This report is an effort to summarize social media conversations around COVID-19 issues in Pennsylvania, focusing on vaccination. It contains an analysis of the general topics about the current pandemic, such as COVID-19 regulations, mandates, masks, pro- and anti-vaccination campaigns, as well as other topics related to COVID-19 misinformation, disinformation, conspiracy theories, and vaccine hesitancy messages.

The material contained in this report is a summary of social media content and does not represent a judgment or characterization of any individual.
Process Description

- To get a broad sense of the Twitter conversation about vaccines and vaccine misinformation we have collected tweets based on a combination of keyword-based and location-based methods.

- Locations are assigned to tweets based on a mix of the following: Twitter’s own location-based search operations, Twitter’s annotations, and our own machine-learning based tool.

- We are focused on the 5 following locations:
  - 4 larger city areas: Philadelphia, Pittsburgh, Allentown/Bethlehem, Erie
  - 1 area comprised of as much of the rest of PA as is possible (rural areas plus other smaller urban areas) – this is not currently shown in these slides

Types of Discussions

- It is helpful to be aware that Twitter conversations around vaccines and vaccine misinformation may contain a variety of types of discussions:
  - Pro-vaccine news and information
  - Honest questions/concerns about vaccines
  - Informative responses to questions
  - Misinformation and disinformation about vaccines
  - Informative responses to misinformation/fact-checking
  - Pro-vaccine satire/sarcasm/personal attacks against proponents of anti-vaccine views
  - Anti-vaccine satire/sarcasm/personal attacks against proponents of pro-vaccine views/government and medical professionals
Vaccine Narrative Descriptions

- **Overall Vaccine Conversation:** tweets that mention any of a set of vaccine keywords
- **Vaccine Passports:** mix of discussions mentioning vaccine passports
  - Misinfo: “Mark of the Beast” – religiously-tinged conspiracy theory that vaccines and vaccine passports represent the mark of the Devil from an interpretation of Christian end times scripture
  - Mixed: Non-Religious Government control narratives – mix of questioning and outright conspiracy
  - Fake vaccine cards – discussions of creating fake IDs (both pro and anti-making the IDs)
- **Vaccine Ingredients**
  - Misinfo: Luciferase - religious-tinged conspiracy that the compound is of the Devil (Luciferase is a real compound related to bioluminescence), mix of misinformation and those scorning the misinformation
  - Misinfo: Microchips – conspiracy theory that microchips for population control are in the vaccines, Twitter conversation is mix of sharing conspiracy and sharing scorn for it
- **Vaccine Side effects**
  - Mixed: Menstrual ghost effects/shedding – questioning and/or passing of misinformation about vaccine’s ability to “hop” from person to person affecting menstrual patterns
  - Mixed: Herpes – questioning and/or passing of misinformation that vaccines cause herpes
  - Misinfo: Celebrity deaths – discussions blaming the death of DMX and Prince Phillip on them getting COVID vaccines

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Vaccine Narrative Descriptions (cont.)

- **Need for vaccine**
  - Misinfo: “if you have already had the disease” then you don’t need the vaccine – mix of questioning and misinformation

- **Vaccine administration**
  - Not FDA approved – discussion/misinformation about emergency use authorization
  - Boosters – news and discussion of whether boosters are just a cash grab

- **Johnson and Johnson fallout** – discussions of the pause in use of J&J vaccine in US, mix of questioning, news discussion, and misinformation related to vaccine safety/confounding all three vaccines in the US
High Level View Apr 1 – Apr 21, 2021

<table>
<thead>
<tr>
<th>Conversation</th>
<th>Total PA Tweets</th>
<th>Philadelphia Tweets</th>
<th>%</th>
<th>Pittsburgh Tweets</th>
<th>%</th>
<th>Erie Tweets</th>
<th>%</th>
<th>Allentown/Bethlehem Tweets</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Vaccine Conversation</td>
<td>342,735</td>
<td>200,641</td>
<td>59%</td>
<td>84,825</td>
<td>25%</td>
<td>3,098</td>
<td>1%</td>
<td>54,171</td>
<td>16%</td>
</tr>
<tr>
<td>Vaccine Passports</td>
<td>5,546</td>
<td>2,946</td>
<td>53%</td>
<td>1,289</td>
<td>23%</td>
<td>60</td>
<td>1%</td>
<td>1,251</td>
<td>23%</td>
</tr>
<tr>
<td>Misinfo: &quot;Mark of the Beast&quot;</td>
<td>81</td>
<td>46</td>
<td>57%</td>
<td>22</td>
<td>27%</td>
<td>0</td>
<td>0%</td>
<td>3</td>
<td>16%</td>
</tr>
<tr>
<td>Misinfo: Non-Religious Gov Control</td>
<td>20</td>
<td>8</td>
<td>40%</td>
<td>8</td>
<td>40%</td>
<td>0</td>
<td>0%</td>
<td>4</td>
<td>20%</td>
</tr>
<tr>
<td>Fake Vaccine Cards</td>
<td>109</td>
<td>56</td>
<td>51%</td>
<td>28</td>
<td>24%</td>
<td>1</td>
<td>1%</td>
<td>26</td>
<td>24%</td>
</tr>
<tr>
<td>Misinfo: &quot;Luciferase&quot;</td>
<td>6</td>
<td>3</td>
<td>50%</td>
<td>1</td>
<td>17%</td>
<td>0</td>
<td>0%</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>Misinfo: &quot;Celebrity Deaths&quot;</td>
<td>330</td>
<td>223</td>
<td>68%</td>
<td>59</td>
<td>18%</td>
<td>3</td>
<td>1%</td>
<td>45</td>
<td>14%</td>
</tr>
<tr>
<td>Not FDA approved</td>
<td>109</td>
<td>59</td>
<td>54%</td>
<td>30</td>
<td>28%</td>
<td>0</td>
<td>0%</td>
<td>20</td>
<td>18%</td>
</tr>
<tr>
<td>Boosters</td>
<td>171</td>
<td>92</td>
<td>54%</td>
<td>50</td>
<td>29%</td>
<td>0</td>
<td>0%</td>
<td>29</td>
<td>19%</td>
</tr>
<tr>
<td>Johnson and Johnson Fallout</td>
<td>3,665</td>
<td>2,319</td>
<td>64%</td>
<td>941</td>
<td>26%</td>
<td>32</td>
<td>1%</td>
<td>353</td>
<td>10%</td>
</tr>
<tr>
<td>Misinfo: Microchips</td>
<td>491</td>
<td>238</td>
<td>48%</td>
<td>141</td>
<td>29%</td>
<td>5</td>
<td>1%</td>
<td>107</td>
<td>22%</td>
</tr>
<tr>
<td>Misinfo: Menstrual Ghost effects</td>
<td>162</td>
<td>128</td>
<td>79%</td>
<td>15</td>
<td>9%</td>
<td>0</td>
<td>0%</td>
<td>19</td>
<td>12%</td>
</tr>
<tr>
<td>Misinfo: Shedding</td>
<td>27</td>
<td>21</td>
<td>78%</td>
<td>5</td>
<td>19%</td>
<td>0</td>
<td>0%</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>COVID Vaccine gives Herpes</td>
<td>211</td>
<td>112</td>
<td>53%</td>
<td>53</td>
<td>25%</td>
<td>1</td>
<td>0%</td>
<td>45</td>
<td>21%</td>
</tr>
<tr>
<td><em>Already infected don't need vaccine</em></td>
<td>5</td>
<td>4</td>
<td>80%</td>
<td>1</td>
<td>20%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Some Observations

- As is usual with Twitter, higher population areas typical also have higher amounts of Twitter discussion.

- Most discussion is of a mixed nature about vaccine passports and J&J vaccine, both of which were related to government announcements during this period.

- Discussions around easily identifiable misinformation were smaller, and were a mix of proponents of the misinfo and sarcasm/scorn directed at them. Of these, microchip-related discussion was the greatest.
Ongoing work

- Adding data on Tweets from rural/other PA locations
- Separating out more clearly the pro-misinformation and anti-misinformation discussions and which narratives occur together in time
- Looking more closely at proponents of misinformation that are targeting officials/health agencies – so far, while we have seen this activity the amount of attention it has generated on Twitter has been minimal
- Adding in other media platforms

For More Information

- Dr. Kathleen M. Carley - kathleen.carley@cs.cmu.edu
  - http://www.casos.cs.cmu.edu/bios/carley/carley.html
- IDeaS website - https://www.cmu.edu/ideas-social-cybersecurity/
- CASOS website – http://www.casos.cs.cmu.edu/