

Acceptance of COVID-19 Vaccination in Children among Adults Attending Selected Health Facilities in Kinondoni Municipality; Dar es salaam, Tanzania: A Cross Sectional Study

Nashon Mugobera¹, Leonard Malasa¹, Dharia Amour¹, Maulid Fataki¹,
Felician Rutachunzibwa¹ & Florence Salvatory Kalabamu¹

¹ Department of Pediatrics and Child Health, Hubert Kairuki Memorial University, Dar es salaam, Tanzania

Correspondence: Florence Salvatory Kalabamu, Department of Pediatrics and Child Health, Hubert Kairuki Memorial University, P.O. Box 65300, Dar es salaam, Tanzania. Tel: +225-75-355-6696. E-mail: mkalabamu@gmail.com

Received: February 5, 2024 Accepted: March 9, 2024 Online Published: March 13, 2024

doi:10.5539/gjhs.v16n4p13

URL: <https://doi.org/10.5539/gjhs.v16n4p13>

Abstract

Background: Safe and effective vaccines are crucial for controlling and containing COVID-19 pandemic. However, poor acceptance and hesitance to vaccinate limit effective utilization. In Tanzania, COVID-19 vaccines have been in use with adequate coverage in adults from 18-years old, however, the acceptability of their use in children is not well understood. This study was aimed at determining the acceptability of COVID-19 vaccination in children among adults in Dar es salaam, Tanzania.

Methods: A cross section study was conducted among adults attending outpatient clinic in Dar es salaam and were having children below 18-years at home. A self-administered questionnaire was used to collect their demographic information and their opinions regarding COVID-19 vaccine use in their children. Data was analyzed using Statistical Package for Social Sciences (SPSS version 23). Level of acceptance and other categorical variables were calculated in frequency and percentages while factors associated with COVID-19 vaccination in children were determined using binary logistic regression analysis. A type II error of less or equal to 0.05 was considered statistically significant.

Results: A total of 320 participants were recruited in the study. Among these, 289 (90.3%) were females. Out of all participants, 124 (38.57%) were willing for their children to receive COVID-19 vaccines upon availability and recommendation by respective authorities. Confidence in the safety of COVID-19 vaccines (Adjusted Odd Ratio=0.03; 95% CI: 0.01-0.13; $p=0.02$, and perceived importance of COVID-19 vaccine use in children (AOR=0.29; 95% CI: 0.1-0.84; $p=0.02$) were independent factors associated with acceptance of COVID-19 vaccination in children.

Conclusion: The level of acceptance of COVID-19 vaccination for children in this study was low (38.57%), with uncertainty around vaccine safety being the major concern. Therefore, to increase COVID-19 vaccines acceptance and uptake in children, effective public communication supported by data on safety and effectiveness of COVID-19 vaccines should be emphasized.

Keywords: Acceptance, COVID-19, children, Dar es Salaam, vaccines

1. Introduction

Up to October 2023, the World Health Organization (WHO) had recorded approximately 772million confirmed COVID-19 cases, and around 7 million deaths globally (World Health Organization, 2020). However, this could be an underestimation because of inadequate testing and reporting especially in the Low-and-Middle-Income Countries (LMIC) as the result of suboptimal health system functioning (Chitungo et al., 2020; Rutayisire et al., 2020). The pandemic did not only affect the health systems, but also the social and economic activities (ESRF, 2020; Rahmanid et al., 2021).

Among other control measures, safe and effective COVID-19 vaccines played a pivotal role in keeping the pandemic under control. Up to March 2023 when WHO declared COVID-19 no longer a public health emergency, an estimated total of 14 billion COVID-19 vaccines have been distributed globally, and around 5 billion people

have completed the primary series (World Health Organization, 2020). A meta-analysis study has shown the real-world effectiveness of COVID-19 vaccines to be 89.1% against the severe form of the disease and 99% against death (Zheng et al., 2022). Furthermore, mathematical models have shown that effective use of COVID-19 vaccines averted around 14.4 millions deaths in several countries within one year of deployment (Watson et al., 2022).

Despite the success of use of vaccines to control the pandemic, there were a significant hesitancy in the general population, with more worries around safety of these vaccines, lack of trust towards healthcare workers; political leaders, and vaccine stakeholders (Afolabi & Ilesanmi, 2021; İkişik et al., 2021; Jong & Tulloch, 2021). The reported low acceptance defined as the degree to which individuals accept, questions or refuse vaccination was exacerbated by anti-vaccines campaigns, which spread easily and quickly as a result of advancement in communication technology such as online social media platforms (Sallam et al., 2021; Umakanthan et al., 2021). This fueled confusion, distress, and mistrust toward the existing political, health, and social systems with subsequent derail in COVID-19 vaccines uptake (Lockyer et al., 2021; Razai et al., 2021). The drivers of vaccine acceptance are complex, and usually vary with respect to context, time, place, and types of vaccines.

The 3-Cs model of vaccine acceptance and hesitancy (confidence, complacency, and convenience), suggests three domains which may affect vaccine acceptance (MacDonald, 2015). These include Confidence—the level of trust in safety and effectiveness of vaccines, the system that delivers the vaccine, and motivation of policymakers who decide on the use of vaccines (MacDonald, 2015). On the other hand, complacency is when the perceived risk of the vaccine preventable disease is low leading to low motivation for vaccine uptake while Convenience is anchored on availability, accessibility and affordability of the respective vaccine, and the way the vaccine is delivered in relation to culture and contextual issues of the community. Hence, these themes form a complex interlinked matrix of factors that may influence vaccine acceptance and uptake.

Tanzania is among the African countries in which initial covid-19 vaccines uptake was slow as a result of low confidence in vaccines (Davis et al., 2022; Konje et al., 2022; Mfinanga et al., 2021; Mtei et al., 2023). However, the uptake increased dramatically after massive national wide education and vaccination campaigns (Mfinanga et al., 2021, 2023). Introduction of vaccines was gradual depending on the availability of vaccines, starting with the higher risk groups (elderly, healthcare workers, frequent travelers, and people with co-morbidities) followed by all adults from 18-years of age and above (Mfinanga et al., 2023; WHO, 2023). Several countries have recommended and started using COVID-19 vaccines among children as a means of keeping them safe, protect family members, and the community (NACI, 2022; Staiano et al., 2022). However, Tanzania is yet to vaccinate children below 18 years due to inadequate supportive data on the burden of the disease, safety, and effectiveness of use in this age group.

Even though the currently circulating SARS-Cov-2 variants are usually milder in children and adolescents compared to other groups (Tao et al., n.d.), it is still unpredictable. There is a potential risk of evolving more virulent variants that may cause a more severe COVID-19 infection without sparing children, warranting a wide use of COVID-19 vaccines in this age group. However, the acceptance of the Tanzanian population on the use of COVID-19 vaccines in this age group is not well understood, which poses a potential barrier to effective uptake when the need arises. Therefore, we aimed to assess acceptability and factors associated with acceptance of COVID-19 vaccines use in children among adult population in Dar es Salaam, Tanzania.

2. Methods

2.1 Study Site, Design, and Population

This was a cross sectional study conducted at Mwananyamala and Kairuki Hospitals located in Kinondoni Municipality, Dar es salaam metropolitan city from November to December 2022. Mwananyamala hospital is a public owned regional referral hospital for Kinondoni municipality while Kairuki hospital is a privately owned hospital and a teaching hospital for Hubert Kairuki Memorial University. In Tanzania health facility grading, both hospitals are 4th level referral facilities providing both basic and specialized health care services. Both facilities were purposely selected based on their referral level status and ownership.

This study was conducted among male and female adults attending routine outpatient services at both hospitals. Another inclusion criterion was having a child below 18 years of age at home.

2.2 Data Collection Procedures

Data including demographic characteristics of study participants were collected using a self-administered questionnaire. Further, assessment of opinions and perceptions regarding the use of COVID-19 vaccines in children among study participants was done using a pre-designed Likert's scaled tool.

2.3 Ethical Considerations

This study was approved by the research and ethical review committee of the Hubert Kairuki Memorial University. Permission to conduct the study at the study site was provided by the respective hospital administration. Participation in this study was voluntary; informed consent was sought from participants before being enrolled. Filling questionnaires was done while waiting for registration or results; therefore, participation in the study did not interfere with health services provision. Additionally, participants who were severely sick or were not feeling well to participate in the study were not included. No personal identifiers were used in the data collection forms; only code numbers were used for study purposes, and data analysis was done anonymously.

2.4 Data Analysis

Data was analyzed using Statistical Package for Social Sciences version 23 (IBM Corp., Chicago, USA). Categorical variables were descriptively summarized as frequency and percentages depending on the category responses in each variable. For acceptance of COVID-19 vaccination in children among participants, we further categorized a “No” or “Uncertain” as a non-acceptance response while “Yes” was considered as an acceptance response.

Factors associated with COVID-19 vaccination in children among study participants were analyzed using binary logistic regression analysis in two steps: univariate analysis was initially done by assessing how the variable is associated with the dependent variable (acceptance), the respective Crude Odd Ratios (COR) and 95% confidence intervals were also computed. Factors which were significant at p-value of 0.2 or less were later included in the multivariate model. Adjusted Odd Ratios (AOD) and respective 95% confidence intervals were calculated for each variable in the multivariate model. A variable with a *p*-level of less or equal to 0.05 was considered statistically significant.

3. Results

3.1 Demographic Characteristics of Study Participants.

A total of 320 participants were recruited in the study. Among these participants, majority (90.3 %) were females. Among all participants, 185 (57.8%) had primary school education. Other parameters are as shown in **Table 1**.

Table 1. Demographic characteristics of study participants (N = 320)

Variable	Frequency	Percent
Sex		
Male	31	9.7
Female	289	90.3
Level of education		
Primary education	185	57.8
Secondary education	100	31.3
Advanced level	25	7.8
University/college	10	3.1
Number of children		
Less or equal to 3	292	91.3
More than 3	28	8.8
Age		
Less or equal to 20	3	.9
20-30	202	63.1
31-40	101	31.6
Above 40	14	4.4
Marital status		
Married	273	85.3
Single	46	14.4
Divorced	1	0.3

3.2 Perceived Risk of COVID-19 in Children

The perceived risk of COVID-19 infection in children among participants was relatively high. Out of 320 participants, 302 (94.4%) had opinion that COVID-19 is very dangerous in children while 7 (2.2%) responded that COVID-19 is not dangerous in children (**Table 2**).

3.3 Perceived Importance of COVID-19 Vaccines in Children

Among respondents, 251 (78.4%) responded that COVID-19 vaccines are important for their children. On the other hand, 14 (4.4%) had the opinion that these vaccines are not important in children (**Table 2**). Additionally, 279 (87.2%) has trust in healthcare workers in case they recommend COVID-19 vaccination in children.

Table 2. Opinions of participants regarding the use of COVID-19 vaccines in children (N=320)

Variable	Frequency	Percent
How dangerous is COVID-19 in children		
Very dangerous	302	94.4
Dangerous	11	3.4
Not dangerous	7	2.2
Do you think that COVID-19 vaccine is important for your child?		
No	14	4.4
I don't know	55	17.2
Yes	251	78.4
Will you trust your healthcare provider if he recommends COVID-19 vaccine to your child?		
No	41	12.8
Yes	279	87.2
Are you confident that COVID-19 vaccines are safe in children?		
No	30	9.4
I don't know	159	49.7
Yes	131	40.9

3.4 Confidence in COVID-19 vaccination in children.

Among all participants, 131 (40.9%) were confident that COVID-19 vaccines are safe in children, while 30 (9.4%) responded that they are not safe. Relatively, 159 (49.7%) were unsure of the safety of COVID-19 vaccines in children (**Table 2**).

3.5 Acceptance of COVID-19 vaccination in children

Among participants, only 124 (38.57%) were willing for their children to be vaccinated if the vaccines are available and recommended for use in children. On the other hand, 149 (46.56%) participants were uncertain on their responses (**Figure 1**)

If Covid-19 vaccines are be available and recommended for children, will you be willing your child to bevaccinated?

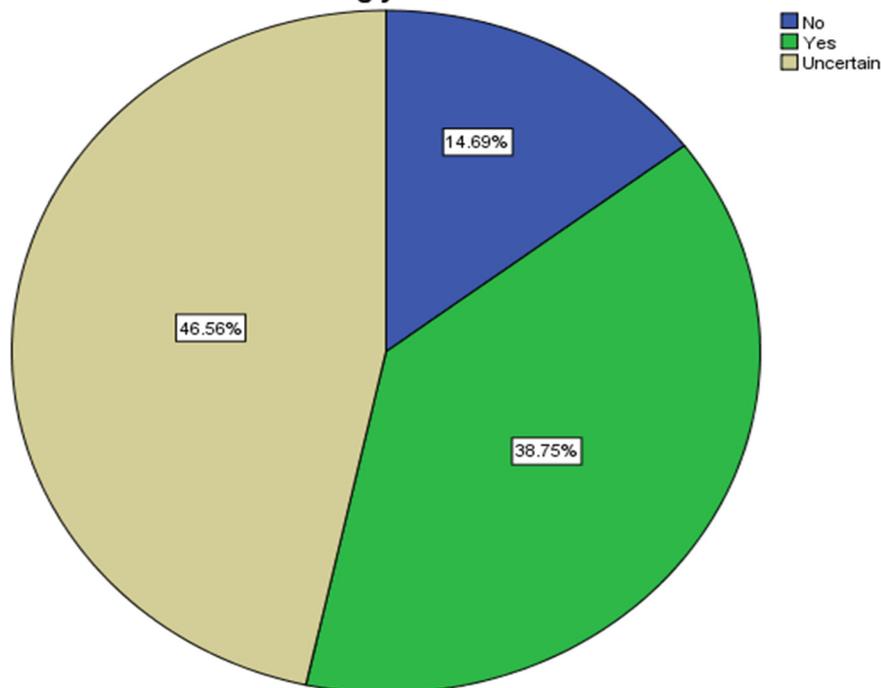


Figure 1. Acceptance of COVOD-19 vaccines for children among study Participants (N = 320)

3.6 Factors Associated with Acceptance of COVID-19 Vaccines

Confidence in COVID-19 vaccines safety in children was associated with acceptance of COVID-19 vaccination in children. Therefore, perceived risk of COVID-19 vaccines, uncertainty of the importance and safety of COVID-19 vaccines in children were independent factors associated vaccine acceptance status (Table 3).

Table 3. Factors associated with acceptance of COVID-19 vaccines use in children among study participants (N=320)

Variable	95% Confidence			P-Value	95% Confidence			P-Value
	COR	Interval Lower	Upper		AOR	Interval Lower	Upper	
Sex								
Male	0.73	.33	1.6	0.73				
Female	Ref.							
Level of education								
Primary school	0.6	0.29	1.24	0.17	1.18	0.35	3.98	0.8
Secondary school	0.48	0.22	1.06	0.07	1	0.28	3.57	0.99
College/University	Ref.							
Age (years)								
20-30	0.94	0.31	2.82	0.92				
31-40	0.65	0.21	2.02	0.45				
Above 40	Ref.							

Marital status								
Married	0.68	0.36	1.26	0.22				
Single	Ref							
Number of children								
≤ 3	1.65	0.7	3.87	0.25				
>3	Ref.							
Participants confidence in safety of COVID-19 vaccines use in children								
No	0.02	0.004	0.06	0.02	0.03	0.01	0.13	0.02
I don't know	0.03	0.01	0.05	0.03	0.03	0.01	0.04	0.02
Yes	Ref.							
Participants' trust on health workers in case they recommend COVID-19 vaccines for their children								
No	0.03	0.004	0.23	0.001				
Yes	Ref							
Participants' opinion on the importance of COVID-19 vaccines								
No	0.09	0.012	0.72	0.02	0.4	0.02	7	0.53
I don't know	0.24	0.11	0.5	<0.001	0.29	0.1	0.84	0.02
Yes	Ref.							
Participants' perception on how dangerous COVID-19 in children is								
Very dangerous	1.58	0.3	8.28	0.59				
Dangerous	2.08	0.28	15.77	0.48				
Not dangerous	Ref.							

4. Discussion

In this study, the overall acceptance of COVID-19 vaccines use in children was low among participants, with only 38.6% willing for their children to be vaccinated in case the vaccine is available and recommended for use in children in Tanzania. COVID-19 vaccine safety and perceived importance of COVID-19 vaccines in children were significantly associated with acceptance of COVID-19 vaccines use in children.

Low level acceptance of COVID-19 vaccination for children in this study was consistent with other similar studies conducted elsewhere (AlGethami et al., 2021; Almansour et al., 2022; İkişik et al., 2021; Lee et al., 2022). Surprisingly, the level of acceptance was low despite most of the participants rating high the risk of COVID-19 in children. This is contrary to most of health behavior change theories which indicate that making health choices is influenced by the perceived risk of the consequences of the disease itself (Noar & Zimmerman, 2005). Therefore, health behaviors change communication and promotion starts with addressing perceptions before moving towards desirable health behaviors (Noar & Zimmerman, 2005).

Our findings imply that low acceptance is most likely linked to the uncertainties around the vaccine safety and not low perception of COVID-19 severity in children. Similarly, despite the low level of acceptance, we found that majority of participants (78.4%) had opinion that COVID-19 vaccination in children is important which was also independently associated with acceptance of COVID-19 vaccination. The linkage between perceived importance of vaccination and acceptance has also been reported in other similar studies and explained in vaccine hesitancy models (MacDonald, 2015; Tram et al., 2022). This shows the improvement in confidence in COVID-19 vaccines in Tanzania which was low during the early stages of the pandemic (Chilongola et al., 2022; Makoni, 2021; Mfinanga et al., 2021). These changes might have been contributed by massive COVID-19 campaigns which were accompanied by health education and behaviors change communication strategies put in place by the Tanzania

government and supportive local and international stakeholders (Hamisi et al., 2023).

We further found the continuum of attitudes ranging from acceptance, hesitancy to complete refusal of use of COVID-19 vaccine use in children. The high level of the uncertainty (46.6%) further supports the suggestions that the low acceptance in this study could be arising from limited trust in safety and effectiveness of COVID-19 vaccines.

In this study however, most respondents expressed confidence in healthcare providers with readiness to trust them in case they recommend the use of COVID-19 vaccines in children. Contrary to this trust, the majority were uncertain if they would let their children receive COVID-19 vaccines. This suggest that vaccine acceptance is a behavioral response which involves a complex decision-making process that involve multiple inter-linked factors (Martinelli & Veltri, 2023). In this regard, healthcare providers could be a good an appropriate group to provide health related education to the public including vaccine related information. Furthermore, healthcare providers need to be well equipped in vaccine-related knowledge to be disseminated to the community during facility visits and health promotion activities. Since the public trust them, they will be likely to follow their recommendations. In a study conducted in the northern part of Tanzania amidst the COVID-19 pandemic, healthcare providers were among the group hesitant to receive COVID-19 vaccine with the main perceived reason being the unknown safety of COVID-19 vaccines (Chilongola et al., 2022). This hesitancy among healthcare providers could be contributing confusion among the public and contribute to overall hesitance to receive COVID-19 vaccines. This necessitates more engagement and awareness creation on safety and effectiveness of vaccine among healthcare providers.

The major limitation of this study is that participants were recruited from health facilities which could be a potential source of bias. Those attending health facilities could be having a high healthcare seeking behavior and trust in healthcare providers compared to the general public. However, to minimize this bias, we had enough sample size and randomization to avoid this bias.

5. Conclusion

In conclusion, the level of acceptance of COVID-19 vaccination for children among adults attending health facilities in Dr es salaam was low, with uncertainty around vaccine safety being the major concern. Since COVID-19 is still evolving, with a lot of uncertainties and unpredictability of new variants and their severity among different population groups, it is imperative to collect, analyze and effectively communicate with the public on safety, efficacy, and effectiveness of COVID-19 vaccines in children. This will likely increase the confidence in COVID-19 vaccines, with subsequent increased uptake among children once the need of vaccination in this group arises.

Acknowledgements

Authors acknowledge the support from study participants, hospital administration and staff from Kairuki and Mwananyamala hospitals.

Funding

None.

Informed Consent

Obtained.

Provenance and Peer Review

Not commissioned, externally double-blind peer reviewed.

Data Availability Statement

The data that support the findings of this study are available on request.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Afolabi, A. A., & Ilesanmi, O. S. (2021). Dealing with vaccine hesitancy in Africa: The prospective COVID-19 vaccine context. *Pan African Medical Journal*, 38(3), 1-7. <https://doi.org/10.11604/pamj.2021.38.3.27401>
- AlGethami, H., Altamran, M., Khan, M., Zaman, K., & Alswaied, N. (2021). Awareness and Knowledge Towards Pediatric and Adult COVID-19 Vaccination: A Cross Sectional Community-based Study in Saudi Arabia. *Materia Socio Medica*, 33(4), 262. <https://doi.org/10.5455/msm.2021.33.262-268>

- Almansour, A., Hussein, S. M., Felemban, S. G., & Mahamid, A. W. (2022). Acceptance and hesitancy of parents to vaccinate children against coronavirus disease 2019 in Saudi Arabia. *Plos one*, *17*(10), e0276183. <https://doi.org/10.1371/journal.pone.0276183>
- An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). (2022). Updated recommendations on the use of COVID-19 vaccine booster doses in children 5 to 11 years of age and concurrent vaccine administration.
- Chilongola, J. O., Rwegoshola, K. M., Balingumu, O. H., Semvua, H. S., & Kwigizile, E. T. (2022). COVID-19 Knowledge, Attitudes, Practices, and vaccination hesitancy in Moshi, Kilimanjaro Region, Northern Tanzania. *Tanzania Journal of Health Research*, *23*(1). <https://doi.org/10.4314/thrb.v23i1.3>
- Chitungo, I., Dzobo, M., Hlongwa, M., & Dzinamarira, T. (2020). COVID-19: Unpacking the low number of cases in Africa. *Public Health in Practice*, *1*, 100038. <https://doi.org/10.1016/j.puhip.2020.100038>
- Davis, T. P., Yimam, A. K., Kalam, M. A., Tolossa, A. D., Kanwagi, R., Bauler, S., Kulathungam, L., & Larson, H. (2022). Behavioural Determinants of COVID-19-Vaccine Acceptance in Rural Areas of Six Lower- and Middle-Income Countries. *Vaccines*, *10*(2), 214. <https://doi.org/10.3390/vaccines10020214>
- ESRF. (2020). *Rapid Social-Economic Impact Assessment of COVID-19 in Tanzania*.
- Hamisi, N. M., Dai, B., & Ibrahim, M. (2023). Global Health Security amid COVID-19: Tanzanian government's response to the COVID-19 Pandemic. *BMC Public Health*, *23*(1), 205. <https://doi.org/10.1186/s12889-023-14991-7>
- İkişik, H., Akif Sezerol, M., Taşçı, Y., & Maral, I. (2021). COVID-19 vaccine hesitancy: A community-based research in Turkey. *International Journal of Clinical Practice*, *75*(8), 1-9. <https://doi.org/10.1111/ijcp.14336>
- Jong, T. R. De, & Tulloch, O. (2021). Covid-19 Vaccine Perceptions in Africa: Social and Behavioural Science Data. *Social Science and Humanitarian Action*, March 2020, 1-35.
- Konje, E. T., Basinda, N., Kapesa, A., Mugassa, S., Nyawale, H. A., Mirambo, M. M., Moremi, N., Morona, D., & Mshana, S. E. (2022). The Coverage and Acceptance Spectrum of COVID-19 Vaccines among Healthcare Professionals in Western Tanzania: What Can We Learn from This Pandemic? *Vaccines*, *10*(9), 1429. <https://doi.org/10.3390/vaccines10091429>
- Lee, M., Seo, S., Choi, S., Park, J. H., Kim, S., Choe, Y. J., Choi, E. H., Kwon, G. Y., Shin, J. Y., Choi, S. Y., Jeong, M. J., Lee, H., & You, M. (2022). Parental Acceptance of COVID-19 Vaccination for Children and Its Association with Information Sufficiency and Credibility in South Korea. *JAMA Network Open*, *5*(12), E2246624. <https://doi.org/10.1001/JAMANETWORKOPEN.2022.46624>
- Lockyer, B., Islam, S., Rahman, A., Dickerson, J., Pickett, K., Sheldon, T., Wright, J., McEachan, R., & Sheard, L. (2021). Understanding COVID-19 misinformation and vaccine hesitancy in context: Findings from a qualitative study involving citizens in Bradford, UK. *Health Expectations*, *24*(4), 1158-1167. <https://doi.org/10.1111/hex.13240>
- MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, *33*(34), 4161-4164. <https://doi.org/10.1016/j.vaccine.2015.04.036>
- Makoni, M. (2021). Tanzania refuses COVID-19 vaccines. *Lancet (London, England)*, *397*(10274), 566. [https://doi.org/10.1016/S0140-6736\(21\)00362-7](https://doi.org/10.1016/S0140-6736(21)00362-7)
- Martinelli, M., & Veltri, G. A. (2023). COVID-19 vaccine acceptance: A comparative longitudinal analysis of the association between risk perception, confidence, and the acceptance of a COVID-19 vaccine. *Risk Analysis*. <https://doi.org/10.1111/risa.14200>
- Mfinanga, S. G., Gatei, W., Tinuga, F., Mwengee, W. M. P., Yoti, Z., Kapologwe, N., ... & Makubi, A. (2023). Tanzania's COVID-19 vaccination strategy: lessons, learning, and execution. *The Lancet*, *401*(10389), 1649. [https://doi.org/10.1016/S0140-6736\(23\)00723-7](https://doi.org/10.1016/S0140-6736(23)00723-7)
- Mfinanga, S. G., Mnyambwa, N. P., Minja, D. T., Ntinginya, N. E., Ngadaya, E., Makani, J., & Makubi, A. N. (2021). Tanzania's position on the COVID-19 pandemic. *The Lancet*, *397*(10284), 1542-1543. [https://doi.org/10.1016/S0140-6736\(21\)00678-4](https://doi.org/10.1016/S0140-6736(21)00678-4)
- Mtei, M., Mboya, I. B., Mgongo, M., Manongi, R., Amour, C., Bilakwate, J. S., ... & Msuya, S. E. (2023). Confidence in COVID-19 vaccine effectiveness and safety and its effect on vaccine uptake in Tanzania: A community-based cross-sectional study. *Human Vaccines & Immunotherapeutics*, *19*(1).

<https://doi.org/10.1080/21645515.2023.2191576>

- Noar, S. M., & Zimmerman, R. S. (2005). Health Behavior Theory and cumulative knowledge regarding health behaviors: are we moving in the right direction? *Health Education Research*, 20(3), 275–290. <https://doi.org/10.1093/her/cyg113>
- Rahman, M. K., Gazi, M. A. I., Bhuiyan, M. A., & Rahaman, M. A. (2021). Effect of Covid-19 pandemic on tourist travel risk and management perceptions. *Plos one*, 16(9), e0256486. <https://doi.org/10.1371/journal.pone.0256486>
- Razai, M. S., Chaudhry, U. A. R., Doerholt, K., Bauld, L., & Majeed, A. (2021). Covid-19 vaccination hesitancy. *BMJ*, n1138. <https://doi.org/10.1136/bmj.n1138>
- Rutayisire, E., Nkundimana, G., Mitonga, H. K., Boye, A., & Nikwigize, S. (2020). What works and what does not work in response to COVID-19 prevention and control in Africa. *International Journal of Infectious Diseases*, 97, 267–269. <https://doi.org/10.1016/j.ijid.2020.06.024>
- Sallam, M., Dababseh, D., Eid, H., Al-Mahzoum, K., Al-Haidar, A., Taim, D., Yaseen, A., Ababneh, N. A., Bakri, F. G., & Mahafzah, A. (2021). High Rates of COVID-19 Vaccine Hesitancy and Its Association with Conspiracy Beliefs: A Study in Jordan and Kuwait among Other Arab Countries. *Vaccines*, 9(1), 42. <https://doi.org/10.3390/vaccines9010042>
- Staiano, A., Agostiniani, R., Bozzola, E., Russo, R., & Corsello, G. (2022). COVID 19 vaccine in the pediatric age: the recommendation of the Italian Pediatric Society. *Italian Journal of Pediatrics*, 48(1), 46. <https://doi.org/10.1186/s13052-022-01244-3>
- Tao, K., Tzou, P. L., Nouhin, J., Gupta, R. K., Oliveira, T., Kosakovsky Pond, S. L., ... & Shafer, R. W. (n.d.). The biological and clinical significance of emerging SARS-CoV-2 variants. *Nature Reviews Genetics*, 22(12), 757–773. <https://doi.org/10.1038/s41576-021-00408-x>
- Tram, K. H., Saeed, S., Bradley, C., Fox, B., Eshun-Wilson, I., Mody, A., & Geng, E. (2022). Deliberation, Dissent, and Distrust: Understanding Distinct Drivers of Coronavirus Disease 2019 Vaccine Hesitancy in the United States. *Clinical Infectious Diseases*, 74(8), 1429–1441. <https://doi.org/10.1093/cid/ciab633>
- Umakanthan, S., Patil, S., Subramaniam, N., Sharma, R., & Barattucci, M. (2021). COVID-19 Vaccine Hesitancy and Resistance in India Explored through a Population-Based Longitudinal Survey. *Vaccines*, 9(10), 1064. <https://doi.org/10.3390/vaccines9101064>
- Watson, O. J., Barnsley, G., Toor, J., Hogan, A. B., Winskill, P., & Ghani, A. C. (2022). Global impact of the first year of COVID-19 vaccination: a mathematical modelling study. *The Lancet Infectious Diseases*, 22(9), 1293–1302. [https://doi.org/10.1016/S1473-3099\(22\)00320-6](https://doi.org/10.1016/S1473-3099(22)00320-6)
- World Health Organization [WHO]. (2023, April 20). From below 10 to 51 percent - Tanzania increases COVID-19 Vaccination Coverage.
- World Health Organization [WHO]. (2020). WHO COVID-19 Dashboard. Retrieved from <https://covid19.who.int/>
- Zheng, C., Shao, W., Chen, X., Zhang, B., Wang, G., & Zhang, W. (2022). Real-world effectiveness of COVID-19 vaccines: a literature review and meta-analysis. *International Journal of Infectious Diseases*, 114, 252–260. <https://doi.org/10.1016/j.ijid.2021.11.009>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).