Protest Movements in October 2020 in the middle COVID-19 epidemic on the Polish Tweetosphere - epidemiological harm reduction perspective - preliminary analysis

Andrzej Jarynowski, Daniel Płatek

January 19, 2021

Abstract

Background: Extensive anti-government protests have been held in Poland in October 2020 related to accumulated social tensions due to COVID-19 pandemic among others. Measures against Coronavirus were not the only reason for demonstrations and protests at this time. For instance farmers organized protests in over 1000 locations across the country. However, pro-choice (abortion) demonstrations gather the highest number of protesters and attention in media.

Methods: Tweets in Polish language with hashtags #Strajkkobiet representing pro-choice movement woman's strike (227125), #zajob representing coronascepricism movement (22379), #ProtestRolników for farmers protest (9739) have been collected. Next step was to perform statistical analysis of the time series, Natural Language Processing (NLP) methods such as sentiment analysis techniques and conceptual field analysis, Social Network Analysis (SNA) of the Internet media users connected via their tweets sharing activities.

Results: We have identified in each of the protests: - main actors and communities; - key vocabulary, topics and sentiment; - characteristic timeline. For instance majority of users engaged with #Strajkkobiet are teenagers, which are only weakly connected to activists. #ProtestRolników has clear structure of communities of particular interest among protester as farmers, agricultural and rightwing parties as well as pro and anti governmental parties, who are against protests. Anticovid discourse (#Zajob) does not reveal any particular structure and consist of multiple individual protesters.

Conclusions: Massive gatherings could catalyze COVID-19 spread and harm reduction policy must be applied. We have profiled users for each protest to effectively reach them with health interventions. The revealed insights shed light on social dynamics in the context of such major disruptive events as COVID-19 pandemic and could serve as a basis for optimization of risk awareness campaigns by the authorities.

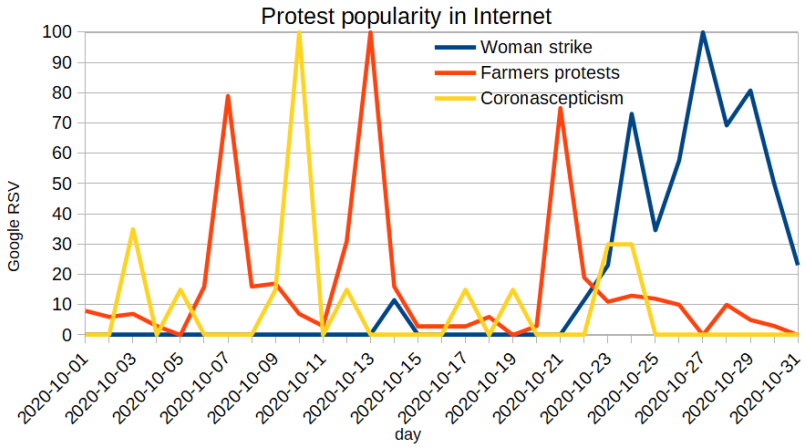

Figure 1: Time series of Goggle RSV (search queries) For women strike, farmers protests and coronasceptic protest ("Marshes of freedom"

1 background/introduction

Traditional and social media do not only reflect reality,[1] but also create it. This especially concerns major disruption events such as pandemics with COVID-19 being exceptional in its profound impact on society and economy. For instance, demonstrations against racism #BLM in May in the USA[2] or significant anticorona protests in Germany in August,[3] which took place without satisfying sanitary regimes, did not significantly influenced incidence rates. On the other hand, due to the different form, weather and prevalence, despite attempts to cover the mouth and noses, Polish protests with a high probability accelerated the transmission dynamics, but it is not known to what extent. There was Anti-government fall of protests in October 2020 in Poland (the biggest since 1989), in particular, the pro-choice (in context of abortion ban) movement as well as farmers and coronaseptics. Organization and coordination of activities in social movements as real-life protest especially during pandemic is based on usage of social media (online communication). The social movements' aspiration to change the law combining political conflict and the politics of civil rights lays in conflict with epidemiological threat of COVID-19 pandemic. The transmission of SARS-CoV-2 is facilitated by long and close contact between people, as the virus is spread through respiratory droplets for short distances up to 1-2m (and only with a very little evidence as airborne for long distances) and contact with contaminated

1. Bartłomiej Łódzki et al., "Medialny obraz rzeczywistości," *Studia Socialia Cracoviensia* 9, no. 1 (16) (2017): 121–136.

2. Ashley Lindsay Quigley et al., "Estimated Mask Use and Temporal Relationship to COVID-19 Epidemiology of Black Lives Matter Protests in 12 Cities," *Available at SSRN 3712951*, 2020, Dhaval M Dave et al., *Black lives matter protests, social distancing, and COVID-19*, technical report (National Bureau of Economic Research, 2020); Gregory Neyman and William Dalsey, "Black Lives Matter protests and COVID-19 cases: relationship in two databases," *Journal of public health (Oxford, England)*, 2020,

3. Andrzej Jarynowski, Alexander Semenov, and Vitaly Belik, "Protest perspective against COVID-19 risk mitigation strategies on the German Internet," *LNCS 12575*, 2020, pp. 1–12.

surfaces, so outdoor is not the best environment for it's transmission.[4] Thus, the longer the time people spend and the larger the gathering, the risk is higher. Contact tracing studies suggest that vast majority of transmission 95% occur in indoor settings compared with outdoor environments where risk is almost 20 fold lower.[5] Unfortunately (producing massive amount of droplets), shouting or violence could significantly increase transmission probabilities. Moreover, protesters could use common transport, dine or spend time before and after street protest together, etc. Transmission might have occurred were associated w/close interactions, particularly extended duration, or settings where people mixed indoors alongside an outdoor setting.Moreover, since second half of October till the peak in the beginning of November daily COVID-19 notifications had been significantly increasing.[6] On the other hand governmental party accused protesters for causing a biological thread to the society, which was not supported by any scientific evidence.[7] Epidemiologists repeated a stay-at-home appeal during protest and encouraged online activity instead of street protests. Nevertheless, people went out on the streets,[8] so this situation required the adaptation of existing tactics and the use of innovative communicates for harm reduction with focus on DDM principles (physical Distance, Disinfection and mask). These communicates concerned restrictions related to pandemic risks as covering mouth and nose, physical distancing and hand/respiratory hygiene along with access to PPE (personal protective equipment) for protesters' and their further contact security. Moreover, it should be clearly announced,[9] that people with covid-like symptoms must not attend protest as well as all participant should observe their health and consider minimizing physical contact with the most at risk populations (seniors or people with immunodeficiency).

Online social media projection of street protests in Poland have been already studied several times, during anti-ACTA in 2012,[10] around African Swine Fever in czego ukoronownaniem był2019,[11] woman's strike in 2016.[12] Timeline of protests give as temporal perspective of extraordinary October 2020 [fig. 1]. Coronasceptic protest were happening in various location in weekends with a culmination of a big event on 11 October in Warsaw.

4. WHO, *Coronavirus disease (COVID-19): Mass gatherings*, https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19-mass-gatherings, Accessed: 2020-12-04, 2020.

5. Mike Weed and Abby Foad, "Rapid scoping review of evidence of outdoor transmission of covid-19," *medRxiv*, 2020,

6. Michal Rogalski, *COVID-19 wedlug powiatow*, https://docs.google.com/spreadsheets/d/1Tv6jKMUYdK6ws6SxxAsHVxZbglZfisC8x__HZ1jacmBM/edit?usp=sharing, Accessed: 2020-05-27, 2020.

7. ICM, *Komunikat ICM w związku z informacjami medialnymi dotyczącymi wpływu aktualnie trwających protestów na rozwój epidemii COVID-19*, https://icm.edu.pl/blog/2020/11/03/komunikat-icm-zwiazku-informacjami-medialnymi-dotyczacymi-wplywu-aktualnie-trwajacych-protestow-rozwoj-epidemii-covid-19., Accessed: 2020-12-04, 2020.

8. Piotr Żuk and Paweł Żuk, *O kulturze protestu jako rdzeniu tradycji eurpejskiej* (Instytut Wydawniczy Książka i Prasa, 2015).

9. WHO, *Coronavirus disease (COVID-19): Mass gatherings*.

10. Andrzej Jarynowski, Jarosław Jankowski, and Anita Zbieg, "Natural vs artificial viral spread within the online community," *E-methodology* 2 (2015): 71–78; Jakub Nowak, "The good, the bad, and the commons: A critical review of popular discourse on piracy and power during anti-ACTA protests," *Journal of Computer-Mediated Communication* 21, no. 2 (2016): 177–194.

11. Andrzej Jarynowski et al., "African Swine Fever Awareness in the Internet Media in Poland–exploratory review," *E-methodology* 6, no. 6 (2019): 100–115.

12. Elżbieta Korolczuk et al., *Bunt kobiet: czarne protesty i strajki kobiet* (Europejskie Centrum Solidarności, 2019).

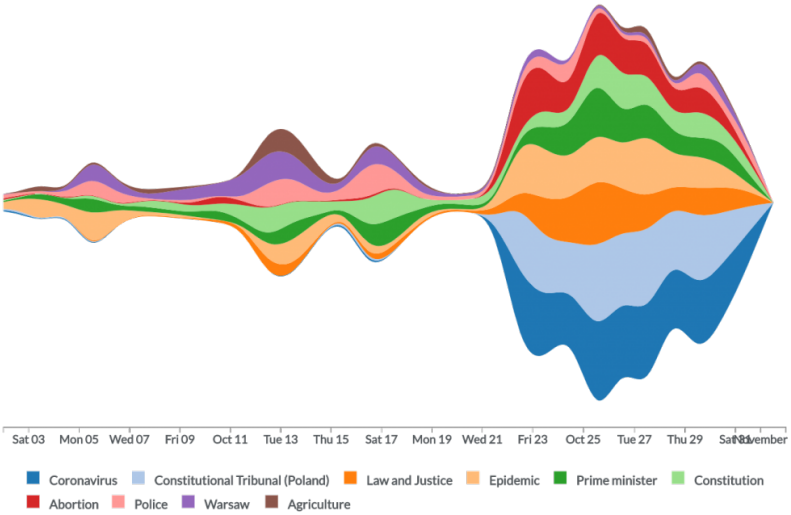

Figure 2: Distribution in topics in the articles on protests in Poland (generated using Eventregistry) for the entire October

Farmers have protested during weekdays and three massive organized actions could be distinguished at the time. Another accumulation of the protest took place on 28 October. The legal status of protests has been changing over time. Division into risk zones for virus infection was designated for each Polish county in the beginning of October.[13] The public may attend meetings max. 150 in yellow, max. 10 people in red and no limit in green zones. Since 10 October entire country was assigned to the yellow zone (no big protests were allowed) and some counties were red (restriction for most of demonstration). However, in second part of October epidemic reproduction rate (Rt) was increasing.[14] After main farmers and coronasceptic protest all of Poland was designated red zone (effective since 24 October). Government imposed significant restriction in gatherings in public places limited to 5 people (from outside the same household) among others as school closure. Thus, October protests definitely increased contact rates and mobility in the time of high prevalence of SARS-CoV-2 in population with decreasing general immunity due to Autumn (Seasonal changes in human immune function). Moreover, there was a discussion about the contribution of these protests to the peak of infection notification in Poland which reached over 30k cases daily in the beginning of the November.[15]

In traditional media, agricultural and anti-Covid protests were only a few times less represented in relation to the Women's Strike [fig. 2]. On the other hand, the difference in social media is incomparably more marked, because Tweets concerning the Woman's Strike are counted in

13. WHO, *The Health System Response Monitor - Poland*, https://www.covid19healthsystem.org/countries/poland/countrypage.aspx, Accessed: 2020-12-04, 2020.
14. Rogalski, *COVID-19 wedlug powiatow*.
15. Rogalski.

hundreds of thousands, while there are only 20 thousand about anti-Covid protests, and 10 thousand of agricultural protests. Moreover, share of Twitter mentions in general discussion in media is only 3% for Farmer's protest, 5% for Women's protest, but almost 40% for Coronascepticism.

1.1 Farmers protests

There is a complex interaction landscape between farmers and society as well as their interaction with nature.[16] There were attempts to map the landscape by surveys or media perception analysis with a special focus on conflicts and protests.[17] In September PiS proposed the so-called "Five for Animals" which attempt to extend animal right,[18] but the same time it hits a number of sectors of Polish agriculture. The proposition of the new governmental regulations and ethical standards warmed up conflicts of various social groups of interest. Animal breeders and other farmers as well as pro-animal organizations have been protesting in Poland. Moreover, due to similar conflicting lines such protests happened to some extent in other EU countries too. Agricultural protest were widespread distributed around whole country and concentrated around the middle of the October. October 2020 has manifested the crisis and pressures on farmers related to epidemiological and climate challenges.[19] Drawing attention away from the main animal rights issue, results in the fact that the problem is not widely known to the public. COVID-19 is currently one of the major problem in agriculture immediately affecting the meat production market. E.g. the average price of hogs body mass (0.75EUR/kg) in Poland[20] in the middle of Autumn 2020 was the lowest in the history of exchange markets, far below production cost. The feeling of abandonment (by the state) and powerlessness (what can be done?) is characteristic of all farmers especially due to COVID-19 related reasons. The announcement of new restrictions in Autumn 2020 (as remote work prioritisation in public administration) due the Covid-19 pandemic in Poland imposed irregularities on activities of veterinary inspection and other services related to animal welfare, as well as diverting a certain amount of foreseen budget funds. Reducing working hours or ability to travel to farms led to situations when some non-urgent activities had to be postponed or cancelled.

16. Jarynowski et al., "African Swine Fever Awareness in the Internet Media in Poland–exploratory review."

17. Krzysztof Gorlach, "Freedom for credit: Polish peasants protests in the era of communism and post-communism," *Polish Sociological Review*, no. 129 (2000): 57–85; Aleksandra Maria Bilewicz, "Beyond the Modernisation Paradigm: Elements of a Food Sovereignty Discourse in Farmer Protest Movements and Alternative Food Networks in Poland," *Sociologia Ruralis*, 2020,

18. Sejm, *Projekt ustawy o zmianie ustawy o ochronie zwierząt oraz niektórych innych ustaw*, https://www.sejm.gov.pl/sejm9.nsf/PrzebiegProc.xsp?id=1AB63D4F17FA40D8C12585E3004A30B8, Accessed: 2020-12-04, 2020.

19. Jan Douwe van der Ploeg, "Farmers' upheaval, climate crisis and populism," *The Journal of Peasant Studies* 47, no. 3 (2020): 589–605.

20. Ceny Rolnicze, *CENY TUCZNIKÓW NAJNIŻSZE W WOLNEJ POLSCE*, https://www.cenyrolnicze.pl/wiadomosci/rynki-rolne/trzoda-chlewna/21300-ceny-tucznikow-najnizsze-w-wolnej-polsce-rolnicy-swinie-wypuszcza-w-pola-albo-przywioza-do-warszawy, Accessed: 2020-12-04, 2020.

1.2 Coronascepticism protests

Risk uncertainties induce ongoing protests and demonstrations[21] against COVID-19 pandemic mitigation strategies[22] such as lockdown and mandatory mask wearing. Protests movements over responses to the COVID-19 pandemic are organizing themselves around the world. Every Polish regions or even group of protesters have a distinct perspective and different issues driving protests. Some question the need for the lockdown, fear economical consequences of a disease "not more dangerous than a flu" or are upset by strong social or freedom injustice. Some protest against alleged citizen rights violations, others claim the pandemic was planned ("Plandemic" conspiracy). Others are afraid of yet to come vaccinations campaigns, which will probably be available in Poland soon. Demonstrations against measures have been happening since May (eg. entrepreneurs protest "protest przedsiębiorców") with cumulative events in August (eg. cancel plandemic "Odwołać Plandemię") and in October (eg. marches for freedom "Marsze o wolność"). Protesters gather in public spaces disobeying the rules without masks and physical distancing to emphasize that the existing restrictions should not be applied.[23]

1.3 Woman's strike

The Constitutional Tribunal's made a decision on 22 October to restrict abortion of the most severe cases leading to lethal conditions. This met with a widespread disagree and took protesters to the streets. The Women's Strike movement[24] quickly managed to mobilize not only the opponents of the anti-abortion law, but it allow for expression of adolescents who were lacking social interaction due to physical school and other social points of interest closure.[25] Street protests began on the night of 23 October and continue until submission of this manuscript with culmination on 28 and 30 October with 400 thousands participants around in Poland with almost 100 thousands in Warsaw.

2 research problems, aims, methodological challenges of the study during pandemic

During pandemic, people were using more and more the Internet to communicate for instance to express their voice. So media monitoring could be a method for preparing resources and safety cautions before such a protest

21. Andrzej Jarynowski et al., "Attempt to Understand Public Health Relevant Social Dimensions of COVID-19 Outbreak in Poland," *Society Register* 4, no. 3 (2020): 7–44; Jarynowski, Semenov, and Belik, "Protest perspective against COVID-19 risk mitigation strategies on the German Internet."

22. PEW, *Most Approve of National Response to COVID-19 in 14 Advanced Economies*, https://www.pewresearch.org/global/2020/08/27/most-approve-of-national-response-to-covid-19-in-14-advanced-economies/, Accessed: 2020-09-20, 2020.

23. Maciej Kowalewski, "Street protests in times of COVID-19: adjusting tactics and marching 'as usual'," *Social Movement Studies*, 2020, 1–8.

24. Korolczuk et al., *Bunt kobiet: czarne protesty i strajki kobiet*.

25. IBI, *Rola interakcji w edukacji tradycyjnej (fizyczna), zdalnej czy hybrydowej w nadchodzącym roku szkolnym 2020/2021*, http://interdisciplinary-research.eu/rola-interakcji-w-edukacji-tradycyjnej-fizyczna-zdalnej-czy-hybrydowej-w-nadchodzacym-roku-szkolnym-2020-2021, Accessed: 2020-07-21, 2020.

could take pace. In this chapter we aim at discussing infection prevention and harm reduction information programs for protester by understanding their internal communication structure. Social media (as Twitter) is playing a critical role in communication before, during and after protests,[26] but could be also a transmission mode of the reliable information to disseminate infection risks[27] and interventions for harm reduction. Probably, no other media phenomenon except SARS-CoV-2 epidemic were observed on such a scale in the history of the Internet. Non-medical Internet content generated from various sources, including traditional or social media such as Twitter, have been widely used to discuss the COVID-19 pandemic around the world. Public trust in government or media communication (very low in Poland[28]) is a crucial and the most cost-effective modifiable factor in interventions slowing down the spread of SARS-CoV-2.[29] Sociological analysis of health issues deals with the complex relationship between mass culture and social movements:[30]

- fear causing increases risk mitigation protective behavior during protests or decision in joining protest;
- protesting ignoring restriction or not being properly informed about risks
- anger due to the measures, fueling anti-restriction protests[31] and backlash.

We analyze:

- the number and nature of social media events such as tweets volume time series;
- sentiment and conceptual fields analysis. We choose Nencki Affective Word List including Happiness, Anger, Sadness, Fear and Disgust.[32] We have compare our results with SentiOne algorithms descpribed by posotive, negative and neutral dimensions. We choose word clouds for language analysis;
- social network analysis. We choose retweeting (a the Gold Standard for Social Media Engagement with better information propagation prediction liability than following, commenting, replaying etc.[33]) ac-

26. Kowalewski, "Street protests in times of COVID-19: adjusting tactics and marching 'as usual'."

27. Joanna Burzyńska, Anna Bartosiewicz, and Magdalena Rękas, "The social life of COVID-19: Early insights from social media monitoring data collected in Poland," *Health Informatics Journal*, 2020, 1460458220962652.

28. Maciejewski J Jarynowski Andzej Stochmal M, "Przegląd i charakterystyka prowadzonych w Polsce badań na temat społecznych uwarunkowań epidemii COVID-19 w jej początkowej fazie," *Bezpieczeństwo, Obronność, Socjologia*, 2020, Standard Eurobarometer, "Public opinion in the European Union," *European Commission*, 2014,

29. Nils Haug et al., "Ranking the effectiveness of worldwide COVID-19 government interventions," *MedRxiv*, 2020,

30. Sang-Hwa Oh, Seo Yoon Lee, and Changhyun Han, "The effects of social media use on preventive behaviors during infectious disease outbreaks: The mediating role of self-relevant emotions and public risk perception," *Health communication*, 2020, 1–10.

31. Adrienne Katner et al., "Panic in the Streets—Pandemic and Protests: A Manifestation of a Failure to Achieve Democratic Ideals," *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 2020, 1048291120960233.

32. Nencki, *The Nencki Affective Word List*, https://exp.lobi.nencki.gov.pl/nawl-analysis, Accessed: 2020-12-04, 2015.

33. Danah Boyd, Scott Golder, and Gilad Lotan, "Tweet, tweet, retweet: Conversational aspects of retweeting on twitter," in *2010 43rd Hawaii international conference on system sciences* (IEEE, 2010), 1–10.

tivity as a based of our network. Each retweet is a directed link between nodes - users. Louvain community detection of retweets was applied to shed light on structure and the Fruchterman-Reingold layout algorithm was used for visualization;[34]

- main agents identifying with centrality on propagation network (defined as a weighed degree - sum of links - retweeting of being retweeted by other users);
- some attempt to demographic and geographical profiling of users.

Functionalities provided by Twitter (retweet, mention, reply and following) allows to investigate communications paths (interaction in social networks) and their presumable changes across time. High segregation of the propagation of information,[35] due to polarised echo chambers and filter bubbles could be a barrier in pro health communicates delivery.

Twitter in Poland has relatively low popularity in comparison to Facebook/Youtube leaders on Polish social media market (6 million registered accounts and 1.5 million active users which correspond to 5% of the literate population[36]) and is mainly used by expats, journalists and politicians. It's also bias ([37] towards males (65%), young adults (70% of users 15-34 y.o), inhabitants of big cities (affinity index 140). Twitter audience is over professionalized than general population and is more likely to be described as "elite communication" in compassion to Facebook "massive communication".[38] As other social media, it increased significantly users and their activity during pandemic.[39] Twitter provides an API for data acquisition available to general public almost for free. This allowed us to analyze not only content of tweets, but also their context (location, retweeting, etc.). Surveys showed that 42-70% of Poles get their COVID-19 information from social media (8% from Twitter), more often than from local and government sources or health professionals.[40] Trust[41] in national politicians and government is far below the EU average, and

34. Stanley Wasserman, Katherine Faust, et al., *Social network analysis: Methods and applications*, vol. 8 (Cambridge university press, 1994); Vincent D Blondel et al., "Fast unfolding of communities in large networks," *Journal of statistical mechanics: theory and experiment* 2008, no. 10 (2008): P10008.

35. Frederic Guerrero-Solé, "Interactive behavior in political discussions on Twitter: Politicians, media, and citizens' patterns of interaction in the 2015 and 2016 electoral campaigns in Spain," *Social Media+ Society* 4, no. 4 (2018): 2056305118808776.

36. IAB, *Przewodnik po Social Media w Polsce*, https://iab.org.pl/wp-content/uploads/2020/01/IAB-Przewodnik-po-Social-Media-w-Polsce-2019-2020.pdf, Accessed: 2020-09-04, 2020.

37. PBI, *Popularnosc Twitter w Polsce*, https://pbi.org.pl/media/popularnosc-twitter-a-polsce/, Accessed: 2020-03-04, 2019.

38. Paweł Matuszewski and Gabriella Szabó, "Are echo chambers based on partisanship? Twitter and political polarity in Poland and Hungary," *Social Media+ Society* 5, no. 2 (2019): 2056305119837671.

39. Washingtonpost, *Twitter sees record number of users during pandemic*, https://www.washingtonpost.com/business/economy/twitter-sees-record-number-of-users-during-pandemic-but-advertising-sales-slow/2020/04/30/747ef0fe-8ad8-11ea-9dfd-990f9dcc71fc_story.html, Accessed: 2020-09-04, 2020; Statista, *Most popular social media services during the coronavirus (COVID-19) epidemic in Poland)*, https://www.statista.com/statistics/1114857/poland-leading-social-media-during-the-covid-19-pandemic/, Accessed: 2020-12-04, 2020.

40. Monika Wójta-Kempa, *Ocena poziomu poinformowania na temat przebiegu i skutków pandemii COVID-19*, 2020.

41. Eurobarometer, "Public opinion in the European Union"; Jarynowski Andzej, "Przegląd i charakterystyka prowadzonych w Polsce badań na temat społecznych uwarunkowań epidemii COVID-19 w jej początkowej fazie."

trust in institutional and traditional media is even lower. It is showed that during COVID-19 discourse in first phases, traditional journalism (news) have ahead commentary reaction on Twitter,[42] which could suggest, that Twitter in not a primary source of information[43] and cannot be use in real-time signaling/surveillance,[44] but commenting major health issues could be of epidemiological importance. Identification of major actors as well patterns and dynamics of communication, of e.g. authorities and public reaction to them, could be used to reveal better management options for such protest events. However, the vast majority of general population are not users of social media platform (only around 50% of literate Poles have Facebook accounts[45]) and do not read online news. Thus our approach has only complementary approach to standard sociological longitudinal qualitative and quantitative survey studies among protesters and their adherence to protective measures.

Protesters are situated in the dilemma between competing factors:[46] 1) their interest and ideas; 2) to ignore the danger of infecting themselves or others in COVID-19 threat. Traditional media is framing protest in particular political interest and different narrative is done by various providers eg. public or private.[47] We chose to investigate material on these three protest during a single month a October, which was a culminating point for Farmers and Women's strike and second dominating for coronascepicism movement. Echo chambers and propaganda led to the reinforcement of misinformation and misguided beliefs on real epidemiological risk with mechanism as perils of perception[48] of infectious disease. Socio-cultural polarization[49] induced by social media poses a dangerous problem for society and influencers, scientists, journalists and politician should try to mitigate.

We choose such keywords for Tweets published in Polish between 1 and 31 October 2020 using rtweet package in R.:

- #Strajkkobiet representing woman's strike (227125),
- #zajob representing coronascepricism movement (22379),
- #ProtestRolników for farmers protest (9739)

There are others hashtags which were popular earlier on come later into use as Internet users are changing related #.[50] Consistency of material were verified against commercial media monitoring tools as SentiOne, CoSMos and Brand24. As Woman's strike and farmer protests are well

42. Andrzej Jarynowski, Monika Wójta-Kempa, and Vitaly Belik, "Trends in interest of COVID-19 on Polish Internet," *Przeglad epidemiologiczny* 74, no. 2 (2020): 258–275.

43. Wójta-Kempa, *Ocena poziomu poinformowania na temat przebiegu i skutków pandemii COVID-19*.

44. Ghazaleh Beigi et al., "An overview of sentiment analysis in social media and its applications in disaster relief," in *Sentiment analysis and ontology engineering* (Springer, 2016), 313–340, https://doi.org/10.1007/978-3-319-30319-2_13.

45. IAB, *Przewodnik po Social Media w Polsce*.

46. Salon24, *Young Lives Matter. Polska kontrkultura 2020*, https://www.salon24.pl/u/jankepost/1088181,young-lives-matter-polska-rewolucja-2020, Accessed: 2020-12-04, 2020.

47. Andrzej Jarynowski, "Monitorowanie percepcji ryzyka Covid-19 na Dolnym Śląsku za pomocą analizy śladu cyfrowego w internecie 15.01-05.08. 2020," 2020,

48. Gerd Gigerenzer and Adrian Edwards, "Simple tools for understanding risks: from innumeracy to insight," *Bmj* 327, no. 7417 (2003): 741–744.

49. Israr Qureshi et al., "Causes, Symptoms and Consequences of Social Media Induced Polarization (SMIP)," *Information Systems Journal*.

50. Anna Nacher, "# BlackProtest from the web to the streets and back: Feminist digital activism in Poland and narrative potential of the hashtag," *European Journal of Women's Studies*, 2020, 1350506820976900.

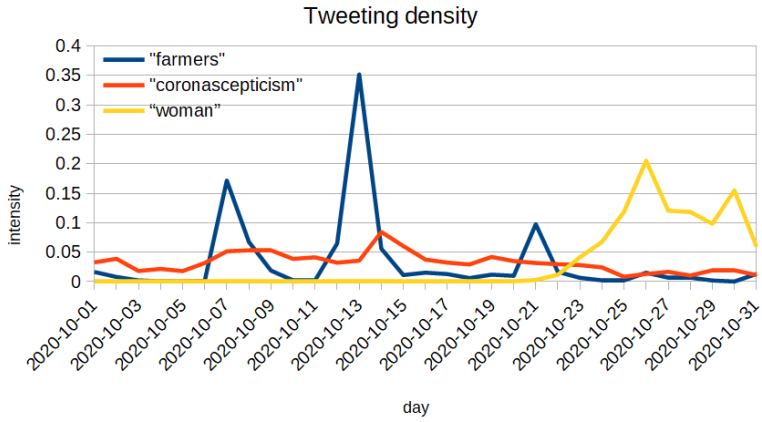

Figure 3: Time series of normalized tweets numbers per day for women strike, farmers protests and coronasceptic protest

described by given hashtags and sample (Twitter recognizes tweets compatible to a given hashtag, even if it wasn't explicitly there) , that coronasceptism movement is more difficult to describe by single hashtag.[51] "Zajob" is a vulgarly and slang version weirdness, craziness and is associated with SARS-CoV-2 virus and overreacting, panic-like behaviour of media and majority of Polish population.

3 explanation of methodology in the context of pandemic

Recently media activities are being analyzed worldwide to better understand perception and spread of diseases. This helps in some cases to track the spread of diseases (even COVID-19 in initial phases[52]) to some extend. A reliable analysis of the perception of communicates, could provide insight into mechanisms of social dynamics. This could allow to manage the social dimension optimally to prevent possible radicalization resulting in protests[53] and conflicts, to maintain social cohesion, and to increase compliance to the containment measures. Social media have been widely used in health behavioural intervention, where audiences should be profiled, user-generated content promoted and scaling techniques applied for broader impact.[54] During COVID-19 pandemic, the Internet is even more

51. Jarynowski, "Monitorowanie percepcji ryzyka Covid-19 na Dolnym Śląsku za pomocą analizy śladu cyfrowego w internecie 15.01-05.08. 2020"; Agnieszka Cierpich-Kozieł, "Koronarzeczywistość–o nowych złożeniach z członem korona-w dobie pandemii," *Język Polski*, 2020,

52. Tomasz Szmuda et al., "Are Online Searches for the Novel Coronavirus (COVID-19) Related to Media or Epidemiology? A Cross-sectional Study," *International Journal of Infectious Diseases*, 2020, Vasileios Lampos et al., "Tracking COVID-19 using online search," *arXiv preprint arXiv:2003.08086*, 2020,

53. Jarynowski, Semenov, and Belik, "Protest perspective against COVID-19 risk mitigation strategies on the German Internet"; Jarynowski et al., "Attempt to Understand Public Health Relevant Social Dimensions of COVID-19 Outbreak in Poland."

54. Piotr Siuda and Magdalena Pluta, *Internet, zdrowie i choroba–powiązania społeczne, kulturowe i edukacyjne*, 2020; Holly Korda and Zena Itani, "Harnessing social media for health

important due to lockdowns and physical distancing as still a significant part of the protest moved to Internet. This is an exploratory research[55] in context of:

- interaction, content production and redistribution of protesters at the micro level;
- social media naturalisation in social movements on the macro level;
- construction risk mitigation communication strategies on meso level.

The media (the agenda-setting[56] and cultivation frameworks) are informing the public what issues and their importance or not with repeated exposure to chosen events (eg. showing only violence on the protest). Moreover, online interaction on social media due to mechanism of flaming, filter bubbles and echo chambers led to cyberbalkanization (moderns cyber tribes), group-thinking (false consensus effect on epidemiological risk), herd behaviour (not planned violence on protests) and confirmation bias.[57] Internet content is currently intensively analyzed for the English speaking societies in the context of COVID-19,[58] which results and interpretations are not directly transferable to further European countries.[59] Studies for languages besides English (such as Polish) are extremely underrepresented.[60]

By analysing "digital footprints", we refer to entries in the Internet/social media (here Twitter) across the entire spectrum of social dimensions – interpersonal/institutional relationships, the activities of social movements, or the ideological climate in a given community etc. comprising various sectors of social life. The observed behaviour in online social media may therefore result from user activities on other online platforms or from offline activities and vice versa. Technological transition increased mobile access to social media, while different online channels create different ecosystem (do we see representative volume of information from pro and anti -protesters on Polish Twitter?) as well as ideological self-selection explains only a small percentage of co-exposure to content (what communities on Twitter could mean?).[61] There are two parallel processes

promotion and behavior change," *Health promotion practice* 14, no. 1 (2013): 15–23.

55. Katarzyna Kopecka-Piech, "Methodological Aspects of Research on Mediatization and Demediatization of Everyday Life. Current State and Key Challenges," *Annales Universitatis Paedagogicae Cracoviensis/ Studia de Cultura* 12, no. 4 (2020): 113–121.

56. Mieczysław Gałuszka et al., "Medykalizacja w kulturze strachu: przykład medialnej ekspozycji grypy A/H1N1," *Przegląd Socjologiczny* 66, no. 1 (2017): 53–81.

57. Qureshi et al., "Causes, Symptoms and Consequences of Social Media Induced Polarization (SMIP)."

58. Lampos et al., "Tracking COVID-19 using online search"; Thayer Alshaabi et al., "How the world's collective attention is being paid to a pandemic: COVID-19 related 1-gram time series for 24 languages on Twitter," *arXiv preprint arXiv:2003.12614*, 2020, Oguzhan Gencoglu and Mathias Gruber, "Causal Modeling of Twitter Activity During COVID-19," *arXiv preprint arXiv:2005.07952*, 2020, Pablo Beytıa and Carlos Cruz Infante, "Digital Pathways, Pandemic Trajectories. Using Google Trends to Track Social Responses to COVID-19," *HIIG Discussion Paper Series*, 2020,

59. Jerzy Rosiński et al., "Factors shaping attitudes of medical staff towards acceptance of the standard precautions," *International journal of environmental research and public health* 16, no. 6 (2019): 1050.

60. Burzyńska, Bartosiewicz, and Rękas, "The social life of COVID-19: Early insights from social media monitoring data collected in Poland"; Andrzej Jarynowski, Monika Wójta-Kempa, and Vitaly Belik, "Perception of "coronavirus" on the Polish Internet until arrival of SARS-CoV-2 in Poland," *Nursing and Public Health* 10, no. 2 (2020): 89–106, https://doi.org/10.17219/pzp/120054.

61. Brooke Foucault Welles and Sandra González-Bailón, *The Oxford Handbook of Networked Communication* (Oxford University Press, USA, 2020).

taking place on social media:[62] the dynamics of joining/leaving community (building networks) and the dynamics of information propagation (process on networks). The analysis of this material from selected categories of agents is partly carried out within the social field theory[63] and Actor Network Theory[64] mainly in a forms of social movements such as protests. Those theories assume that the social behaviour constitutes the decisions of actors that form a network of cooperation or conflict. What is important to draw the line of conflicting for governmental regulations:

- "anticovid law" Coronasceptic Movement is mainly driven by right wing populism,[65] however some liberal activists could also sympathize with them. The majority of general population is sceptical toward anti-covid protesters.[66]
- "five for animals" Protest are driven by Farmers (who are excepting support due to losses induced by COVID-19 and complaining about change in their animal production). There are supported by veterinary services and agricultural administration (who however must execute legislative acts). On the other side there are ecologists and animal right activists from both governing and opposition parties (who do insist on animal welfare act). Majority of the population living in cities is not interested at all in this discourse.[67]
- "antiabortion law" Majority of the population (even supporters of right wing parties[68]) support the protesters postulates. The landscape of socio-political context is much more complicated than underlining conflict pro-life/pro-choice. The core protesters are NGOs and opposition parties united around "women's strike" initiative,[69] however these protests reached much broader audience.

4 research results

4.1 Woman's strike

Out of 52779 Twitter users engaged in Women's strike 47146 have been interacting by tweeting. The retweet network focuses on the main pro-choice component, but we see an isolated dark yellow pro-life cluster [fig. 4]. The communities in the main component are quite interconnected, but there is a clear internal structure:

62. Andrzej Jarynowski, Michał B Paradowski, and Andrzej Buda, "Modelling communities and populations: an introduction to computational social science," 2019, Sandra González-Bailón et al., "The dynamics of protest recruitment through an online network," *Scientific reports* 1 (2011): 197.

63. Mario Diani, *The cement of civil society* (Cambridge University Press, 2015).

64. Bruno Latour, "On recalling ANT," *The sociological review* 47, no. 1 (1999): 15–25.

65. Piotr Żuk and Paweł Żuk, "Right-wing populism in Poland and anti-vaccine myths on YouTube: Political and cultural threats to public health," *Global Public Health* 15, no. 6 (2020): 790–804.

66. Jarynowski, "Monitorowanie percepcji ryzyka Covid-19 na Dolnym Śląsku za pomocą analizy śladu cyfrowego w internecie 15.01-05.08. 2020."

67. Jarynowski et al., "African Swine Fever Awareness in the Internet Media in Poland–exploratory review."

68. Wikipedia, *Protesty:Opinia Publiczna*, https://pl.wikipedia.org/wiki/Protesty_przeciwko_zaostrzeniu_przepisów_dotyczących_aborcji_w_Polsce#Opinia_publiczna, Accessed: 2020-12-04, 2020.

69. Dominika Urzędowska and Joanna Suchomska, "Feministki w Sieci. Nowe Media w Działaniach Przeciwko Ograniczaniu Praw Kobiet w Polsce," *INSTYTUT DYSKURSU I DIALOGU*, 2020,

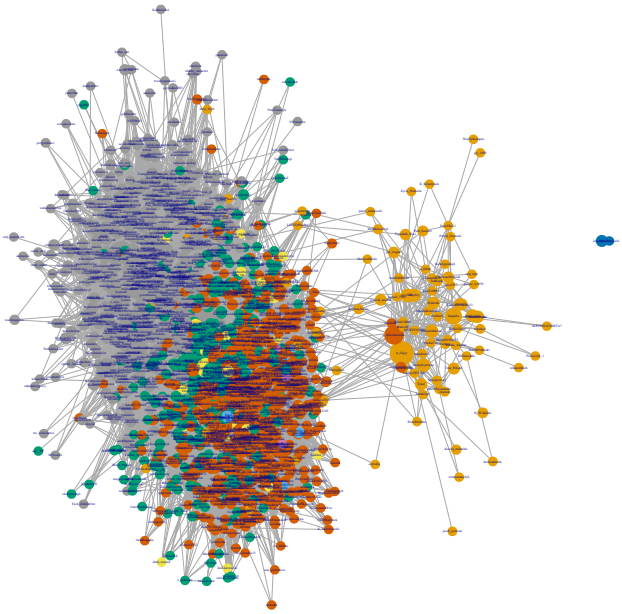

Figure 4: Weighted retweet network of 1729 most central accounts participating in the Strajkkobiet discourse

- the dominant gray cluster consists mainly of young people;
- the green cluster is largely composed of politicians and the media;
- the orange cluster is characterized by a large representation of left-wing activists

Moreover, it can be noticed that the Warsaw traffic is concentrated in the center of the main component, the Poznań traffic on the right and the Tri-City traffic on the left. It is worth noting that this protest tweetosphere is dominated by youth (60% of content is generated by <25 y. o[70]) and it seems that they are the driving force behind the protests.

The vocabulary in the discourse is quite brutal and with a clearly dominant negative tinge [fig. 8], especially after the physical protests. Based on the activity of Twitter users, we can see how the tension grew, culminating on Monday, October 26 [fig. 3]. Tweeters (a small percentage of those who provide their locations) are most closely associated with Warsaw, and secondly with large cities such as Wrocław, Kraków, Poznań and Gdańsk. Protest happened in many more locations in Poland, but vast majority of content was concentrated in a the biggest metropolises with almost 30% of probably of foreign origin.[71]

Comparing the retweet network with community flows [fig. 5], it can be seen that the dominant youth component (No. 2) emerged as a separate entity during the weekend of 24-25. On the other hand, professionals (media and politicians and activists) create component 4 which dynamically creates sub-communities (5,6,8).

70. Polityka$_w$*Siecie*, *70% tweetów dot StrajkKobiet pochodzi z ter. Polski...*, https://twitter.com/Polityka_wSieci/status/1321783329113493504, Accessed: 2020-12-04, 2020.
71. Polityka$_w$*Siecie*.

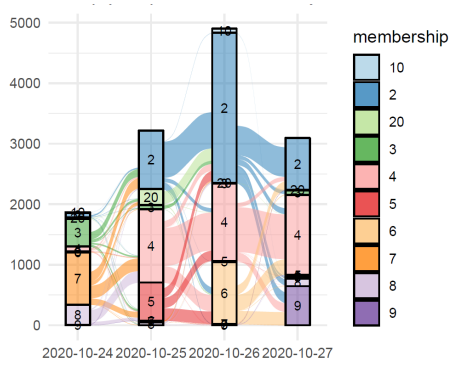

Figure 5: Daily situation for #strajkkobiet demonstration. Flow of users between communities with the biggest communities. Codes for the main identified communities: 2 (blue) - youth, 4 (pink) - media and political accounts, 10 (light blue) - pro-life movement.

Sensibility analysis of cut-of threshold level was applied to verify if community detection is stable. Women's strike communities are resilient to change of cut-off and for various thresholding level revealed communities were the same as some peripheral users were migrating between well defined communities. Similar lack of hierarchy of coronasceptic movement was also constant. Farmers protest community structure were only susceptible to threshold and time. This is so, probably due to ad hoc forming communities during protest days.

We see a large fraction of accounts created in spring 2020 (probably due to the pandemic and the transfer of social activity to the Internet) as well close the protests [fig. 10]. However, there are many experienced Twitter users (probably activists).

4.2 Coronascepticism protests

3089 users were engaged in discourse, while 2821 retweeted or were retweeted at least once.

Coronascepticism movement protest on Twitter is extremely granulated (the lowest modularity among all protests) and differs significantly to rest of the movements as well to anticovid discourse in other countries.[72] It is difficult to distinguish communities but, Orange top: Right-wing against anti-covid protests; dark blue top: Supporting PiS anti-covid protests; Light Blue: Matka Kurka's bubble. On the other hand this network is the densest (amount of retweets normalized to possible connections) among all protest.

Coronascepticism discourse is concentrate around mainly Pomerania, Greater Poland and secondary in Masovia, Silesia and Lower Silesia [fig. 8]. This configuration corresponds to popularity of anti-vaccination movements.[73]

72. Jarynowski, Semenov, and Belik, "Protest perspective against COVID-19 risk mitigation strategies on the German Internet."

73. Skawina Ireneusz Jarynowski Andrzej, "Attempt at profiling and regionalisation of COVID-19 vaccine campaigns in Poland - preliminary results," *Preprint - ResearchGate*, 2020,

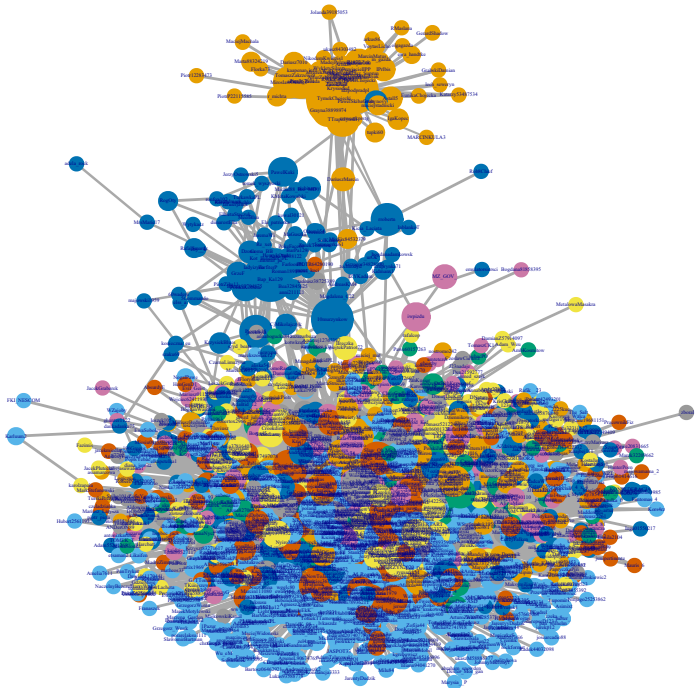

Figure 6: Weighted retweet network of 1559 most central accounts Twitter users participating in the coranscepticism discourse. Coronasceptic protesters are in a main component on the bottom, while protests opponents are on the top

4.3 Farmers protests

The geographical distribution of agricultural protests, despite the COVID-19 pandemic and restrictions on the freedom of assembly, is therefore huge and widespread. However, Majority of Tweets are coming from Masovia region [fig. 8]. Very low coverage of tweets from Eastern Poland could suggest that Twitter is not popular there among farmers. 2812 users were engaged in discourse, while 2595 retweeted or were retweeted at least once.

Retweeting network for hashtag #Strajkrolników showed a clear community structure [fig. 7] Colorcode: purple left – opponents of protests from the opposition; green left – opponents of protest associated with PiS – a governing party; yellow bottom – Protestant protesters; middle blue – protesting farmers and agricultural organizations; violet right – supporters of protests within right-wing organizations; light blue – supporters of protests associated with agricultultural party PSL.

4.4 Comparison between protests

Sociolingistic analysis of each protest should be performed[74] for deeper understanding of the processes [fig. 8]. Recognition of geographical locations should be interpreted with a caution. We have plotted only up to 10 most frequent locations only. Moreover, there is high rate of 30-50% un-

74. A Jarynowski and A Rostami, "Reading Stockholm Riots 2013 in social media by text-mining.[in:] 6th Language & Technology Conference, Poznań, Poland, December 7-9, 2013 (pp. 353-358)," *Wydawnictwo Naukowe Uniwersytetu im. Adama Mickiewicza*, 2013,

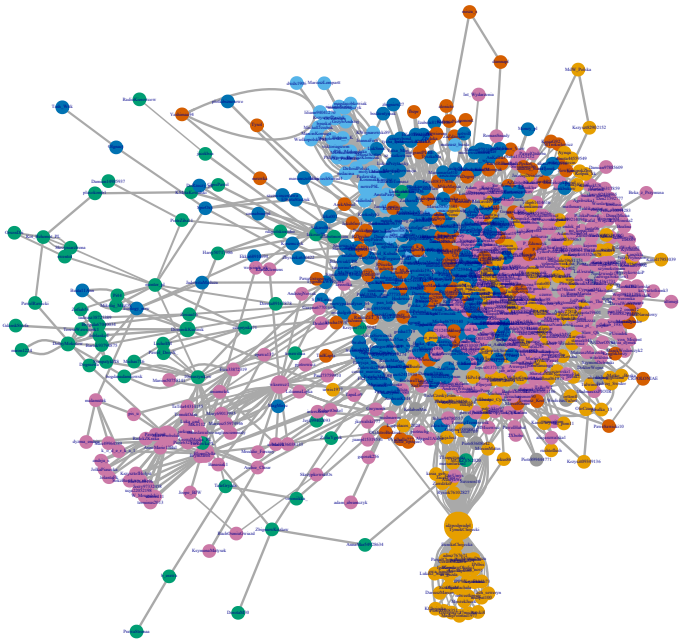

Figure 7: Weighted retweet network of 1123 most central accounts o Twitter users participating in the agricultural protest discourse. On the left are situated protest opponents and the main component are various sub-communities of protest supporters

Figure 8: Word clouds in the discourse [Left] the Women's Strike [Centre] Farmers protests [Right] Coronascepticism

Figure 9: Main cities of tweeting accounts. Size of circle corresponds to the percentage of given location among all tweets [Left] the Women's Strike [Centre] Farmers protests [Right] Coronascepticism

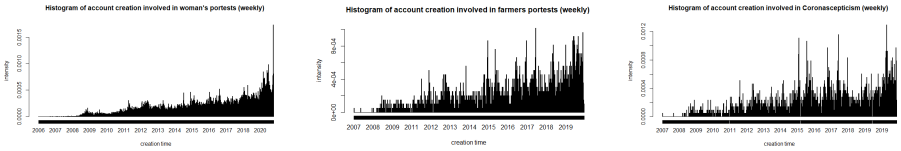

Figure 10: When were the debaters' accounts created? [Left] the Women's Strike [Centre] Farmers protests [Right] Coronascepticism

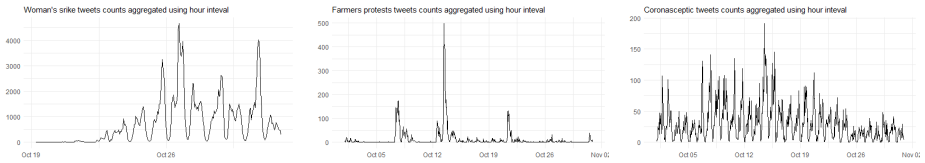

Figure 11: Tweeting activity hour by hour in connection with the [Left] Women's Strike, [Centre] Farmers protests [Right] Coronascepticism

known/unclassified location as well as significant volume of tweets seems to come from abroad 30-20%.

Coronasceptcism discourse is dominated by males (for males it's as frequently mentioned as Women's strike [tab. 1]) for 1 women there is 4 males, so health promotion communicates (if somebody decide to) should be definitely targeted. Farmers protests discourse is dominated by males too, but for 1 women there is 2 males only. In active physical street protests even higher male/female ratio can be observed, so main target of protective measures campaigns should be males too. On the other hand, Women's strike is only slightly over-represented by woman (55% vs 45%) on Twitter, however this gap between ration increase if it come to physical street protest, so health related campaigns should mainly target females.

Discourse around Farmers protest [fig. 12] concentrates around late mornings (time after post sunrise grooming of animals) with main activity in working days as protest are usually happened on Wednesdays. Woman's strike is discussed in late mornings and late evenings. Discourse around coronascpeticism is usually during late Evenings and often during weekends.

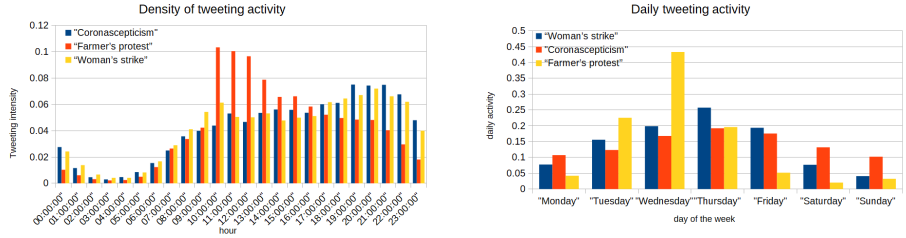

Figure 12: Seasonality of tweeting activity [Left] Top hours of the day [Right] Top days of the week

protest	males	females	density ($10^{(} - 4$))	modularity
Woman strike	47%	70%	0.7	0.45
Farmers protests	6%	5%	7.8	0.50
Coronascepticism	47%	25%	8.3	0.40

Table 1: Composition of mentions according to gender for males females and network statistics density and modilarity

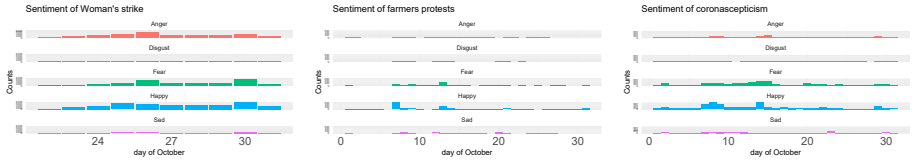

Figure 13: Sentiment analysis [Left] the Women's Strike [Centre] Farmers protests [Right] Coronascepticism

5 conclusions with recommendations

This chapter offers an empirical illustration for complementing aggregative communication patters on selected social media platform (Twitter) with relational methods in the sociology[75] of social movements and infodemiology.[76] Due to the COVID-19 pandemic, the importance of infectious disease spread in mass gathering is nowadays more important than ever before.[77] The various means and content of providing information and recommendations related to SARS-CoV-2 were not adapted to the protests participants. There was no targeted communication campaigns[78] and crisis management as well as PR teams should work out on a proper communication strategy. It was suggested by government and public media[79] that infection and death rates in the country will increase because of street demonstrations. Experience from other spring/summer protests suggest none or little effect of street demonstrations on spread of COVID-19 infections,[80] because open air environment is not the easiest transmission environment. However, the transmission risk, due the failure of the DDM principles by participants in the protest, should be definitely announced and communicate to attendees of street demonstrations. Instead of information spots via Internet across various social media - as Twitter – on preventive and hygienic standards on the protest and what to do after protests, both government and also opposition media

75. Matuszewski and Szabó, "Are echo chambers based on partisanship? Twitter and political polarity in Poland and Hungary."

76. Gunther Eysenbach, "How to fight an infodemic: the four pillars of infodemic management," *Journal of medical Internet research* 22, no. 6 (2020): e21820; Marcel Salathé, "Digital epidemiology: what is it, and where is it going?," *Life sciences, society and policy* 14, no. 1 (2018): 1.

77. WHO, *Coronavirus disease (COVID-19): Mass gatherings*.

78. Jarynowski Andrzej, "Attempt at profiling and regionalisation of COVID-19 vaccine campaigns in Poland - preliminary results."

79. ICM, *Komunikat ICM w związku z informacjami medialnymi dotyczącymi wpływu aktualnie trwających protestów na rozwój epidemii COVID-19*.

80. Jarynowski, Semenov, and Belik, "Protest perspective against COVID-19 risk mitigation strategies on the German Internet"; Neyman and Dalsey, "Black Lives Matter protests and COVID-19 cases: relationship in two databases"; Dave et al., *Black lives matter protests, social distancing, and COVID-19*; Quigley et al., "Estimated Mask Use and Temporal Relationship to COVID-19 Epidemiology of Black Lives Matter Protests in 12 Cities."

proceeded with political propaganda (as it was observed during first wave of infection[81]). Public health advice in a pandemic must not dependent on accepting reason of gathering. A dozen weeks before, governmental (so called public) media approved of the mass gathering during presidential election campaign and some opposition media were criticizing protesters for arguing to delay new animal rights law or opening up the economy. The main role of public health authorities and experts is delivering knowledge to people (who will take the final decision) and prepare harm reduction communicates too.[82] Often, a selfish attitude towards one's own beliefs or personal comfort raises concerns about the the need or effectiveness of DDM (as coronascptic protest). On the other hand, during protest for social justice it is difficult to avoid close contact with others, especially if emotions are playing and important role. The negative consequences of polarization, such as Cyberbalkanization/Splitinternet observed in farmers and women protests [fig. 7, 7], need enhanced depolarization social actions and intervention (with a significant potential role of media), at least in public health dimension.[83] However, ethical considerations are out of scope of this chapter.

We present a semantic maps of a conflicted society specific to the Polish language, and unequal distribution of different protesting subcommunities. We were able to capture the most important features of the social field of each protest. In all discourse fields we observe collective oppositions us (protesters) vs others. In this sense messages of influencers from inside of the community would be preferred. It is essential that organizers of protests take civil responsibility of providing meaningful epidemiological risk assessment (including information on proper behavior during and after protests and risk assessment) in an absence of illegibility of governmental bodies. Also peripheral participants (as an average protesters) could be involved in increasing the reach of safety messages during the protests.[84]

5.1 Coronascepticism protests

Coronasceptic movement is from definition resistant to information campaigns,[85] so general public should is an audience for communicates. High granulation of coronasceptic movement indicates, that there is no clear leadership and protesters form small communities weakly connected to each others [fig. 6]. This could be linked to high individualism of participants representing various ideologies from far right religious[86] as Catholic,

81. Jarynowski, "Monitorowanie percepcji ryzyka Covid-19 na Dolnym Śląsku za pomocą analizy śladu cyfrowego w internecie 15.01-05.08. 2020."

82. Alina K Bartscher et al., "Social capital and the spread of Covid-19: Insights from European countries," 2020,

83. Jarynowski Andzej, "Przegląd i charakterystyka prowadzonych w Polsce badań na temat społecznych uwarunkowań epidemii COVID-19 w jej początkowej fazie."

84. Pablo Barberá et al., "The critical periphery in the growth of social protests," *PloS one* 10, no. 11 (2015): e0143611.

85. Kowalewski, "Street protests in times of COVID-19: adjusting tactics and marching 'as usual'"; Anni Sternisko, Aleksandra Cichocka, and Jay J Van Bavel, "The dark side of social movements: Social identity, non-conformity, and the lure of conspiracy theories," *Current opinion in psychology* 35 (2020): 1–6.

86. Anne Borsch et al., *Corona and Religion*, https://www.zegk.uni-heidelberg.de/religionswissenschaft/veröffentlichungen/veröffentlichungen/Religion%20and%20Coron.pdf, Accessed: 2020-09-20, 2020.

Protestant (clear community of "Idź Pod Prąd"), populist[87] as well as left wing (in much lesser extend) as liberal green and naturalists. It is important to mention, that ideologies popular in anticovid movements abroad as QAnon were hardly observed in Poland. Twitter accounts potentially belonging to the so-called trolls (which in other studies were classified to the extreme right in the context of elections to the Elections,[88] or to the far-left side in the context of the African Swine Fever epidemic,[89] promoted content in discussion on coronavirus[90] by attacking both protesters and government. Journalists should consider ignoring coronasceptic movement in mainstream media and reducing information about them to specialist press, as it was done in Germany.[91] Very high network density with very low modularity suggest that main component, even having no internal hierarchical structure, is well interconnected. This suggest, that such a network is resilient to interventions as blocking single accounts[92] or inhibiting reaches of content, could be not efficient due possibility of information propagation by multiple paths.[93]

5.2 Woman' s strike

The main participants of street protest are young females from big cities, so communicates should be framed directly to them. As Twitter is mascularized, only Woman's strike involved massively females into protest's discourse [Tab. 1]. We have realized how difficult is to get to Polish youth.[94] Moreover, they form a separated echo chambers than leaders of the protest their belong [fig. 4]. Thus, it would be important to formulate health promoting messages among them with use of social media, probably Instagram[95] could be even better than Twitter. From epidemiological perspective it would be important to distinguish communication on individual risk mitigation (those who attend the protests) and populational risk mitigation (those who support them from home).[96] Due to possible stressful condition with high emotional engagements communicate on proper nutrition, hydration and avoiding drugs/stimulant are welcome. Any user possess potential to distribute valuable message likely to be exposed to many protesters.[97] On the other hand, due to modu-

87. Żuk and Żuk, "Right-wing populism in Poland and anti-vaccine myths on YouTube: Political and cultural threats to public health."

88. OKO, *Proba wplyniecia na wyniki wyborow? Dwie siatki patriotycznych trolli wspieraly Konfederacje*, https://oko.press/proba-wplyniecia-na-wyniki-wyborow-dwie-siatki-patriotycznych-trolli-wspieraly-konfederacje/, Accessed: 2020-03-04, 2019.

89. Jarynowski et al., "African Swine Fever Awareness in the Internet Media in Poland–exploratory review."

90. Jarynowski, Wójta-Kempa, and Belik, "Perception of "coronavirus" on the Polish Internet until arrival of SARS-CoV-2 in Poland."

91. Jarynowski, Semenov, and Belik, "Protest perspective against COVID-19 risk mitigation strategies on the German Internet."

92. Twitter, *Permanent suspension of @realDonaldTrump*, https://blog.twitter.com/en_us/topics/company/2020/suspension.html, Accessed: 2021-01-10, 2021.

93. Yusoon Kim, Yi-Su Chen, and Kevin Linderman, "Supply network disruption and resilience: A network structural perspective," *Journal of operations Management* 33 (2015): 43–59.

94. Salon24, *Young Lives Matter. Polska kontrkultura 2020*.

95. Buzzup, *Instagram jako narzędzie protestujących kobiet*, https://buzzup.pl/instagram-jako-narzedzie-protestujacych-kobiet, Accessed: 2020-12-04, 2020.

96. Jarynowski Andzej, "Przegląd i charakterystyka prowadzonych w Polsce badań na temat społecznych uwarunkowań epidemii COVID-19 w jej początkowej fazie."

97. Barberá et al., "The critical periphery in the growth of social protests."

lar structure of the network, where activists, media, and politician are is a separate community than the main population [fig. 4], probably organizers or protest leaders will not be able to propagate pro-healthy communicates towards the younger cluster. We strongly advice any user to be active in creating their health promoting content and redistribute existing ones. Key message to the protesters should be to protect their more susceptible for severe COVID-19 contacts. For instance propagating suggestion for younger protest participants to avoid physical contacts with their grandparents if it's possible as well as suggestion for observing their health status. One should consider emotionally oriented content referring to conformism and common good for harm reduction.[98]

5.3 farmers protests

Both farmers and woman protests could be solved if governing party would have a political will. The polarization of attitudes already observed in social media does not seem to be a desirable issue and at least epidemiological risks could be communicated for all kind of protesters. Farmers protest communication have the most modular structure and topology with a clear boundaries between communities [fig. 7]. This mean that main agents as recognized governmental agencies, agricultural media, journalist, politicians could propagate DDM campaigns for their followers. The only question is how to involved them in campaigns. Farmers, as being mainly middle aged males, should be additionally notified, as they could be in risk groups for developing severe COVID-19, as well as they could be super-spreaders due to possible high viral load of SARS-CoV-2 in respiratory secretions. Thus, infuencing agents[99] should urge people who have any symptoms of COVID-19 or those who have pre-existing medical conditions to avoid attending protests. Moreover, framing time [fig. 12] based on agricultural daily routine should be consider for campaigns.

We thank PNFN (2019-21) for partial financial support, NCN (2016/22/E/HS2/00034) for technical support, Monika Wójta-Kempa, Ireneusz Skawina and participants/organizers of conference Media () Life After/During Covid-19 Pandemic for fruitful discussions.

References

Alshaabi, Thayer, Joshua R Minot, Michael Vincent Arnold, Jane Lydia Adams, David Rushing Dewhurst, Andrew J Reagan, Roby Muhamad, Christopher M Danforth, and Peter Sheridan Dodds. "How the world's collective attention is being paid to a pandemic: COVID-19 related 1-gram time series for 24 languages on Twitter." *arXiv preprint arXiv:2003.12614*, 2020.

Barberá, Pablo, Ning Wang, Richard Bonneau, John T Jost, Jonathan Nagler, Joshua Tucker, and Sandra González-Bailón. "The critical periphery in the growth of social protests." *PloS one* 10, no. 11 (2015): e0143611.

98. Jarynowski Andrzej, "Attempt at profiling and regionalisation of COVID-19 vaccine campaigns in Poland - preliminary results."

99. Sandra González-Bailón, Javier Borge-Holthoefer, and Yamir Moreno, "Broadcasters and hidden influentials in online protest diffusion," *American behavioral scientist* 57, no. 7 (2013): 943–965.

Bartscher, Alina K, Sebastian Seitz, Michaela Slotwinski, Sebastian Siegloch, and Nils Wehrhöfer. "Social capital and the spread of Covid-19: Insights from European countries," 2020.

Beigi, Ghazaleh, Xia Hu, Ross Maciejewski, and Huan Liu. "An overview of sentiment analysis in social media and its applications in disaster relief." In *Sentiment analysis and ontology engineering*, 313–340. Springer, 2016. https://doi.org/10.1007/978-3-319-30319-2_13.

Beytıa, Pablo, and Carlos Cruz Infante. "Digital Pathways, Pandemic Trajectories. Using Google Trends to Track Social Responses to COVID-19." *HIIG Discussion Paper Series*, 2020.

Bilewicz, Aleksandra Maria. "Beyond the Modernisation Paradigm: Elements of a Food Sovereignty Discourse in Farmer Protest Movements and Alternative Food Networks in Poland." *Sociologia Ruralis*, 2020.

Blondel, Vincent D, Jean-Loup Guillaume, Renaud Lambiotte, and Etienne Lefebvre. "Fast unfolding of communities in large networks." *Journal of statistical mechanics: theory and experiment* 2008, no. 10 (2008): P10008.

Borsch, Anne, Merijn ter Haar, Inken Prohl, and Vera Schaer. *Corona and Religion*. https://www.zegk.uni-heidelberg.de/religionswissenschaft/veröffentlichungen/veröffentlichungen/Religion%20and%20Coron.pdf. Accessed: 2020-09-20, 2020.

Boyd, Danah, Scott Golder, and Gilad Lotan. "Tweet, tweet, retweet: Conversational aspects of retweeting on twitter." In *2010 43rd Hawaii international conference on system sciences*, 1–10. IEEE, 2010.

Burzyńska, Joanna, Anna Bartosiewicz, and Magdalena Rękas. "The social life of COVID-19: Early insights from social media monitoring data collected in Poland." *Health Informatics Journal*, 2020, 1460458220962652.

Buzzup. *Instagram jako narzędzie protestujących kobiet*. https://buzzup.pl/instagram-jako-narzedzie-protestujacych-kobiet. Accessed: 2020-12-04, 2020.

Cierpich-Kozieł, Agnieszka. "Koronarzeczywistość–o nowych złożeniach z członem korona-w dobie pandemii." *Język Polski*, 2020.

Dave, Dhaval M, Andrew I Friedson, Kyutaro Matsuzawa, Joseph J Sabia, and Samuel Safford. *Black lives matter protests, social distancing, and COVID-19*. Technical report. National Bureau of Economic Research, 2020.

Diani, Mario. *The cement of civil society*. Cambridge University Press, 2015.

Eurobarometer, Standard. "Public opinion in the European Union." *European Commission*, 2014.

Eysenbach, Gunther. "How to fight an infodemic: the four pillars of infodemic management." *Journal of medical Internet research* 22, no. 6 (2020): e21820.

Gałuszka, Mieczysław, et al. "Medykalizacja w kulturze strachu: przykład medialnej ekspozycji grypy A/H1N1." *Przegląd Socjologiczny* 66, no. 1 (2017): 53–81.

Gencoglu, Oguzhan, and Mathias Gruber. "Causal Modeling of Twitter Activity During COVID-19." *arXiv preprint arXiv:2005.07952*, 2020.

Gigerenzer, Gerd, and Adrian Edwards. "Simple tools for understanding risks: from innumeracy to insight." *Bmj* 327, no. 7417 (2003): 741–744.

González-Bailón, Sandra, Javier Borge-Holthoefer, and Yamir Moreno. "Broadcasters and hidden influentials in online protest diffusion." *American behavioral scientist* 57, no. 7 (2013): 943–965.

González-Bailón, Sandra, Javier Borge-Holthoefer, Alejandro Rivero, and Yamir Moreno. "The dynamics of protest recruitment through an online network." *Scientific reports* 1 (2011): 197.

Gorlach, Krzysztof. "Freedom for credit: Polish peasants protests in the era of communism and post-communism." *Polish Sociological Review*, no. 129 (2000): 57–85.

Guerrero-Solé, Frederic. "Interactive behavior in political discussions on Twitter: Politicians, media, and citizens' patterns of interaction in the 2015 and 2016 electoral campaigns in Spain." *Social Media+ Society* 4, no. 4 (2018): 2056305118808776.

Haug, Nils, Lukas Geyrhofer, Alessandro Londei, Elma Dervic, Amelie Desvars-Larrive, Vittorio Loreto, Beate Pinior, Stefan Thurner, and Peter Klimek. "Ranking the effectiveness of worldwide COVID-19 government interventions." *MedRxiv*, 2020.

IAB. *Przewodnik po Social Media w Polsce*. https://iab.org.pl/wp-content/uploads/2020/01/IAB-Przewodnik-po-Social-Media-w-Polsce-2019-2020.pdf. Accessed: 2020-09-04, 2020.

IBI. *Rola interakcji w edukacji tradycyjnej (fizyczna), zdalnej czy hybrydowej w nadchodzącym roku szkolnym 2020/2021*. http://interdisciplinary-research.eu/rola-interakcji-w-edukacji-tradycyjnej-fizyczna-zdalnej-czy-hybrydowej-w-nadchodzacym-roku-szkolnym-2020-2021. Accessed: 2020-07-21, 2020.

ICM. *Komunikat ICM w związku z informacjami medialnymi dotyczącymi wpływu aktualnie trwających protestów na rozwój epidemii COVID-19*. https://icm.edu.pl/blog/2020/11/03/komunikat-icm-zwiazku-informacjami-medialnymi-dotyczacymi-wplywu-aktualnie-trwajacych-protestow-rozwoj-epidemii-covid-19.. Accessed: 2020-12-04, 2020.

Jarynowski, A, and A Rostami. "Reading Stockholm Riots 2013 in social media by text-mining.[in:] 6th Language & Technology Conference, Poznań, Poland, December 7-9, 2013 (pp. 353-358)." *Wydawnictwo Naukowe Uniwersytetu im. Adama Mickiewicza*, 2013.

Jarynowski, Andrzej. "Monitorowanie percepcji ryzyka Covid-19 na Dolnym Śląsku za pomocą analizy śladu cyfrowego w internecie 15.01-05.08. 2020," 2020.

Jarynowski, Andrzej, Andrzej Buda, DANIEL PŁATEK, and Vitaly Belik. "African Swine Fever Awareness in the Internet Media in Poland–exploratory review." *E-methodology* 6, no. 6 (2019): 100–115.

Jarynowski, Andrzej, Jarosław Jankowski, and Anita Zbieg. "Natural vs artificial viral spread within the online community." *E-methodology* 2 (2015): 71–78.

Jarynowski, Andrzej, Michał B Paradowski, and Andrzej Buda. "Modelling communities and populations: an introduction to computational social science," 2019.

Jarynowski, Andrzej, Alexander Semenov, and Vitaly Belik. "Protest perspective against COVID-19 risk mitigation strategies on the German Internet." *LNCS 12575*, 2020, pp. 1–12.

Jarynowski, Andrzej, Monika Wójta-Kempa, and Vitaly Belik. "Perception of "coronavirus" on the Polish Internet until arrival of SARS-CoV-2 in Poland." *Nursing and Public Health* 10, no. 2 (2020): 89–106. https://doi.org/10.17219/pzp/120054.

———. "Trends in interest of COVID-19 on Polish Internet." *Przeglad epidemiologiczny* 74, no. 2 (2020): 258–275.

Jarynowski, Andrzej, Monika Wójta-Kempa, Daniel Płatek, and Karolina Czopek. "Attempt to Understand Public Health Relevant Social Dimensions of COVID-19 Outbreak in Poland." *Society Register* 4, no. 3 (2020): 7–44.

Jarynowski Andrzej, Skawina Ireneusz. "Attempt at profiling and regionalisation of COVID-19 vaccine campaigns in Poland - preliminary results." *Preprint - ResearchGate*, 2020.

Jarynowski Andzej, Maciejewski J, Stochmal M. "Przegląd i charakterystyka prowadzonych w Polsce badań na temat społecznych uwarunkowań epidemii COVID-19 w jej początkowej fazie." *Bezpieczeństwo, Obronność, Socjologia*, 2020.

Katner, Adrienne, Kari Brisolara, Philip Katner, Andrew Jacoby, and Peggy Honore. "Panic in the Streets—Pandemic and Protests: A Manifestation of a Failure to Achieve Democratic Ideals." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 2020, 1048291120960233.

Kim, Yusoon, Yi-Su Chen, and Kevin Linderman. "Supply network disruption and resilience: A network structural perspective." *Journal of operations Management* 33 (2015): 43–59.

Kopecka-Piech, Katarzyna. "Methodological Aspects of Research on Mediatization and Demediatization of Everyday Life. Current State and Key Challenges." *Annales Universitatis Paedagogicae Cracoviensis/ Studia de Cultura* 12, no. 4 (2020): 113–121.

Korda, Holly, and Zena Itani. "Harnessing social media for health promotion and behavior change." *Health promotion practice* 14, no. 1 (2013): 15–23.

Korolczuk, Elżbieta, Beata Kowalska, Claudia Snochowska-Gonzalez, and Jennifer Ramme. *Bunt kobiet: czarne protesty i strajki kobiet*. Europejskie Centrum Solidarności, 2019.

Kowalewski, Maciej. "Street protests in times of COVID-19: adjusting tactics and marching 'as usual'." *Social Movement Studies*, 2020, 1–8.

Lampos, Vasileios, Simon Moura, Elad Yom-Tov, Ingemar J Cox, Rachel McKendry, and Michael Edelstein. "Tracking COVID-19 using online search." *arXiv preprint arXiv:2003.08086*, 2020.

Latour, Bruno. "On recalling ANT." *The sociological review* 47, no. 1 (1999): 15–25.

Łódzki, Bartłomiej, et al. "Medialny obraz rzeczywistości." *Studia Socialia Cracoviensia* 9, no. 1 (16) (2017): 121–136.

Matuszewski, Paweł, and Gabriella Szabó. "Are echo chambers based on partisanship? Twitter and political polarity in Poland and Hungary." *Social Media+ Society* 5, no. 2 (2019): 2056305119837671.

Nacher, Anna. "# BlackProtest from the web to the streets and back: Feminist digital activism in Poland and narrative potential of the hashtag." *European Journal of Women's Studies*, 2020, 1350506820976900.

Nencki. *The Nencki Affective Word List*. https://exp.lobi.nencki.gov.pl/nawl-analysis. Accessed: 2020-12-04, 2015.

Neyman, Gregory, and William Dalsey. "Black Lives Matter protests and COVID-19 cases: relationship in two databases." *Journal of public health (Oxford, England)*, 2020.

Nowak, Jakub. "The good, the bad, and the commons: A critical review of popular discourse on piracy and power during anti-ACTA protests." *Journal of Computer-Mediated Communication* 21, no. 2 (2016): 177–194.

Oh, Sang-Hwa, Seo Yoon Lee, and Changhyun Han. "The effects of social media use on preventive behaviors during infectious disease outbreaks: The mediating role of self-relevant emotions and public risk perception." *Health communication*, 2020, 1–10.

OKO. *Proba wplyniecia na wyniki wyborow? Dwie siatki patriotycznych trolli wspieraly Konfederacje*. https://oko.press/proba-wplyniecia-na-wyniki-wyborow-dwie-siatki-patriotycznych-trolli-wspieraly-konfederacje/. Accessed: 2020-03-04, 2019.

PBI. *Popularnosc Twitter w Polsce*. https://pbi.org.pl/media/popularnosc-twittera-polsce/. Accessed: 2020-03-04, 2019.

PEW. *Most Approve of National Response to COVID-19 in 14 Advanced Economies*. https://www.pewresearch.org/global/2020/08/27/most-approve-of-national-response-to-covid-19-in-14-advanced-economies/. Accessed: 2020-09-20, 2020.

Ploeg, Jan Douwe van der. "Farmers' upheaval, climate crisis and populism." *The Journal of Peasant Studies* 47, no. 3 (2020): 589–605.

Polityka$_w$*Siecie*. *70% tweetów dot StrajkKobiet pochodzi z ter. Polski...* https://twitter.com/Polityka_wSieci/status/1321783329113493504. Accessed: 2020-12-04, 2020.

Quigley, Ashley Lindsay, Phi Yen Nguyen, Haley Stone, David J Heslop, Abrar Ahmad Chughtai, and C Raina MacIntyre. "Estimated Mask Use and Temporal Relationship to COVID-19 Epidemiology of Black Lives Matter Protests in 12 Cities." *Available at SSRN 3712951*, 2020.

Qureshi, Israr, Babita Bhatt, Samrat Gupta, and Amit Anand Tiwari. "Causes, Symptoms and Consequences of Social Media Induced Polarization (SMIP)." *Information Systems Journal*.

Rogalski, Michal. *COVID-19 wedlug powiatow*. https://docs.google.com/spreadsheets/d/1Tv6jKMUYdK6ws6SxxAsHVxZbglZfisC8x_HZ1jacmBM/edit?usp=sharing. Accessed: 2020-05-27, 2020.

Rolnicze, Ceny. *CENY TUCZNIKÓW NAJNIŻSZE W WOLNEJ POLSCE*. https://www.cenyrolnicze.pl/wiadomosci/rynki-rolne/trzoda-chlewna/21300-ceny-tucznikow-najnizsze-w-wolnej-polsce-rolnicy-swinie-wypuszcza-w-pola-albo-przywioza-do-warszawy. Accessed: 2020-12-04, 2020.

Rosiński, Jerzy, Anna Różańska, Andrzej Jarynowski, Jadwiga Wójkowska-Mach, et al. "Factors shaping attitudes of medical staff towards acceptance of the standard precautions." *International journal of environmental research and public health* 16, no. 6 (2019): 1050.

Salathé, Marcel. "Digital epidemiology: what is it, and where is it going?" *Life sciences, society and policy* 14, no. 1 (2018): 1.

Salon24. *Young Lives Matter. Polska kontrkultura 2020*. https://www.salon24.pl/u/jankepost/1088181,young-lives-matter-polska-rewolucja-2020. Accessed: 2020-12-04, 2020.

Sejm. *Projekt ustawy o zmianie ustawy o ochronie zwierząt oraz niektórych innych ustaw*. https://www.sejm.gov.pl/sejm9.nsf/PrzebiegProc.xsp?id=1AB63D4F17FA40D8C12585E3004A30B8. Accessed: 2020-12-04, 2020.

Siuda, Piotr, and Magdalena Pluta. *Internet, zdrowie i choroba–powiązania społeczne, kulturowe i edukacyjne*, 2020.

Statista. *Most popular social media services during the coronavirus (COVID-19) epidemic in Poland)*. https://www.statista.com/statistics/1114857/poland-leading-social-media-during-the-covid-19-pandemic/. Accessed: 2020-12-04, 2020.

Sternisko, Anni, Aleksandra Cichocka, and Jay J Van Bavel. "The dark side of social movements: Social identity, non-conformity, and the lure of conspiracy theories." *Current opinion in psychology* 35 (2020): 1–6.

Szmuda, Tomasz, Shan Ali, Tarjei Vevang Hetzger, Philip Rosvall, and Paweł Słoniewski. "Are Online Searches for the Novel Coronavirus (COVID-19) Related to Media or Epidemiology? A Cross-sectional Study." *International Journal of Infectious Diseases*, 2020.

Twitter. *Permanent suspension of @realDonaldTrump*. https://blog.twitter.com/en_us/topics/company/2020/suspension.html. Accessed: 2021-01-10, 2021.

Urzędowska, Dominika, and Joanna Suchomska. "Feministki w Sieci. Nowe Media w Działaniach Przeciwko Ograniczaniu Praw Kobiet w Polsce." *INSTYTUT DYSKURSU I DIALOGU*, 2020.

Washingtonpost. *Twitter sees record number of users during pandemic*. https://www.washingtonpost.com/business/economy/twitter-sees-record-number-of-users-during-pandemic-but-advertising-sales-slow/2020/04/30/747ef0fe-8ad8-11ea-9dfd-990f9dcc71fc_story.html. Accessed: 2020-09-04, 2020.

Wasserman, Stanley, Katherine Faust, et al. *Social network analysis: Methods and applications*. Vol. 8. Cambridge university press, 1994.

Weed, Mike, and Abby Foad. "Rapid scoping review of evidence of outdoor transmission of covid-19." *medRxiv*, 2020.

Welles, Brooke Foucault, and Sandra González-Bailón. *The Oxford Handbook of Networked Communication*. Oxford University Press, USA, 2020.

WHO. *Coronavirus disease (COVID-19): Mass gatherings*. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19-mass-gatherings. Accessed: 2020-12-04, 2020.

WHO. *The Health System Response Monitor - Poland*. https://www.covid19healthsystem.org/countries/poland/countrypage.aspx. Accessed: 2020-12-04, 2020.

Wikipedia. *Protesty:Opinia Publiczna*. https://pl.wikipedia.org/wiki/Protesty_przeciwko_zaostrzeniu_przepisów_dotyczących_aborcji_w_Polsce#Opinia_publiczna. Accessed: 2020-12-04, 2020.

Wójta-Kempa, Monika. *Ocena poziomu poinformowania na temat przebiegu i skutków pandemii COVID-19*, 2020.

Żuk, Piotr, and Paweł Żuk. *O kulturze protestu jako rdzeniu tradycji eurpejskiej*. Instytut Wydawniczy Książka i Prasa, 2015.

———. "Right-wing populism in Poland and anti-vaccine myths on YouTube: Political and cultural threats to public health." *Global Public Health* 15, no. 6 (2020): 790–804.