Public Reaction to Pharmaceutical Preannouncements on Social Media: A Signaling Perspective

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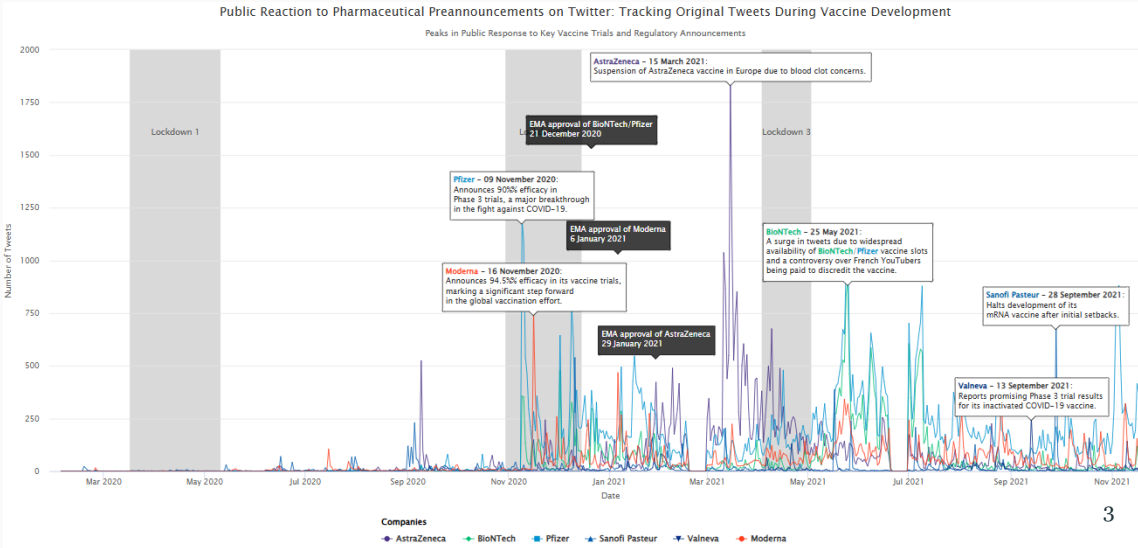
Context During the COVID-19 Pandemic

During the COVID-19 pandemic, the global demand for a vaccine created immense public and market pressure.

- **Massive market potential**: global market in need of billions of doses => **high R&D costs**.
- **Accelerated regulatory processes**: Agencies like the **EMA** fast-tracked approval procedures to respond to the crisis.
- **Intense competition**: A race to develop the first vaccine to secure **first mover advantage**

Context Timeline



Research Problem and Objectives

Problem: How do pharmaceutial preannouncements impact public reaction during COVID-19?

Objectives:

1. Explore public reactions using Twitter data.
2. Analyze sentiment variations and side effects mentions.

Theoretical Framework

- **Signaling theory** explains how companies use signals to reduce uncertainty in markets with high stakes and information asymmetry (Spence, 1973; Akerlof, 1978; Eliashberg & Robertson, 1988).
- **Preannouncements** serve a dual role:
  1. Inform regulators to build trust and smooth approval processes.
  2. Influence competitors and the public to secure a competitive edge.
- **Negativity bias** suggests that negative signals (e.g., side effects) often dominate public discourse more than positive ones (Baumeister et al., 2001).

Hypotheses

We hypothesize that:

1. **Asymmetry in Signals:** Positive signals (e.g., high efficacy) will generate positive sentiment, while negative signals (e.g., side effects) will generate stronger negative reactions.
2. **Backlash Effect:** Sentiment initially aligns with the direction of the signal (positive or negative) but subsequently reverses.

Methodology Overview

We analyzed **French-language tweets** (2020-2021) mentioning major pharmaceutical companies authorized to market a COVID-19 vaccine in France:

- **Pfizer/BioNTech**, **Moderna**, **AstraZeneca**, **Sanofi**, **Johnson & Johnson**. Using **regular expressions** to detect mentions, we focus on **Pfizer**, **Moderna**, and **AstraZeneca** due to their larger presence in discourse.
- **Named Entity Recognition (NER):** We used **GLiNER** (Zaratiana et al., 2024) to extract side effects.
- **Sentiment Analysis:** We used **XLM-RoBERTa**, a transformer-based model fine-tuned on multilingual tweets (Barbieri et al., 2021), to classify tweets into **positive**, **neutral**, or **negative**.

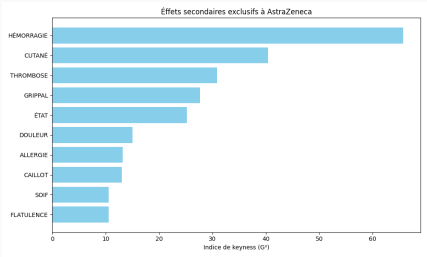
Results: Side Effects in Public Reaction

Public reaction to **side effects** significantly impacts perceptions of vaccine safety.

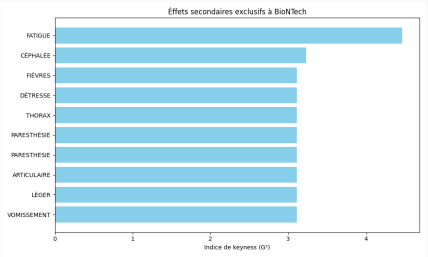
Figure 2: Word cloud showing the top side effects per company

Results: Exclusive Side Effects

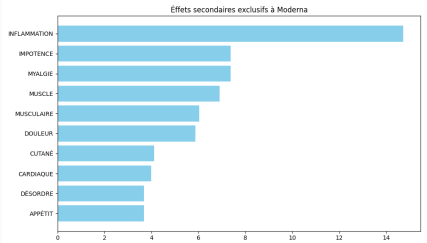
AstraZeneca



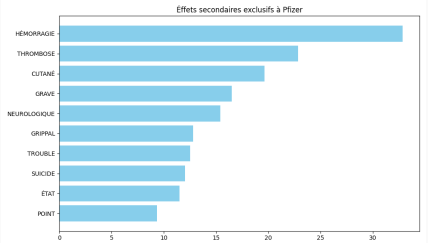
BioNTech



Moderna

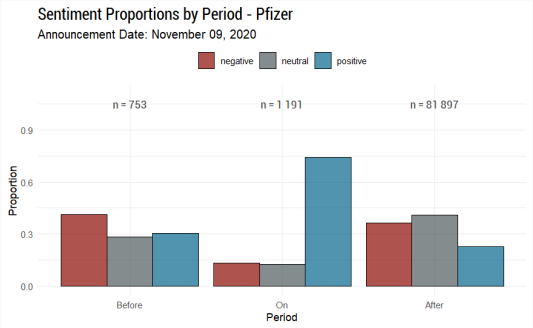


Pfizer

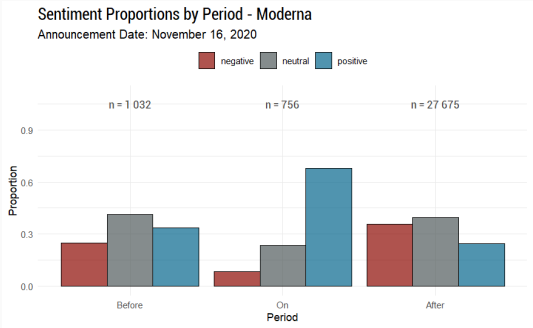


Results: Public Sentiment Pfizer & Moderna

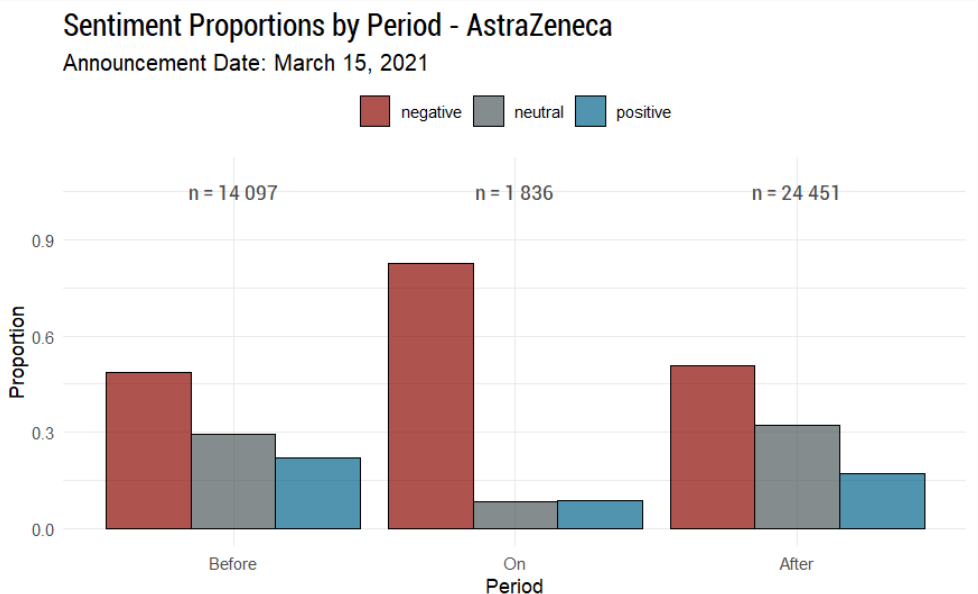
Pfizer



Moderna



Results: Public Sentiment AstraZeneca



Discussion

- Negative signals overshadow positives (negativity bias).
- Strong brand leadership attracts both attention and scrutiny.
- Crisis communication is vital to mitigate reputational damage.
- Preannouncements are double-edged: they show progress but invite closer public monitoring.

Future Research Directions

- Investigate how signals affect long-term trust and brand perception.
- Examine social media sentiment's impact on regulatory decisions.
- Segment populations (media, health professionals, politics, etc.) to identify within-segment variations.
- Use LLMs to clarify genuine brand targeting vs. incidental mention and more nuanced sentiment analysis.
- Implement social listening for agencies (EMA, ANSM, etc.) to quickly detect side effects and complement official reports.