

# COVID-19 Vaccine Acceptance among the Ghanaian Population

## Authors

Nana Ofori Adomako<sup>1\*</sup>, Priscilla Kolibea Mante<sup>2</sup>, Ivan Eduku Mozu<sup>1</sup>, Kofi Nyanor Amoh<sup>1</sup>, Obed Amponsah<sup>1</sup>, Leslie Akplah<sup>1</sup>, Afia Frimpomaa Marfo<sup>1</sup>

<sup>1</sup>Department of Pharmacy Practice, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

<sup>2</sup>Department of Pharmacology, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

## Corresponding Author

Dr. Nana Ofori Adomako email: [kdadomako@gmail.com](mailto:kdadomako@gmail.com) Telephone number: +233 20 912 6246

Department of Pharmacy Practice, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, PMB, University Post Office, Kumasi, Ghana.

## Abstract

The Government of Ghana in its effort to decrease the burden of Coronavirus (COVID-19) plans to secure vaccines for its citizens. Globally, vaccine hesitancy has been reported which may affect efforts to curb the spread and impact of COVID-19 in all aspects of life. Our study aims to determine the willingness of Ghanaians to accept the vaccine or otherwise and create avenues for interventions where necessary. A self-administered online-based cross-sectional study was conducted on 613 participants from the 4<sup>th</sup> of April to 16<sup>th</sup> May, 2021. Data was analysed with SPSS version 25. Sociodemographic characteristics were described using descriptive analysis. Pearson's Chi-square was used to determine the association between vaccine acceptance and sociodemographic characteristics. Statistical significance was set at 95% confidence interval ( $p < 0.05$ ). Majority of the participants were males representing 51.1% ( $n=313$ ). The highest proportion of respondents fell within the age brackets of 21-30 years. A significant proportion of the respondents were yet to take the vaccine (471, 76.84%) but 74.7% ( $n=458$ ) were willing to take the vaccines. For those who declined the vaccine, side effects (61, 39.35%), apathy (34, 21.94%), claim that vaccine had not been tried and tested (28, 18.06%) and concerns on quality of vaccines brought to Africa (22, 14.2%) were the main reasons respondents gave to support their decision to decline the vaccine. There was no significant association between age and acceptance ( $p=0.4220$ ) and educational background and acceptance ( $p=0.187$ ), however, there was a significant association between sex and vaccine acceptance ( $p=0.001$ ). Even though majority of the participants were willing to take the vaccine, there is the need for the Government of Ghana in collaboration with relevant stakeholders to embark on mass education to address various concerns as reported particularly on adverse effects and safety concerns as well as sensitize the population on the need for vaccination to decrease apathy and increase public acceptance of the COVID-19 vaccine.

**Keywords:** Ghana, COVID-19, Vaccination, Acceptance.

## Introduction

The novel coronavirus disease (COVID-19) was declared a global pandemic by the World Health Organization (WHO) on March 11, 2021. As of 26<sup>th</sup> May 2021, the global burden of the disease stood at 168 million cases with 3.49 million deaths. Ghana reported its first COVID-19 case on the 12<sup>th</sup> of March, 2020 from two individuals who travelled home from Norway and Turkey respectively. Since then, the country has recorded 93,711 cases with 783 deaths as of 26<sup>th</sup> May 2021 (COVID-19 Updates | Ghana, 2021).

Globally, governments have put measures in place to help halt the spread of the disease. These include the compulsory wearing of nose masks, institution of social distancing, lockdowns, travel bans, promotion of hand washing and the use alcohol-based hand sanitizers. Though these are effective measures, they are not enough (Bonful et al., 2020; Aduhene

and Osei-Assibey, 2021; Sibiri, Prah and Zankawah, 2021). Vaccination is known to be a paramount approach in disease prevention as they offer immunity to diseases (Bodily, Tsunoda and Alexander, 2020).

In view of this, researchers in collaboration with pharmaceutical firms have formed alliances to help in the development of safe and efficacious COVID-19 vaccines for mass use (Manning et al., 2021). Currently, about 13 different vaccines across 4 platforms have been administered worldwide including the Pfizer/BioNTech (Comirnaty) vaccine, Sputnik V, Moderna, Sinovac, the SII/Covishield and AstraZeneca/AZD1222, Janssen/Ad26 and the recent Sinopharm vaccine which was enlisted for Emergency Use Listing on the 7<sup>th</sup> of May, 2021 (Coronavirus disease (COVID-19): Vaccines, 2021).

The distribution of these vaccines globally has been skewed towards high-risk individuals which include the aged, those with

chronic comorbidities and front-line workers (providers of essential services) due to limited availability (DSouza and Wolfe, 2021) but governments, including that of Ghana, are putting in measures to obtain the vaccines on a larger scale to extend the vaccination program to all its citizens (*Emerging lessons from Africas COVID-19 vaccine rollout - Ghana | ReliefWeb, 2021; Aduhene and Osei-Assibey, 2021*).

Even though easy accessibility is the target, it is not compulsory to take the vaccine (Graeber, Schmidt-Petri and Schröder, 2021) and vaccine hesitancy has been reported by several studies (Fridman, Gershon and Gneezy, 2021; Griffith, Marani and Monkman, 2021; Sallam, 2021). Interestingly, studies have reported the unwillingness of healthcare workers to receive the COVID-19 vaccine. A study conducted in Ghana on acceptance of the vaccine by healthcare workers indicated that 60.7% of the participants were unwilling to accept the vaccine and this may translate into the acceptance by the general population since people rely on healthcare workers for credible medical information (Agyekum *et al.*, 2021). Healthcare experts remain sceptical about the safety and efficacy of the vaccine considering how quickly they were developed and approved (Al-Metwali *et al.*, 2021; Qattan *et al.*, 2021).

Since the news on governments' decision to acquire vaccines from AstraZeneca and Sputnik V, various conversations have come up with diverse opinions on the acceptance of the vaccine (Ghana: Coronavirus and the media | European Journalism Observatory - EJO, 2021). Limited studies have been conducted to determine the level of acceptance of the vaccine by the Ghanaian population. Our study seeks to establish the readiness of the Ghanaian population to receive the vaccine once available and identify the reasons why they may not, so as to suggest suitable interventions to reduce vaccine hesitancy and the burden of the disease.

## Materials and Methods

### Study SeEng and Design

The study was conducted in Ghana, a country in West Africa with a population of about 30.8 million (Summary of Provisional Results, 2021). Our survey is a cross-sectional study which was conducted among the general population in Ghana. We employed a snowballing and convenient sampling technique. Data was taken using an online-based (Google form) self-administered questionnaire which was shared across board using social media platforms such as WhatsApp, Facebook and Twitter. Employing the snowball approach, respondents were encouraged to share the link with others. The online form was appropriate due to the current pandemic as it cuts out face-to-

face conversations with respondents. The only specific inclusion criterion was to be a Ghanaian. Informed consent was sought from participants prior to the filling of the questionnaire and their anonymity safeguarded. Data was collected over a period of one month.

### Sample size

In estimating the sample size, the formular below was used:

$$n = \frac{(z^2) (p)(1 - p)}{(d)^2}$$

Where n= sample size z=1.96 at 95% confidence level, p= prevalence, d= precision. A prevalence of 50% was used since it was unknown and the precision was set at 5%. An estimate of 385 was obtained. Using a non-response rate of 15%, an additional 57.6 participants was factored in for a total of approximately 442 participants.

### Data collection

For the purpose of this study, we defined acceptance as the intention or willingness to accept the COVID-19 vaccine once made readily available. We sought to find out whether or not the respondents will take the vaccine with a "Yes" or "No" answer. A semi-structured questionnaire was developed. The questionnaire had a section to cover sociodemographic characteristics. Additional questions were asked on whether the respondents had taken the vaccine, whether they will take the vaccine, and reasons for not wanting to take the vaccine.

### Analysis of data

Data obtained was exported to Microsoft Excel. Data was analysed with SPSS version 25. Sociodemographic characteristics were described using descriptive analysis. Pearson's Chi-square was used to determine the association between vaccine acceptance and sociodemographic characteristics. Statistical significance was set at 95% confidence interval at p<0.05.

## Results

### Sociodemographic Characteristics of Participants

A total of 613 individuals responded to the questionnaire. Majority of the respondents were males (313, 51.1%). The highest proportion of respondents fell within the 21-30 age bracket. Undergraduates formed majority of the participants (334, 54.49%) Table 1 summarizes the demographic characteristics of the respondents.

**Table 1: Demographic characteristics of participants**

Variable	Frequency (%) n=613
<b>Age</b>	
18-20	29 (4.7)
21-30	371 (60.5)
31-40	177 (28.9)
41-50	18 (2.9)
51-60	9 (1.5)
61 and above	9 (1.5)
<b>Gender</b>	
Female	297 (48.5)
Male	313 (51.1)
Prefer not to say	3 (0.4)
<b>Educational background</b>	
Junior High	2 (0.31)
Senior High	28 (4.58)
Undergraduate	334 (54.49)
Postgraduate	249 (40.62)

**Acceptance of the COVID-19 vaccine**

A significant proportion of the respondents had not taken the vaccine (471, 76.84%), however, they were willing to accept the vaccine when given the opportunity (458, 74.7%) (Table 2).

**Table 2: Acceptance of COVID-19 vaccine**

Question	Frequency (%), n=613
<b>Have you taken the vaccine?</b>	
Yes	142 (23.16%)
No	471 (76.84%)
<b>Will you take the COVID-19 vaccine?</b>	
Yes	458 (74.7%)
No	155 (25.3%)

**Statistical significance between sociodemographic characteristics and vaccine acceptance**

There was a significant association between sex and willingness to accept the vaccine ( $p=0.001$  CI 95% 0.001-0.002). Table 3 summarizes the relationship between the participants willingness and the demographic characteristics.

Table 3: Associations between sociodemographic characteristics and vaccine acceptance

Question	Variable					p-value (95% CI)	
<b>Demographics</b>							
<b>Will you take the vaccine?</b>	<b>Age</b>	<b>Group</b>				<b>0.4220 (0.420-0.440)</b>	
	15-20	21-30	31-40	41-50	51-60		61+
	Yes	19	276	135	13		6
No	10	95	42	5	3	0	
<b>Sex</b>							
<b>Will you take the vaccine?</b>	Female	Male	Prefer not to say			<b>0.001 (0.001-0.002)</b>	
	Yes	211	247	0			
	No	86	66	3			
<b>Educational Background</b>							
<b>Will you take the COVID-19 Vaccine?</b>						<b>0.187 (0.171-0.187)</b>	
		Junior High	Senior High	Undergraduate	Postgraduate		
	Yes	1	8	94	52		
No	1	20	240	197			

#### Reasons for not accepting the COVID-19 vaccine

Participants gave various reasons for their unwillingness to accept the vaccine. The majority attributed the non-acceptance to side effects (61, 39.35%). Other reasons included pregnancy (10, 6.45%), apathy (34, 21.94%), quality (22, 14.2%) and issues associated with trials of the vaccine (28, 18.06%). Table 4 summarizes the reasons stated by the participants.

Table 4: Reasons for refusing vaccination.

Reason	Frequency n=155 (100%)
I don't really care	34 (21.94%)
Pregnancy	10 (6.45%)
Side effects	61 (39.35%)

Vaccine has not been tried and tested	28 (18.06%)
Vaccine brought to Africa might be inferior	<u>22 (14.2%)</u>



## Discussion

Majority of the respondents in this survey were aged between 21-30 and male. This finding is comparable to reports of Ghana's population which shows that there are more males than females in the general populace. (*Digital in Ghana: All the Statistics You Need in 2021 DataReportal Global Digital Insights, 2021*) Of these respondents, only a relatively small proportion had been vaccinated at the time of the survey. There was high vaccine acceptability of almost three fourths of respondents choosing to take the vaccine once it became available to them. There was no association between age and vaccine acceptance. However, there was a significant association between sex and vaccine acceptance although the nature of this association was not assessed in this study. The findings from this study are comparable to findings from othersimilar studies around the world. A recent global survey involving 13,426 respondents returned an overall acceptance of 71.5% "(Lazarus *et al.*, 2021) compared to that obtained in this study. A study in the United States on vaccine acceptability showed an acceptance of 67% in the whole population and 40% among blacks (Malik *et al.*, 2020) while a recent study in Ghana showed only 39.3% of health workers intended to take the vaccine (Table 1: Acceptability of COVID-19 Vaccination among Health Care Workers in Ghana). Similar to the study from Ghana was a study in the Jordan which showed that only 36.8% of respondents intended to be vaccinated against the coronavirus (Al-Qerem and Jarab, 2021). Our findings may indicate a higher acceptability of the vaccine among the general Ghanaian populace than in other places in this study. This could be accounted for by the varied response globally and in Africa to the COVID-19 pandemic (Ogunleye *et al.*, 2020) and vaccine efforts by different countries. Ghana's pandemic management was praised globally in news reports at the height of the 2020 surge in part due to large testing per capita of the population carried out (*How well is Ghana with one of the best testing capacities in Africa responding to COVID-19?*, 2021). The head of the African office of WHO commended Ghana, among others, for making positive strides in combatting the virus (COVID-19 in Africa: insights from our 30 April WHO media briefing | World Economic Forum, 2021). It was also the first country globally outside of India to receive and distribute vaccines to the population through the COVAX facility of WHO (COVID-19 vaccine doses shipped by the COVAX Facility head to Ghana, marking beginning of global rollout, 2021). These, in addition to media campaigns, may have boosted confidence in the government's efforts to stem the surge in cases including the introduction and use of the COVID-19 vaccine. This may be a positive finding for Ghana as more COVID-19 vaccines become available in Ghana (Ghana to take delivery of 300,000 Sputnik V vaccines this week - MyJoyOnline.com, 2021) with the aim of vaccinating over twenty million of its thirty million population by the end of the year 2021. Whether Ghana actually attains this herd immunity will be based on the population's acceptance and actual uptake of the vaccines deployed.

A greater proportion of the respondents had not taken the vaccine yet in this study. This is likely due to the deployment plan employed by Ghana to distribute the vaccines available. Ghana

is currently in Phase 1 of its vaccine deployment plan targeting the three most affected regions with priority on vaccinating healthcare and frontline workers, adults over 60 years, persons with known underlying diseases and essential service providers (*GHANA COVID-19 Situation Report - #16 March 2021*). It is, however, commendable that, although the vaccine had not been rolled out to the general public, almost a third of the respondents had already taken the vaccine as the program was extended to other regions of the country.

One of the determinants of vaccine acceptance is the level of knowledge and awareness possessed by the target population. Thus, accurate knowledge as well as individual and group perceptions about a vaccine may affect vaccine acceptance and hesitancy to uptake (What influences vaccine acceptance: A model of determinants of vaccine hesitancy, 2013). More than half of the respondents had had at least an undergraduate university education with still a good proportion possessing postgraduate education. Education is expected to correlate with knowledge leading to increased vaccination uptake. In the United States, a recent survey showed that individuals with, at least, a bachelor's degree were 43% more likely to get vaccinated for the COVID-19 than those with less education (USC Dornsife - Understanding Coronavirus in America | Understanding America Study, 2021). Education was thus found to be a bigger factor than other demographic information such as race in vaccine uptake (*Education Is Now a Bigger Factor Than Race in Desire for COVID-19 Vaccine USC Schaeffer, 2021; USC Dornsife - Understanding Coronavirus in America | Understanding America Study, 2021*). This finding may not be the case in Ghana as there was no association between education and willingness to take the vaccine. If education level may not increase vaccine acceptance, then public perceptions may need to be swayed in favour of vaccination through widespread media campaigns to combat potential misinformation. This may increase the motivation by the public to seek and get the vaccine as it becomes more available. This may be important considering some of the reasons respondents gave for not wanting to take the vaccine. Most persons who responded to this query feared the potential side effects the vaccines posed, others felt the vaccine had not been tried and tested or that those brought to Africa may be inferior. Similar findings have been reported by Schmidt *et al.* (Graeber, Schmidt-Petri and Schröder, 2021). Media campaigns by government agencies such as the National Commission on Civic Education (NCCE) on popular media outlets may correct some of the misconceptions people may have about the vaccine.

## Study Limitations

Our study is limited potentially by the recruitment of respondents via the internet which may skew the sample to individuals that have a fair use of the internet and social media. Since the study was conducted using an online questionnaire, there is the potential for recall and selection bias. It has, however, been suggested that since the number of internet users globally has increased, the socio-demographic characteristics of the recruited participants via web-based surveys reflect the general population (Im *et al.*, 2020). This may



be the case in Ghana as there is a reported 50% internet penetration (*Digital in Ghana: All the Statistics You Need in 2021 DataReportal Global Digital Insights, 2021*). The perceptions and choices of the respondents may change as new information becomes available to them and so the study represents their choices at this time. A strength of the study is the large sample size with no limitation as to regions and localities in Ghana making the sample used potentially representative of the Ghanaian population. This may reduce the influence of bias in the study.

### Conclusion

Vaccine acceptance may be higher in the general Ghanaian population compared to health workers in Ghana. Ghana may be on course to achieving herd immunity if this acceptance translates to vaccine uptake. Public education efforts may need to be intensified locally to correct misconceptions and increase vaccine acceptance and subsequent uptake as vaccines become available to the public in Ghana.

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### References

- Aduhene, D. T. and Osei-Assibey, E. (2021) 'Socio-economic impact of COVID-19 on Ghana's economy: challenges and prospects', *International Journal of Social Economics*. Emerald Group Holdings Ltd., 48(4), pp. 543–556. doi: 10.1108/IJSE-08-2020-0582.
- Agyekum, M. W. *et al.* (2021) 'Acceptability of COVID-19 Vaccination among Health Care Workers in Ghana', *Advances in Public Health*. Hindawi Limited, 2021. doi: 10.1155/2021/9998176.
- Al-Metwali, B. Z. *et al.* (2021) 'Exploring the acceptance of COVID-19 vaccine among healthcare workers and general population using health belief model', *Journal of Evaluation in Clinical Practice*. Blackwell Publishing Ltd. doi: 10.1111/jep.13581.
- Al-Qerem, W. A. and Jarab, A. S. (2021) 'COVID-19 Vaccination Acceptance and Its Associated Factors Among a Middle Eastern Population', *Frontiers in Public Health*. Frontiers Media S.A., 9, p. 632914. doi: 10.3389/fpubh.2021.632914.
- Bodily, J. M., Tsunoda, I. and Alexander, J. S. (2020) 'Scientific Evaluation of the Court Evidence Submitted to the 2019 Human Papillomavirus Vaccine Libel Case and Its Decision in Japan', *Frontiers in Medicine*. Frontiers Media S.A., 7. doi: 10.3389/fmed.2020.00377.
- Bonful, H. A. *et al.* (2020) 'Limiting spread of COVID-19 in Ghana: Compliance audit of selected transportation stations in the Greater Accra region of Ghana', *PLoS ONE*. Public Library of Science, 15(9 September), p. e0238971. doi: 10.1371/journal.pone.0238971.
- Coronavirus disease (COVID-19): Vaccines* (no date). Available at: [https://www.who.int/news-room/q-a-detail/coronavirus-disease-\(covid-19\)-vaccines?adgroupsurvey=%7Badgroupsurvey%7D&gclid=Cj0KC](https://www.who.int/news-room/q-a-detail/coronavirus-disease-(covid-19)-vaccines?adgroupsurvey=%7Badgroupsurvey%7D&gclid=Cj0KC)
- Qjwhr2FBhDbARIsACjwLo2A6GRXm837H7kG1\_u-WwRtj-AMX9nttwZA5bbiZrIAKJGr6l\_ROVQaAjrEALw\_wcB (Accessed: 27 May 2021).
- COVID-19 in Africa: insights from our 30 April WHO media briefing | World Economic Forum* (no date).
- COVID-19 Updates | Ghana* (no date). Available at: <https://www.ghanhealthservice.org/covid19/> (Accessed: 27 May 2021).
- COVID-19 vaccine doses shipped by the COVAX Facility head to Ghana, marking beginning of global rollout* (no date). Available at: <https://www.who.int/news/item/24-02-2021-covid-19-vaccine-doses-shipped-by-the-covax-facility-head-to-ghana-marking-beginning-of-global-rollout> (Accessed: 27 May 2021).
- D'Souza, R. S. and Wolfe, I. (2021) 'COVID-19 vaccines in high-risk ethnic groups', *The Lancet*. Elsevier B.V., p. 1348. doi: 10.1016/S0140-6736(21)00624-3.
- Digital in Ghana: All the Statistics You Need in 2021 — DataReportal – Global Digital Insights* (no date).
- Education Is Now a Bigger Factor Than Race in Desire for COVID-19 Vaccine – USC Schaeffer* (no date).
- Emerging lessons from Africa's COVID-19 vaccine rollout - Ghana | ReliefWeb* (no date). Available at: <https://reliefweb.int/report/ghana/emerging-lessons-africas-covid-19-vaccine-rollout> (Accessed: 27 May 2021).
- Fridman, A., Gershon, R. and Gneezy, A. (2021) 'COVID-19 and vaccine hesitancy: A longitudinal study', *PLoS ONE*. Public Library of Science, 16(4 April). doi: 10.1371/journal.pone.0250123.
- Ghana: Coronavirus and the media | European Journalism Observatory - EJO* (no date). Available at: <https://en.ejo.ch/ethics-quality/ghana-coronavirus-and-the-media> (Accessed: 27 May 2021).
- GHANA COVID-19 Situation Report - #16 – March 2021* (no date).
- Ghana to take delivery of 300,000 Sputnik V vaccines this week - MyJoyOnline.com* (no date).
- Graeber, D., Schmidt-Petri, C. and Schröder, C. (2021) 'Attitudes on voluntary and mandatory vaccination against COVID-19: Evidence from Germany', *PLoS ONE*. Public Library of Science, 16(5 May 2021), p. e0248372. doi: 10.1371/journal.pone.0248372.
- Griffith, J., Marani, H. and Monkman, H. (2021) 'COVID-19 vaccine hesitancy in Canada: Content analysis of tweets using the theoretical domains framework', *Journal of Medical Internet Research*. JMIR Publications Inc., 23(4), p. e26874. doi: 10.2196/26874.
- How well is Ghana—with one of the best testing capacities in Africa—responding to COVID-19?* (no date).
- Im, E. *et al.* (no date) 'Recruitment of research participants through the Internet', *journals.lww.com*.
- Lazarus, J. V. *et al.* (2021) 'A global survey of potential acceptance of a COVID-19 vaccine', *Nature Medicine*. Nature



- Research, 27(2), pp. 225–228. doi: 10.1038/s41591-020-1124-9.
- Malik, A. A. *et al.* (2020) 'Determinants of COVID-19 vaccine acceptance in the US', *EclinicalMedicine*. Lancet Publishing Group, 26. doi: 10.1016/j.eclinm.2020.100495.
- Manning, M. Lou *et al.* (2021) 'COVID-19 vaccination readiness among nurse faculty and student nurses', *Nursing Outlook*. Mosby Inc. doi: 10.1016/j.outlook.2021.01.019.
- Ogunleye, O. O. *et al.* (2020) 'Response to the Novel Corona Virus (COVID-19) Pandemic Across Africa: Successes, Challenges, and Implications for the Future', *Frontiers in Pharmacology*. Frontiers Media S.A., p. 1. doi: 10.3389/fphar.2020.01205.
- Qattan, A. M. N. *et al.* (2021) 'Acceptability of a COVID-19 Vaccine Among Healthcare Workers in the Kingdom of Saudi Arabia', *Frontiers in Medicine*. Frontiers Media S.A., 8, p. 644300. doi: 10.3389/fmed.2021.644300.
- .allam, M. (2021) 'Covid-19 vaccine hesitancy worldwide: A concise systematic review of vaccine acceptance rates', *Vaccines*. MDPI AG, pp. 1–15. doi: 10.3390/vaccines9020160.
- Sibiri, H., Prah, D. and Zankawah, S. M. (2021) 'Containing the impact of COVID-19: Review of Ghana's response approach', *Health Policy and Technology*. Elsevier B.V., 10(1), pp. 13–15. doi: 10.1016/j.hlpt.2020.10.015.
- Summary of Provisional Results' (no date).  
*Table 1 | Acceptability of COVID-19 Vaccination among Health Care Workers in Ghana* (no date). Available at: <https://www.hindawi.com/journals/aph/2021/9998176/tab1/> (Accessed: 27 May 2021).
- USC Dornsife - Understanding Coronavirus in America | Understanding America Study* (no date).
- What influences vaccine acceptance: A model of determinants of vaccine hesitancy* (2013).