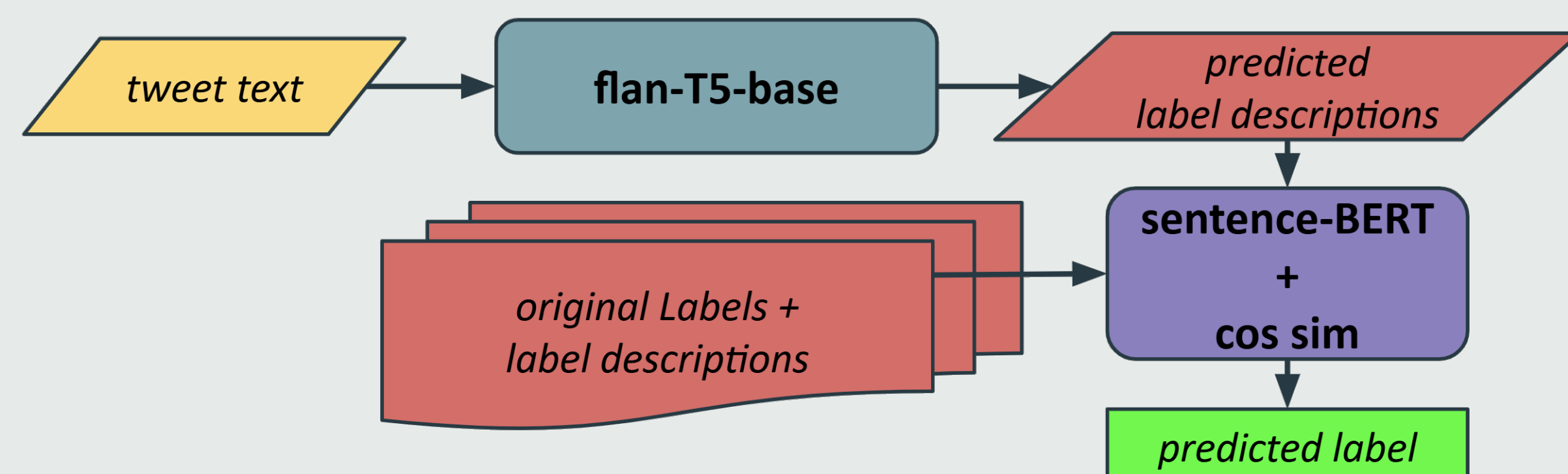
side-effect   **rushed**

[1] S Poddar, AM Samad, R Mukherjee, N Ganguly, S Ghosh "CAVES: A Dataset to facilitate Explainable Classification and Summarization of Concerns towards COVID Vaccines", SIGIR Resource Track 2022

CoV-Gen classifier

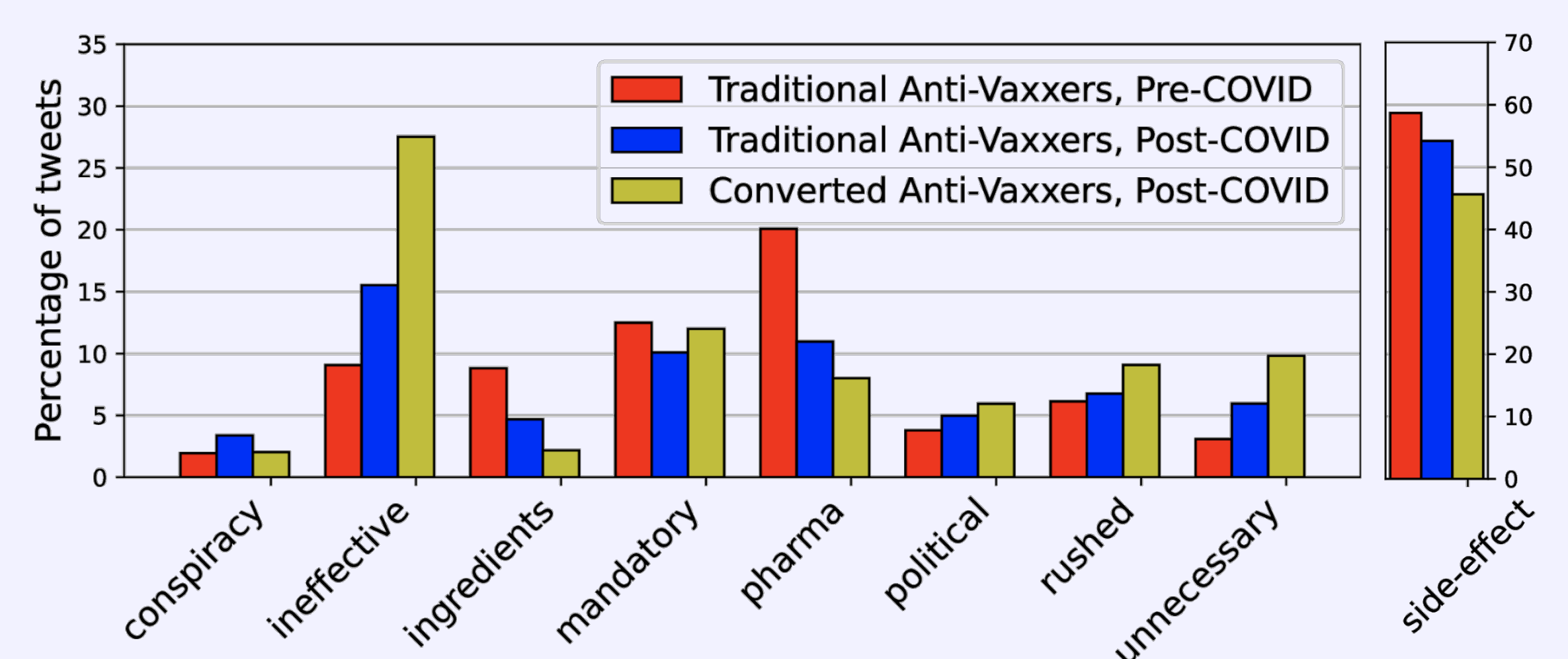| Flan-T5 Input: Prompt + Query (tweet)	Target Label description
Instruction: Read the task description. There could be multiple categories for a tweet. Task: Multi-label Text Classification Description: Generate label description for the given text. *A vaccine that cant prevent reinfection? No thanks I trust my own immunity thats over 99.5% effective.*	The tweet expresses concerns that the vaccines are **not effective** enough and are useless. The tweet indicates vaccines are **unnecessary**, or that alternate cures are better.

Results on the CAVES dataset

Classifier	Macro-F1	Weighted-F1	Jaccard Sim
RoBERTa-Large	0.6626	0.7319	0.6949
CT-BERT	0.6924	0.7419	0.7040
Multi-Task	0.6823	0.7371	0.7018
Chat-GPT (0-shot)	0.4447	0.5234	0.4642
CoV-Gen	**0.8525**	**0.8966**	**0.8885**

Data preparation for analysis

- Collected vaccine-related tweets between Jan 2018 - Jan 2023
- Vaccine-stance classifier from prior work[2] used to filter **Anti-Vax** tweets with high confidence.
- Ran **CoV-Gen** on remaining **19.6M Anti-Vax tweets**.

Pre-COVID | COVID-start | COVID-vax | post-COVID

Jan-2018   Jan-2020   Dec-2021   Apr-2022   Jan-2023

- COVID-19 declared a health emergency
- COVID-19 vaccines started rolling out to general public
- COVID-19 cases/deaths decline, #vaccinations saturate

[2] S Poddar, M Mondal, J Misra, N Ganguly, S Ghosh "Winds of Change: Impact of COVID-19 on Vaccine-related Opinions of Twitter users", ICWSM 2022

Overall trends in Anti Vaccine Discourse

- Before COVID, mostly **side-effect** and **pharma**
- Since COVID, much more diversity of concerns
- Trends returning back post-COVID, but some lingering changes

Concerns about Non-COVID vaccines

▶ **Post-COVID**, new concerns about **COVID vaccines** projected onto **non-COVID vaccines**

> *I **will not be getting a flu shot 4 the first time** in many years. **Never a covid booster!** Not getting a pneumonia shot either. But **I've lost all confidence in CDC protocols**. They can't be trusted*

> *Not sure I would **vaccinate a child against MMR**. I **prioritize not having my record in any database**. Like covid, logic that it is a "public health emergency", won't get me to cave*
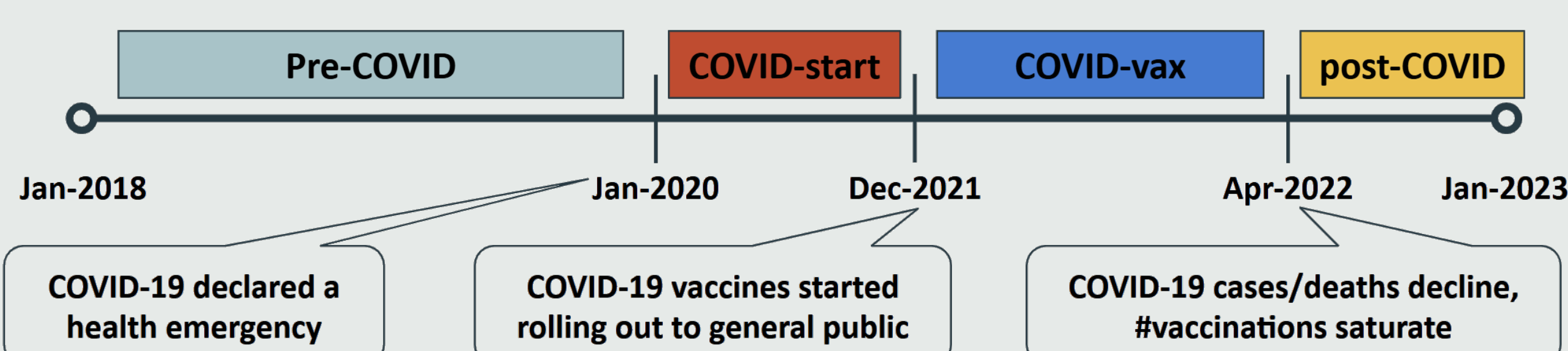
Converted vs Traditional Anti-Vaxxers

- Not the same concerns! More **Ineffective**, less **side-effect**, etc.

Implications

- **CoV-Gen** can be used to automatically gain insights on specific anti-vax concerns of a person or a group of people.
- **Personalise counter-arguments:** Vaccine concerns have become much more varied; generic counter-arguments may not be enough.
- **Mitigate concerns towards non-COVID vaccines:** Many people associate their concerns about COVID vaccines with the non-COVID vaccines.

More Details about our Work

Preprint (arxiv) and Github links