



Vaccine hesitancy due to vaccine country of origin, vaccine technology, and certification

Amiel A. Dror^{1,2} · Amani Daoud^{1,2} · Nicole G. Morozov⁴ · Eli Layous^{1,2} · Netanel Eisenbach^{1,2} · Matti Mizrahi^{1,2} · Doaa Rayan^{1,2} · Ahmad Bader^{1,2} · Shawky Francis^{1,2} · Edward Kaykov^{2,3} · Masad Barhoum^{2,5} · Eyal Sela^{1,2}

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Abstract

Vaccine hesitancy is a global health threat which may hinder the widespread acceptance of several COVID-19 vaccines. Following the collection of 2470 responses from an anonymous questionnaire distributed between October and November 2020 across Israel, we analyzed the responses of physicians, life science graduates (biology, virology, chemistry, etc.), and the general public to whether they would obtain a COVID-19 vaccine with particular vaccine characteristics such as vaccine country of origin, technology, side effect profile, efficacy, and other attributes. Physicians and life science graduates were least likely to accept a vaccine based on mRNA technology (30%) while the general population seemed to adopt any vaccine technology if the declared efficacy is above 90% and the country of manufacturing is the USA/UK rather than China or Russia. However, current inoculation rates in Israel far outpace our predicted rate. Our results highlight the importance of tailored vaccine educational campaigns based on population demographic details and specific vaccine concerns.

Keywords COVID-19 · Vaccine hesitancy · mRNA vaccine · Vaccine certification

Introduction

Vaccine hesitancy is a global health threat. Its dangers have become only more apparent amid rapid COVID-19 vaccine development. While several COVID-19 vaccines are now publicly available, vaccine hesitancy remains a barrier to full population inoculation against this pandemic-causing virus [1, 2]. Because recent research has indicated that strong resistance exists to COVID-19 vaccines, we sought

to determine what common concerns exist among individuals hesitant to inoculation [3].

We evaluated the willingness of physicians, graduates with degrees in life sciences, and individuals in the general population to accept a vaccine based on country of origin, the type of vaccine, the certificates the vaccine has achieved, and other vaccine attributes. We subsequently determine if the data, collected in late 2020 and prior to widespread vaccine distribution, are consistent with current trends of vaccine uptake in eligible populations in general, and specifically healthcare workers, in Israel.

Amiel A. Dror, Amani Daoud and Nicole G. Morozov are equal first authors.

✉ Amiel A. Dror
amielddror@gmail.com

- 1 Department of Otolaryngology, Head and Neck Surgery, Galilee Medical Center, Nahariya, Israel
- 2 The Azrieli Faculty of Medicine, Bar-Ilan University, Safed, Israel
- 3 Geriatric Medicine Department, Galilee Medical Center, Nahariya, Israel
- 4 Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel
- 5 Galilee Medical Center, Nahariya, Israel

Methods

We evaluated the results of an anonymous questionnaire of 2470 individuals in Israel between October 20, 2020 and November 22, 2020 (Fig. 1). Ethical approval was granted by the Research Ethics Committee of the Galilee Medical Center before study initiation. Informed consent was requested on the introductory web page prior to survey enrollment. The anonymous web-based survey followed the American Association for Public Opinion Research (AAPOR) reporting guidelines. Confidentiality

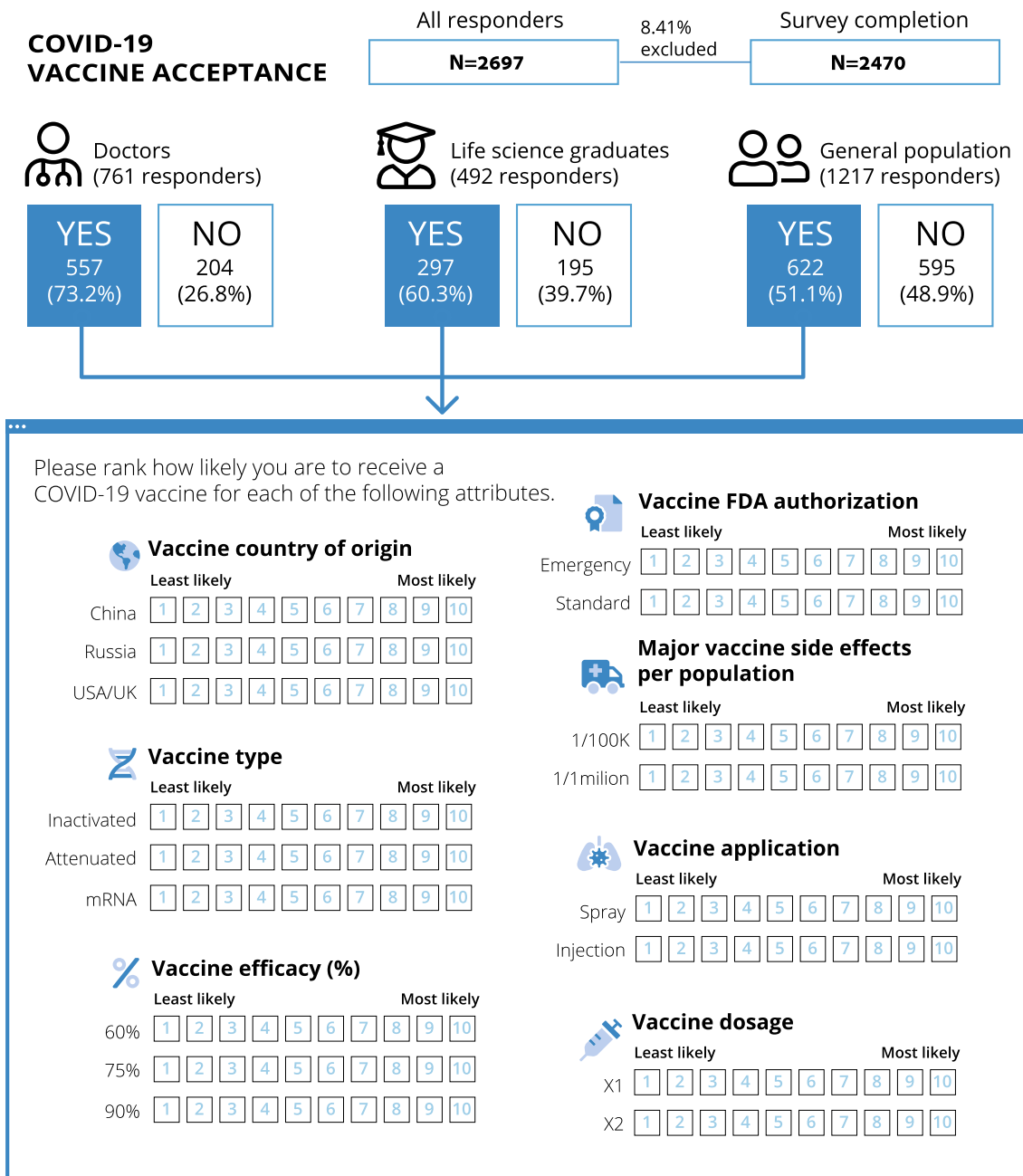


Fig. 1 Demographic categorization (physician, life science graduates, general population) of COVID-19 vaccine acceptance based on attributes including vaccine country of origin, vaccine efficacy, vaccine

type, major vaccine side effects per population, vaccine application, vaccine dosage, and vaccine FDA authorization)

of information was maintained. Participants were permitted to terminate participation at any time.

Participants were categorized using demographic data of occupation (physician vs. non-physician) and educational history (as a graduate of a life sciences degree in biology, biochemistry, biotechnology, biophysics,

chemistry, ecology, evolution and environment, genetics and heredity, immunology, mycology, parasitology, physiology, toxicology, veterinary sciences, and virology). Individuals who were not physicians and who did not obtain one of the aforementioned degrees were placed in the “general population” category.

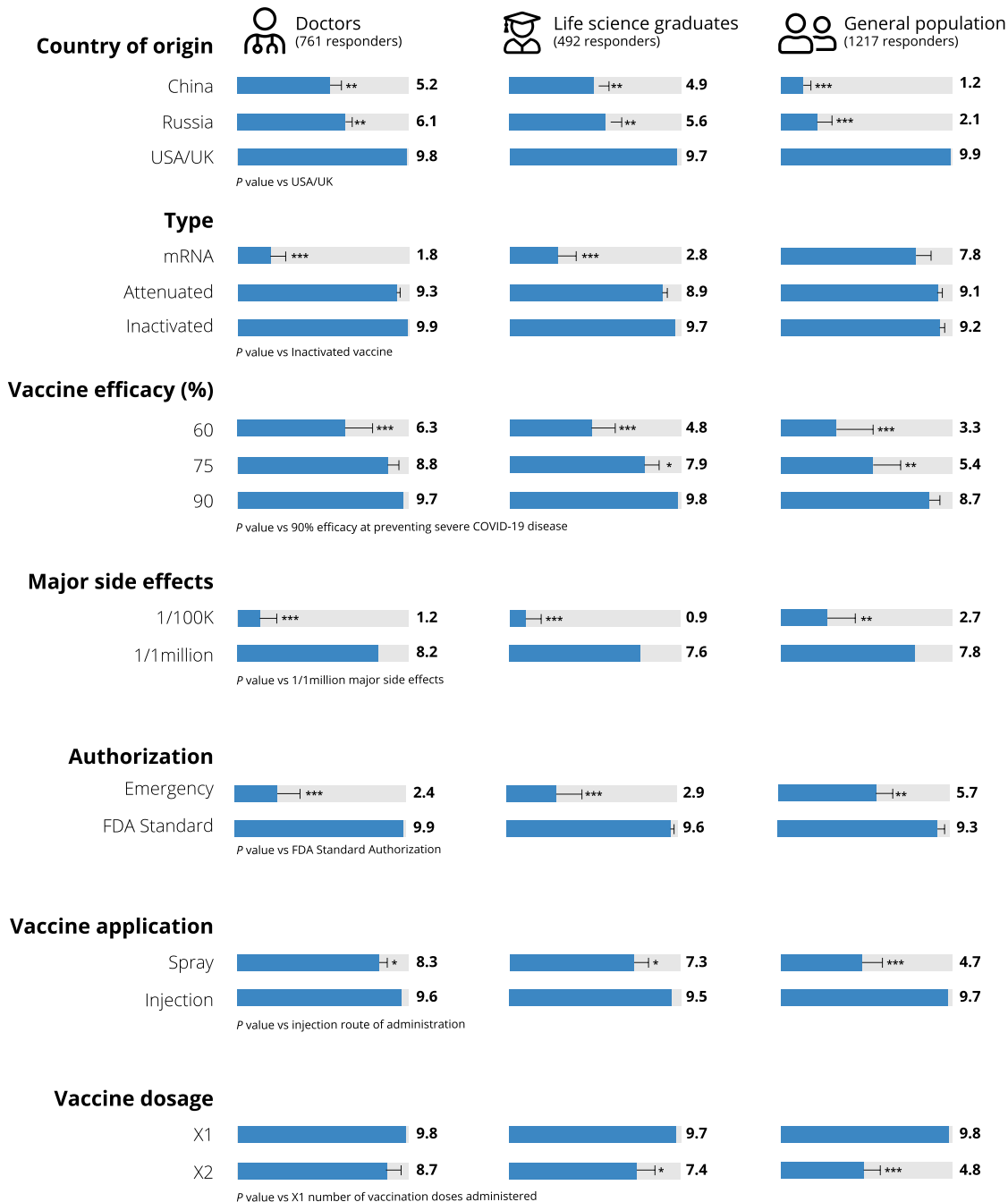
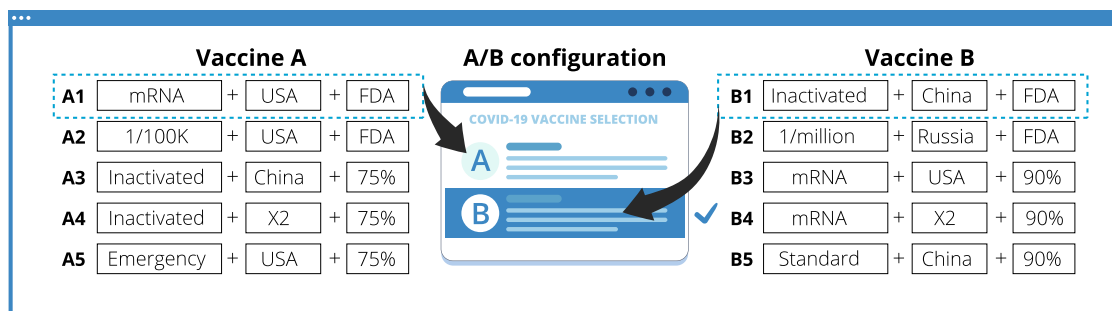


Fig. 2 Graphical representation of acceptance of a vaccine with each attribute, with the filled blue line indicating positive acceptance of a vaccine on a scale of 1 (least likely) to 10 (most likely) along with predetermined combined (A/B) options from which respondents chose

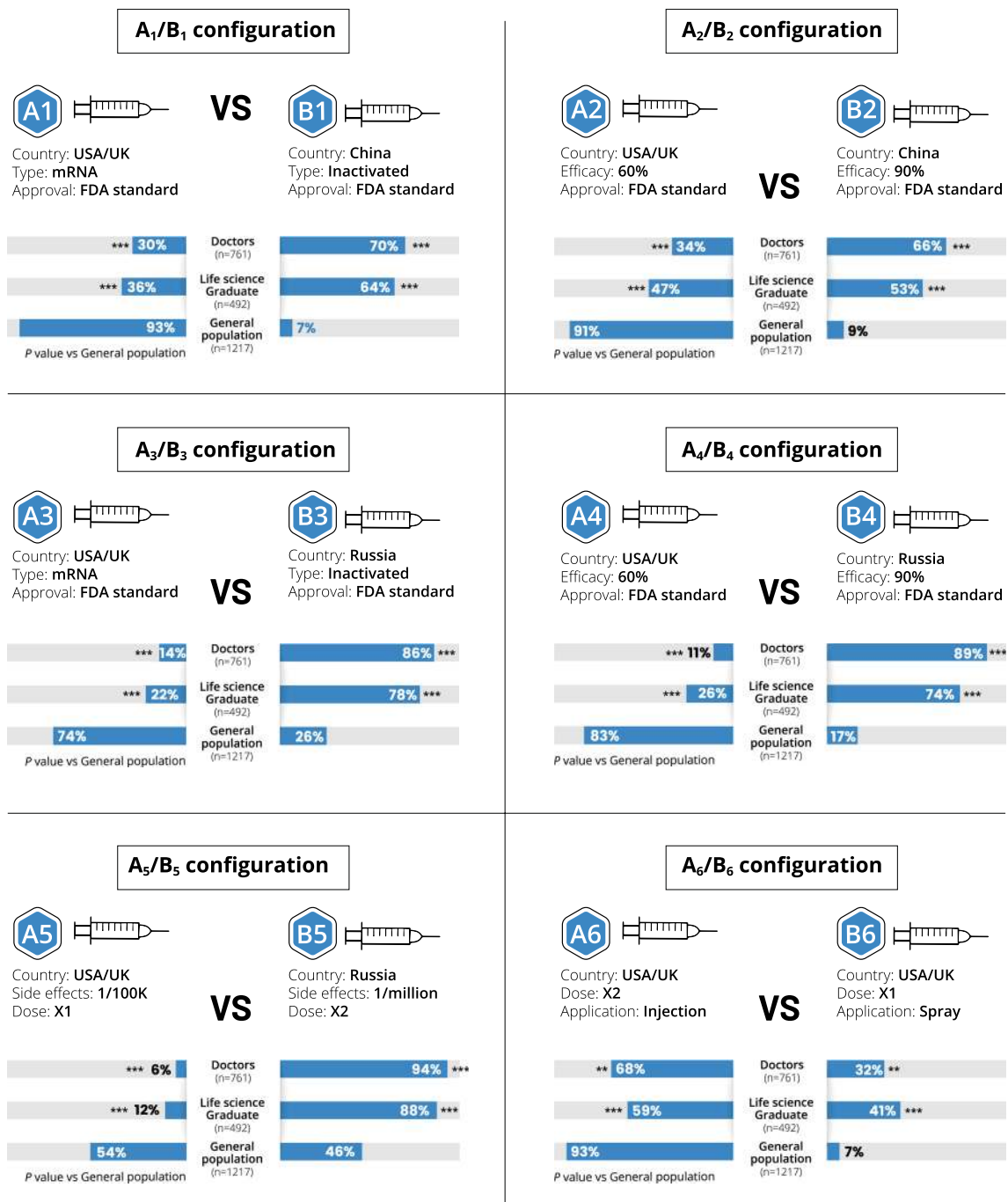


Fig. 2 (continued)

Responders receptive of a COVID-19 vaccine were presented with additional questions regarding reasons for vaccine hesitancy. They ranked the likelihood of accepting a COVID-19 vaccine, on a scale of 1 (least likely) to 10 (most likely) based on vaccine country of origin, vaccine efficacy (60%, 75%, 90%), vaccine type (inactivated, attenuated, or mRNA), side effects per population (1/100,000 or 1/1,000,000), vaccine application (spray or injection),

vaccine dosage (1x or 2x for full inoculation), and vaccine authorization (emergency or FDA standard) (Fig. 1). Responders were asked to choose their preference of two (A/B) vaccine configurations (e.g. choose either an mRNA vaccine with FDA approval which was manufactured in the USA or an inactivated vaccine with standard FDA approval which was manufactured in China) (Fig. 2).

To assess the difference in the likelihood of vaccine acceptance among different groups, we performed χ^2 tests in Prism 8 software (Graphpad, San Diego, California).

Results

Physicians comprised 761 responders, life science graduates 492, and the general population 1217. While physicians had the highest acceptance rate (73.2%) of a COVID-19 vaccine, life science graduates were less accepting (60.3%) and the general population was least accepting (51.5%).

Physicians and life science graduates were least likely to accept a vaccine based on mRNA technology (30%) whereas the general public seemed to adopt any category of vaccine (inactivated, attenuated, or mRNA) almost indiscriminately as long as the declared efficacy was above 90% and the country of manufacturing was the USA/UK. The general population was much more skeptical of a vaccine developed in China or Russia (Figs. 1, 2).

In the A/B vaccine configuration scenario, the general public favored a USA/UK vaccine with 60% efficacy over a Chinese or Russian vaccine with 90% efficacy. The physicians, however, selected the Chinese or Russian vaccine with the higher efficacy if both vaccines have FDA standard authorization. Other interesting findings include that all responders were much more concerned about safety over efficacy. We observed that while physicians and life science graduates said they supported the introduction of new technologies in vaccine development, they reported significant preferences for conventional vaccine conformations (attenuated and inactivated) over the mRNA vaccine despite its status as an outstanding breakthrough in vaccine development (Fig. 2).

Conclusions

Hesitancy to novel COVID-19 vaccines is based on countless concerns from geopolitical prejudices to vaccine technologies. We identified several major concerns including country of origin, vaccine technology, and vaccine certifications. While concerns of physicians, life-sciences graduates, and the general population usually coincided, we discovered several statistically significant differences in the rates of acceptance of a potential vaccine based on vaccine attributes.

Our results indicate that physicians and life-science graduates were less willing to receive an mRNA vaccine

than an attenuated or inactivated vaccine as compared to the general population. However, the general population is much less willing to receive a vaccine from China or Russia than one produced in the United States or the United Kingdom; physicians were more willing to receive a Chinese or Russian vaccine than the general population.

According to the Israeli Ministry of Health, vaccine uptake of the Pfizer/BioNTech COVID-19, an mRNA vaccine developed in the United States and Germany with full FDA approval, among health professionals (including physicians, nurses, and other healthcare workers) has been variable, with as many as 87% of workers in Ziv Medical Center in Safed vaccinated to as few as 66% at Hillel Yaffe Medical Center in Hadera [4]. While only 73.2% of physicians in our study stated they would receive the vaccine, only three major hospitals out of 11 in Israel had vaccine uptake at or below 73%. However, data is not yet available stratifying vaccine acceptance based on employment status as a physician, nurse, or other healthcare worker.

As of early April 2021, 87.91% of eligible individuals within Israel have received both Pfizer/BioNTech COVID-19 vaccine doses [5]. This is prominently above our predicted COVID-19 vaccine acceptance rate in the general population, suggesting that the concerns of individuals who would refuse a COVID-19 vaccine outright may be attenuated by various social, economic, cultural, and political factors.

The availability of a single vaccine type in Israel, developed in Germany and the United States and utilizing mRNA technology, restricts the ability to conduct comparative analyses of accepted vaccine types. Government persuasion to adopt a vaccine, whether by granting “green passports” to vaccinated individuals or disallowing healthcare workers from working in COVID-19 units if unvaccinated, may have also influenced results. Because vaccine skepticism has no single underlying motivation, approaches addressing vaccine hesitancy and encouraging vaccine uptake must be nuanced and versatile to alleviate the specific apprehensions and assuage the individuals expressing them.

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Availability of data and materials Data has been made available.

Code availability Not applicable.

Declarations

Conflict of interest No conflicts of interest to declare.

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