Flattening the curve of COVID-19 vaccine rejection—a global overview.

Wojciech Feleszko [1] ✉, Piotr Lewulis [2], Adam Czarnecki [3], Paweł Waszkiewicz [2] ✉

[1] Department of Pediatric Pulmonology and Allergy, Medical University of Warsaw, Warsaw, Poland

[2] Department of Criminalistics, Faculty of Law and Administration, University of Warsaw, Warsaw, Poland

[3] ARC Rynek i Opinia, Market Research Institute, Warsaw, Poland

✉ e-mail: wojciech.feleszko@wum.edu.pl; p.waszkiewicz@uw.edu.pl

Word count: 612 (750)

Figure: 1

Current levels of public acceptability of immunisation put at serious risk the effectiveness of any future anti-SARS-CoV-2 vaccination programs, as it has been recently pointed out by the French COCONEL Group [1]. Regardless of the suggested correlations between vaccination hesitancy and specific socioeconomic factors, it is clear that anti-vaccination movements are increasingly influential [2]. Moreover, the problem is internationally valid, and the rise in the number of adults openly hesitant about routine childhood vaccination in many Western countries justifies the concern about public participation once the COVID-19 vaccine is available [3]. Given that in terms of collective immunity, vaccination effectiveness is based on its mass implementation, this may seriously undermine the efforts to protect societies against COVID-19 in the near future.

High levels of COVID-19 vaccine hesitancy are reported even from countries severely affected by the pandemic. Only 49% of American respondents plan to vaccinate when the vaccine becomes available [4]. In order to validate these data from a broader perspective, a survey on a representative sample of adult Polish citizens (n=1066) was conducted on June 2–9, 2020. Its results were compared with the data on global COVID-19 vaccine hesitancy (see Supplementary information). The data allowed to confirm not only strong COVID-19 vaccination hesitancy but also its international character and that it is not directly related to the level of confidence in vaccination safety in general.

According to our study, 28% of adults in Poland would not vaccinate against SARS-CoV-2 if the vaccine became available. Alarmingly, a majority (51%) of the reluctant respondents indicated that their minds would not be changed if given information regarding vaccine safety or efficacy, or if threatened with heavy fines. Significantly fewer respondents (37%) supported COVID-19 vaccinations specifically than supported childhood vaccinations in Poland in general (78% in 2018) [5].

We compared the results from the French, American, and Polish surveys with the available data from other countries. A systematic search of nationally representative and methodologically sound surveys identified a total of 20 (Figure 1). The vaccine hesitancy for the hypothetical, yet anticipated COVID-19 vaccine varied from very low (2–6% China) to very high (43%, Czechia, and 44%, Turkey). Surprisingly, the level of unwillingness to vaccinate against COVID-19 is in most countries much higher than regular vaccination reluctance, which varies between 3% (Egypt) and 55% (Russia).

Such high levels of vaccination hesitancy may be detrimental to public health. According to current estimates, the benefits of herd immunity are achievable if 67% of the population is vaccinated [6]. The high share of the population unwilling to vaccinate combined with the number of people unable to receive the COVID-19 vaccine (e.g. for medical reasons) suggests that herd immunity may be out of reach. Information about the high death tolls and hospital overflows from the COVID-19 pandemic has recently flooded the media, but has apparently not convinced the vast majority of the world's population to plan to vaccinate themselves. If the disturbing images being streamed live on social media cannot convince a fair share of the population to protect themselves from lethal risk, then educational or social campaigns may be limited in their effect. Educational efforts would be further undermined by the lack of trust in public authority figures, which fuels conspiracy theories and validates medical fake news [7]. The most effective vaccination programs in the past effectively eradicated certain deadly diseases, such as smallpox. This success in the past was only possible by combining mandatory preventive vaccination programs with coordinated education efforts [8]. A legislative action, as well as the creation of sound and coherent common international public policies,

should precede the availability of effective and safe COVID-19 vaccine. Only then can the curve be flattened. Ultimately.

Acknowledgements: none

Competing interests: We declare no competing interests.

Supplementary information is available for this paper (enclosed in the submission)

References:

1. COCONEL Group. A future vaccination campaign against COVID-19 at risk of vaccine hesitancy and politicisation. *The Lancet Infectious Diseases* 2020. doi: 10.1016/S1473-3099(20)30426-6
2. Schaffer DeRoo S, Pudalov NJ, Fu LY. Planning for a COVID-19 Vaccination Program. *JAMA* 2020.
3. Ball P. Anti-vaccine movement could undermine efforts to end coronavirus pandemic, researchers warn. *Nature* 2020; **581**(7808): 251.
4. The Associated Press-NORC Center for Public Affairs Research. Expectations for a COVID-19 Vaccine. NORC at the University of Chicago 2020. http://www.apnorc.org/projects/Pages/Expectations-for-a-COVID-19-Vaccine.aspx (Accessed on 20.06.2020)
5. Gallup. Country-level data (Appendix C) in: Wellcome Global Monitor – First Wave Findings. How does the world feel about science and health? 2019. Available from: https://wellcome.ac.uk/reports/wellcome-global-monitor/2018 (Accessed 20.06.2020).
6. Randolph HE, Barreiro LB. Herd Immunity: Understanding COVID-19. *Immunity* 2020; **52**(5): 737-41.
7. The Lancet Infectious D. Political casualties of the COVID-19 pandemic. *The Lancet Infectious diseases* 2020: S1473-3099(20)30496-5.
8. Omer SB, Salmon DA, Orenstein WA, DeHart MP, Halsey N. Vaccine refusal, mandatory immunisation, and the risks of vaccine-preventable diseases. *N Engl J Med* 2009; **360**(19): 1981-8.

Figure 1.

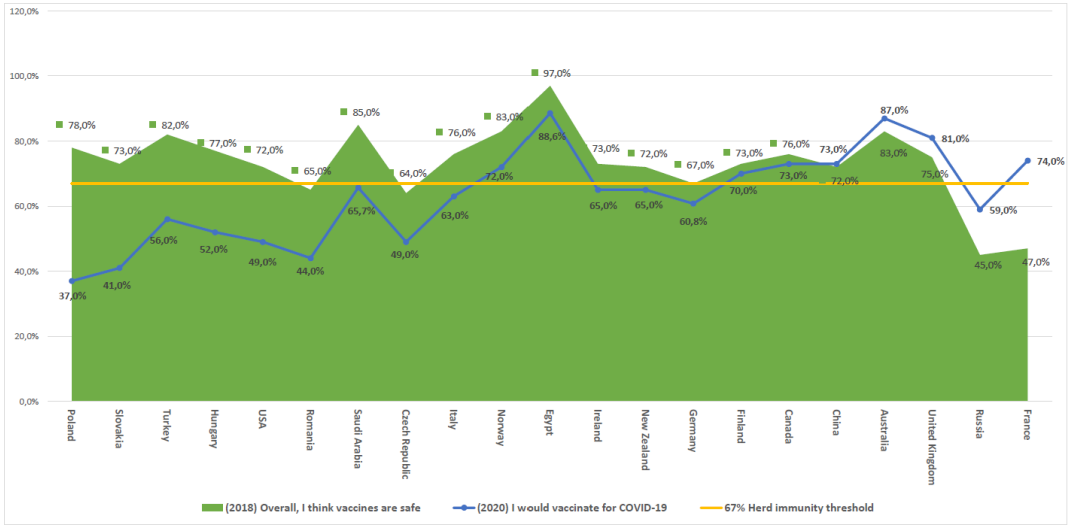
An international overview and comparison of COVID-19 vaccination acceptance levels and attitudes towards vaccination in general (A) with a graphic representation of thereof in the context of herd immunity vaccination threshold (B).

Figure 1

A)

Country	Overall, I think vaccines are safe	Overall, I think vaccines are effective	I would vaccinate for COVID-19	I would not vaccinate for COVID-19
Australia	83,0%	91,0%	87,0%	7,0%
Canada	76,0%	83,0%	73,0%	27,0%
China	72,0%	79,0%	73,0%	2,6%
Czech Republic	64,0%	76,0%	49,0%	43,0%
Egypt	97,0%	96,0%	88,6%	7,2%
Finland	73,0%	83,0%	70,0%	22,0%
France	47,0%	68,0%	74,0%	26,0%
Germany	67,0%	83,0%	60,8%	n/a
Hungary	77,0%	78,0%	52,0%	23,0%
Ireland	73,0%	86,0%	65,0%	9,0%
Italy	76,0%	84,0%	63,0%	21,0%
New Zealand	72,0%	82,0%	65,0%	16,0%
Norway	83,0%	93,0%	72,0%	n/a
Poland	78,0%	84,0%	37,0%	28,0%
Romania	65,0%	75,0%	44,0%	33,0%
Russia	45,0%	62,0%	59,0%	35,0%
Saudi Arabia	85,0%	83,0%	65,7%	7,0%
Slovakia	73,0%	90,0%	41,0%	28,0%
Turkey	82,0%	87,0%	56,0%	44,0%
United Kingdom	75,0%	86,0%	81,0%	4,0%
USA	72,0%	84,0%	49,0%	20,0%
	2018		2020	

B)



Footnote: Percentage data are reflected on scales of red and green. Colour saturation increases with percentage.

Supplementary information

Flattening the curve of COVID-19 vaccine rejection—a global overview.

Wojciech Feleszko, Piotr Lewulis, Adam Czarnecki, Paweł Waszkiewicz

(i) Survey on Poland's population

An online omnibus survey was conducted June 2–9, 2020. Quota sampling and statistical weighting were employed to make the sample representative of Poland's offline population (aged 18–65) in terms of gender, age, region, and city size. The survey was completed on epanel.pl (N=1066), in an opt-in online panel operated by ARC Rynek i Opinia Independent Research Institute. Cadas software was applied for online self-completed questionnaires (CAWI - CADAS Software Sp. z o.o., Warsaw, Poland), and then randomization of items in multichoice questions was applied. Weighted-response frequencies were calculated using SPSS software (IBM SPSS Statistics). Statistical analysis was done, and any sub-group differences included were statistically significant at a 95% confidence interval. No personally identifiable information was included in the data file provided by the research institute.

Question: ***If a vaccine against COVID-19 is available do you plan to vaccinate****?*

	Total	**Gender**		**Age**			
		Female	Male	18–24	25–34	35–44	46–65
Yes	**37%**	31%	43%	43%	32%	33%	41%
No	**28%**	31%	25%	25%	36%	30%	24%
I do not know/It is difficult to answer	**34%**	38%	31%	32%	33%	37%	35%
N	1066	535	531	125	243	254	445

The respondents indicating that they do not plan to vaccinate if the COVID-19 vaccine becomes available (N=301) were confronted with a list of eight different hypothetical reasons to vaccinate.

When asked if any of the reasons would sway them to be in favor of being vaccinated, the majority (51%) answered that none of the presented reasons would change their decision. The list of presented reasons was as follows: Scientific research on vaccine safety (i); Statements of experts - doctors, scientists (ii); If vaccination was recommended by a family doctor (iii); If someone from my loved ones / family / friends was vaccinated (iv); If a public figure whom I trust and respect was vaccinated (v); Low cost/no cost of vaccine (vi); High penalties for not vaccinating myself or my child (e.g. 5000 PLN equivalent ca. 1000€) (vii); It is not possible to enter some countries without a vaccination certificate (viii).

(ii) Data on global COVID-19 vaccine acceptance

Data pertaining to the projected COVID-19 vaccination acceptance levels in various countries and languages were collected on the basis of an online open-source analysis. Online sources considered in the study included openly available scientific papers, research and survey reports, official documents, and news media opinion polls on personal attitudes towards hypothetical COVID-19 vaccinations. The study consisted of two stages: data collection and analysis.

The first stage involved online searches and data collection from opinion polls about COVID-19 vaccination. Polls from as many countries as possible were considered. The results from any given opinion poll found online were taken into consideration if the poll had been performed by a reliable and trusted entity (i.e. an academic unit or a professional survey research company) on a representative sample of the general adult population between March and June 2020. The polls must have contained a closed question (preferably a 'yes' or 'no' question) about one's hypothetical decision about COVID-19 vaccination. Specifically, the polls must have asked, "if a new Coronavirus vaccine became publicly available, would I be willing to be vaccinated?" or a synonymous, differently phrased question in the relevant national language. Only one survey per country was taken into account. Surveys performed on non-representative samples, such as various Internet opinion polls available on news sites, were excluded from the study.

The systematic search was conducted between June 8 and 10, 2020, using basic online data information gathering tools: search engines (google.com and google.scholar.com) and an automatic translation tool (google.translate.com). The search was conducted in 32 national languages (Arabic, Belarusian, Bulgarian, Czech, Danish, Dutch, English, Estonian, Finnish, Flemish, French, Georgian, German, Hindi, Hungarian, Icelandic, Italian, Japanese, Kazakh, Korean, Latvian, Lithuanian, Norwegian, Portuguese, Romanian, Russian, Slovakian, Spanish, Swedish, Thai, Turkish, and Ukrainian). The Internet searches were conducted using google.translate.com to specify search terms and keywords in all the national languages except for English, French, German, Italian, Portuguese, and Turkish, in which the search terms were directly defined. Various keywords and search perimeters

simultaneously used in the study were specified to enable relevant data to be found. For example, 'COVID-19 vaccination acceptance + opinion poll' or 'would you vaccinate against coronavirus + opinion survey' and other similar but differently phrased searches were used to maximize search coverage. As a result, surveys meeting the specified criteria from 20 different jurisdictions were found. A reference list of sources is provided below.

During the analysis stage, the data collected were translated and entered into the data table as representing positive or negative social attitudes towards COVID-19 vaccination. Uncertain answers to the survey question such as 'rather yes' and 'rather no' were extrapolated to 'yes' and 'no' respectively. The original survey results were included in the table as they were presented and not rounded up nor down during the analysis.

Additionally, Table 1 contains data on general attitudes towards vaccination in the source countries in 2018. All the data on public perception of vaccination safety and effectiveness used in the table come from the Wellcome Foundation Global Monitor 2018 study report [1].

References:

1. Gallup. Country-level data (Appendix C) in: Wellcome Global Monitor - – First Wave Findings. How does the world feel about science and health? 2019. Available from: https://wellcome.ac.uk/reports/wellcome-global-monitor/2018 (Accessed 20.06.2020)

Data sources for countries in alphabetical order:

1. Australia:

Finding No. 8369 Topic: Press Release Public Opinion Special Poll Country: Australia United Kingdom. roymorgan.com. http://www.roymorgan.com/findings/8369-roy-morgan-benchmark-survey-covid-19-in-australia-april-06-2020-1-202004070107 (2020).

2. Canada:

Poll conducted by Research Co. On the COVID-19 outbreak in Canada, researchco.ca. https://researchco.ca/wp-content/uploads/2020/04/Tables_Expectations_COVID19_CAN_21Apr2020.pdf (2020).

3. China:

Fu C. et al. Acceptance and preference for COVID-19 vaccination in health care workers. Preprint at https://www.medrxiv.org/content/10.1101/2020.04.09.20060103v1 (2020).

4. Czech Republic:

Cody J. 43% of Czechs don't want to be vaccinated for coronavirus: poll. rmx.news. https://rmx.news/article/article/survey-43-of-czechs-don-t-want-to-be-vaccinated-for-coronavirus (2020).

5. Egypt:

Abdelhafiz, A. S. et al. Knowledge, Perceptions, and Attitude of Egyptians Towards the Novel Coronavirus Disease (COVID-19). *J Community Health*. https://doi.org/10.1007/s10900-020-00827-7 (2020).

6. Finland:

Bjorkqvist A. Uutissuomalainen: Majoriteten av finländarna tänker ta vaccin mot coronavirus. svenska.yle.fi. https://svenska.yle.fi/artikel/2020/05/29/uutissuomalainen-majoriteten-av-finlandarna-tanker-ta-vaccin-mot-coronavirus (2020).

7. France:

Peretti-Watel, P., Seror, V., Cortaredona, S., Launay, O., A future vaccination campaign against COVID-19 at risk of vaccine hesitancy and politicization. The Lancet Infectious Diseases. https://doi.org/10.1016/ S1473-3099(20)30426-6 (2020).

8. Germany:

COVID-19 Snapshot Monitoring (COSMO)- Ergebnisse aus dem wiederholten querschnittlichen Monitoring von Wissen, Risikowahrnehmung, Schutzverhalten und Vertrauen während des aktuellen COVID-19 Ausbruchsgeschehens. projekte.uni-erfurt.de. https://projekte.uni-erfurt.de/cosmo2020/cosmo-analysis.html#15_impfungen (2020).

9. Hungary:

Csaba M. A magyarok fele fél attól: megfertőzi a koronavírus. Index.hu. https://index.hu/techtud/2020/03/21/sokkal_jobban_tartanak_mar_a_magyarok_a_koronavirustol/ (2020).

10. Ireland:

COVID-19 Mental Health Survey by Maynooth University and Trinity College finds high rates of anxiety. Maynoothuniversity.ie. https://www.maynoothuniversity.ie/news-events/covid-19-mental-health-survey-maynooth-university-and-trinity-college-finds-high-rates-anxiety (2020).

11. Italy:

Cipolla A. Quel 21% degli italiani che non vuole vaccinarsi al coronavirus. money.it. https://www.money.it/Sondaggio-21-percento-italiani-no-vaccino-coronavirus?fbclid=IwAR2dUOyoW0Z6uc7w3LlCSipIs9UjiXhdGQswWAnd3ZBJlorRBMNknFezP3E (2020).

12. New Zealand:

Adams J. New poll shows 16% of New Zealanders don't want to be Covid-19 vaccinated. thespinoff.co.nz. https://thespinoff.co.nz/science/20-05-2020/new-poll-shows-16-of-new-zealanders-dont-want-to-be-covid-19-vaccinated/ (2020).

13. Norway:

Simonsen C., Hødnebø L. Sju av ti vil ta fremtidig korona-vaksine. Nrk.no. https://www.nrk.no/norge/ikke-alle-vil-vaksinere-seg-mot-covid-19-1.15039544 (2020).

14. Romania:

10 concluzii după starea de urgentă. ires.ro. https://ires.ro/articol/397/bilan-ul-starii-de-urgen%C8%9B%C4%83-in-romania (2020).

15. Russia:

Вакцинация против COVID-2019: перспективы и ожидания. Wciom.ru. https://wciom.ru/index.php?id=236&uid=10284 (2020).

16. Saudi Arabia:

Padhi, B. K., Al.-Mohaithef, M. Determinants of COVID-19 vaccine acceptance in Saudi Arabia: a web-based national survey. Preprint at https://www.medrxiv.org/content/10.1101/2020.05.27.20114413v2 (2020).

17. Slovakia:

Ak by bola dostupná vakcína na COVID-19, zaočkovalo by sa 40,9 percenta Slovákov. Aktuality.sk. https://www.aktuality.sk/clanok/787146/ak-by-bola-dostupna-vakcina-na-covid-19-zaockovalo-by-sa-40-9-percenta-slovakov/ (2020).

18. Turkey:

Korona virüsü aşısı bulunsa yaptrir misniz?. Turkiyeraporu.com. https://www.turkiyeraporu.com/korona-virusu-asisi-bulunsa-yaptirir-misiniz?fbclid=IwAR1kQAsBaEhAdHHAh0CEAJx9Y5zJehywSH3ln4GSCwdHF1vepqA4WC2cNB4 (2020).

19. United Kingdom:

One in five public unsure about getting coronavirus vaccine, if available. rsph.org.uk. https://www.rsph.org.uk/about-us/news/one-in-five-public-unsure-about-getting-coronavirus-vaccine-if-available.html (2020).

20. USA:

Expectations for a COVID-19 Vaccine. apnorc.org. http://www.apnorc.org/projects/Pages/Expectations-for-a-COVID-19-Vaccine.aspx (2020)