Section A-Research paper

Vaccine Hesitancy in the Context of the COVID-19 Pandemic

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Abstract

Background: Although vaccination has proven to be one of the most effective public health measures, vaccine acceptance rates vary across the world. Vaccine hesitancy is a complex multifactorial problem that faces communities and hinders their efforts to reach herd immunity. It was listed in 2019 by the World Health Organization as one of the top ten global threats. Later on, The COVID-19 pandemic has shed more light on the problem and its bad effects. Multisectoral approaches involving all the related stakeholders are needed to target the determinants of vaccine hesitancy and reduce its bad effects on both individuals and communities.

Keywords:COVID, COVID-19, COVID-19 vaccine, Hesitancy, Vaccine, Vaccine Hesitancy

Introduction

Vaccines, despite being one of the most effective public health measures, are considered a useless, and risky measure by a significant percentage of people. Worries about vaccines and their effects led to the emergence of the problem of vaccine hesitancy. It results from the complex interaction of social and political factors, cultural and religious beliefs, the availability, and competence to understand health and scientific information, as well as individual and community experiences with health systems and governmental policies. In 2019, the World Health Organization considered vaccine hesitancy as one of the top ten threats to global health. The negative effect of antivaccination campaigns is widely recognized as one of the main causes of vaccine hesitancy all over the world [(1)].

Definition of Vaccine Hesitancy:

The Strategic Advisory Group of Experts (SAGE) Working Group defined vaccine hesitancy as: **'Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context-specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence'** [(2)].

COVID-19 Vaccine Hesitancy:

The COVID-19 pandemic and its multiple vaccines had shed more light on the problem of vaccine hesitancy[(3)]. While the reported COVID-19 vaccine acceptance rates vary all over the world, The Middle East/North Africa (MENA), Europe/Central Asia, and West/Central Africa regions showed higher levels of COVID-19 vaccine hesitancy [(4)].

In Egypt, high levels of COVID-19 vaccine hesitancy were recorded, affecting vaccine uptake. According to a study that included about 1000 Egyptian adults aged 18 years and above, from twenty-four Egyptian governorates, (January-March 2021), 54% of the participants reported COVID-19 vaccine hesitancy and 21% of them were not accepting the COVID-19 vaccine. The study findings showed a high level of worries

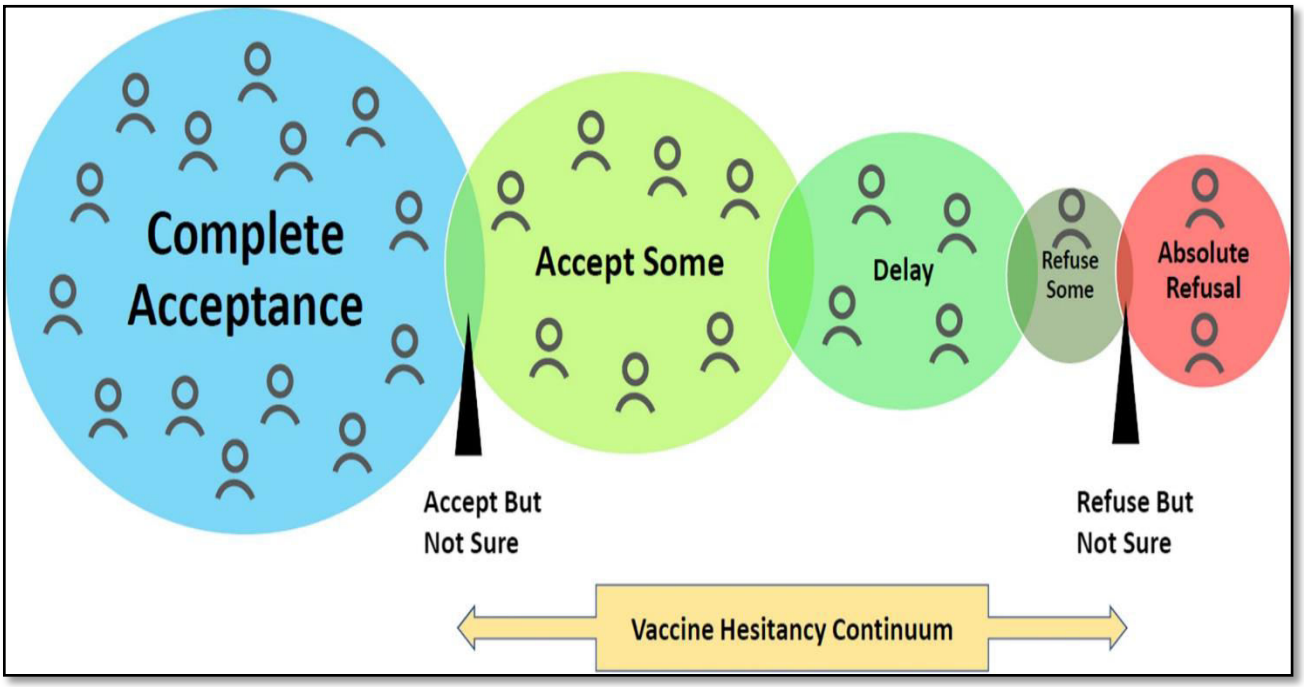
about the COVID-19 vaccines' unexpected effects, especially among females, urban residents, and participants with low education levels [5].

Up to 13 June 2023, the percentage of persons fully vaccinated with the primary vaccination series per 100 population was 41.37% (compared to 65.66% globally), while the percentage of vaccinated persons with at least a single booster dose or additional dose per 100 population was 14.87% (compared to 31.48% globally) [6].

Determinants of Vaccine Hesitancy:

According to the Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy, Vaccine Hesitancy is present on a continuum that extends from complete acceptance of vaccination to absolute refusal of vaccination as shown in **Figure 1** [7,8]**.**

Figure 1: Vaccine Hesitancy Continuum [7,8]**.**

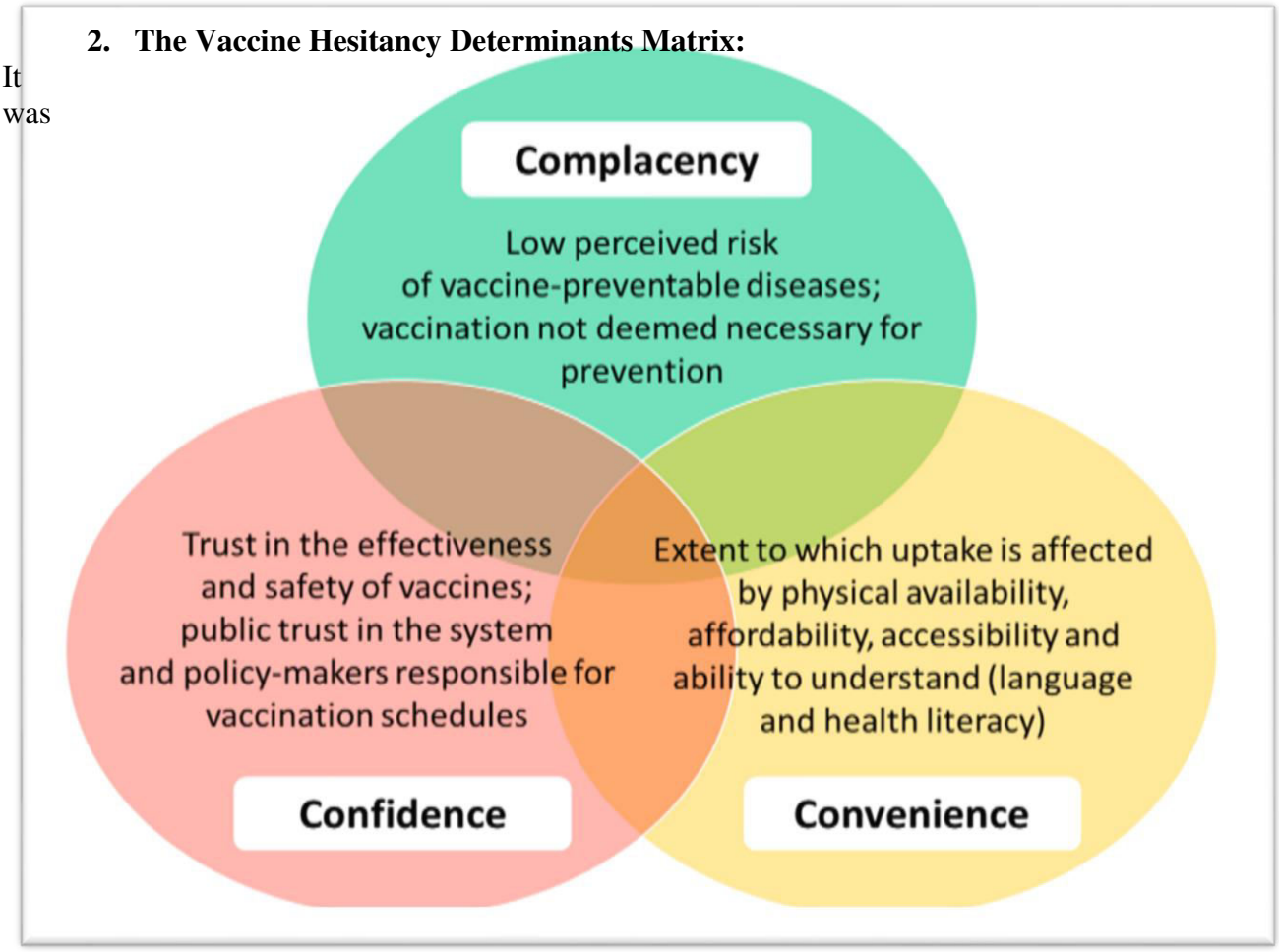


To understand the determinants of vaccine hesitancy, several models were developed such as:

1. **The "3 Cs" vaccine hesitancy model:**

It was proposed by the WHO EURO Vaccine Communications Working Group in 2011and highlightedthree main determinants of vaccine hesitancy: **complacency, confidence, and convenience** as shown in **Figure 2** [(2)]**.**

Figure 2: The 3Cs of vaccine hesitancy [(8,9)]



2. The Vaccine Hesitancy Determinants Matrix:

It was developed by the SAGE Working Group which grouped the vaccine hesitancy determinants into three main categories: **contextual, individual, and vaccine/vaccination-specific influences** as shown in **Figure 3** [(2)]**.**

CONTEXTUAL INFLUENCES Influences arising due to historic, socio-cultural, environmental, health system/institutional, economic or political factors	**a.** Communication and media environment **b.** Influential leaders, immunization program gatekeepers and anti- or pro-vaccination lobbies. **c.** Historical influences **d.** Religion/culture/ gender/socio-economic **e.** Politics/policies **f.** Geographic barriers **g.** Perception of the pharmaceutical industry
INDIVIDUAL AND GROUP INFLUENCES Influences arising from personal perception of the vaccine or influences of the social/peer environment	a. Personal, family and/or community members' experience with vaccination, including pain b. Beliefs, attitudes about health and prevention c. Knowledge/awareness d. Health system and providers-trust and personal experience. e. Risk/benefit (perceived, heuristic) f. Immunisation as a social norm vs. not needed/harmful
VACCINE/ VACCINATION–SPECIFIC ISSUES Directly related to vaccine or vaccination	a. Risk/ Benefit (epidemiological and scientific evidence) b. Introduction of a new vaccine or new formulation or a new recommendation for an existing vaccine c. Mode of administration d. Design of vaccination program/Mode of delivery (e.g., routine program or mass vaccination campaign) e. Reliability and/or source of supply of vaccine and/or vaccination equipment f. Vaccination schedule g. Costs h. The strength of the recommendation and/or knowledge base and/or attitude of healthcare professionals

Figure 3: TheVaccine Hesitancy Determinants Matrix [2]

3. The "5 A" model:

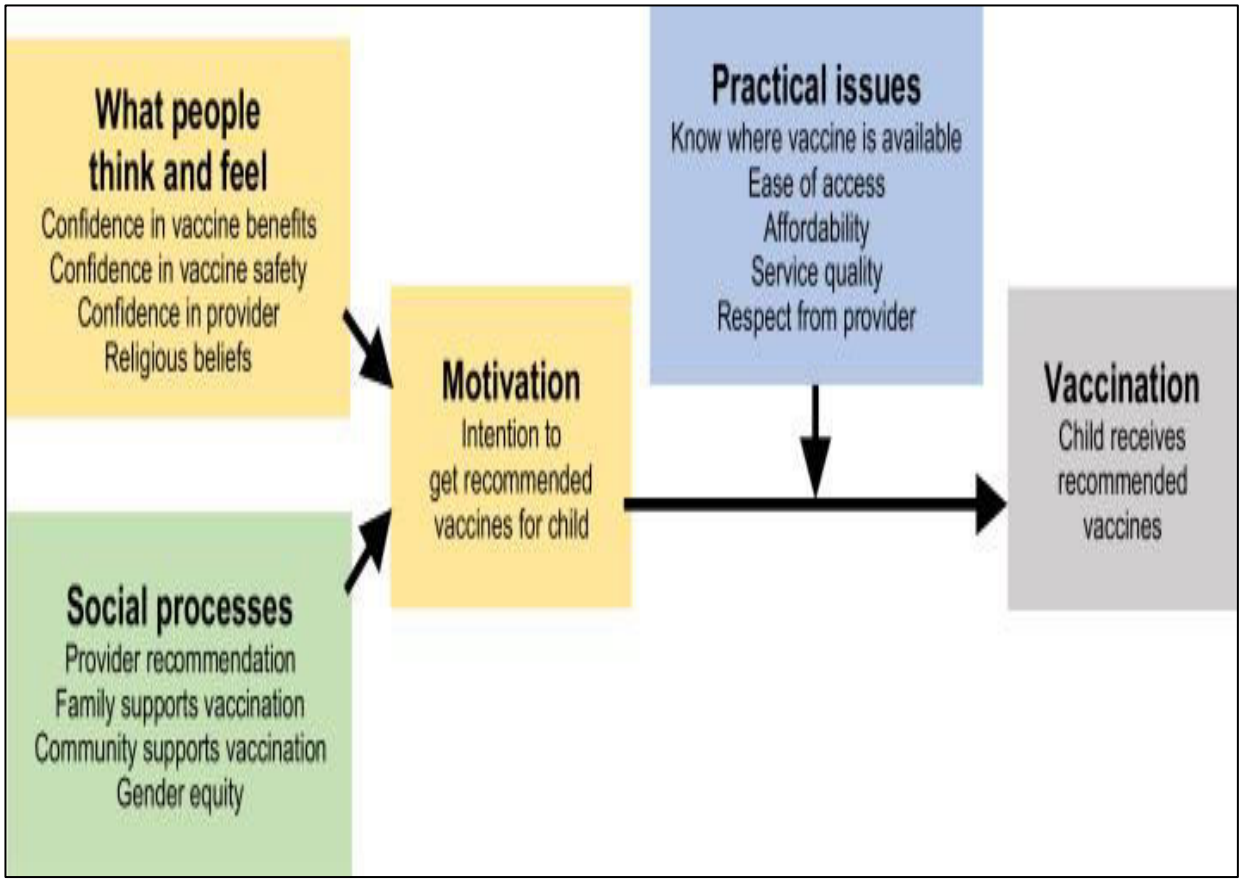
In 2016, Angus Thomson and his colleagues introduced the **5A model** which included five vaccination-related dimensions that could affect vaccine uptake [10].

1. *Access*: The capacity of individuals to reach the recommended vaccines.
2. *Affordability*: The capacity of individuals to afford the costs of vaccination, (both financially and non-financially).
3. *Awareness*: The extent to which individuals know the need for, availability, risks, and benefits of the recommended vaccines.
4. *Acceptance:* The degreeof acceptance, question, and refusal of individuals for vaccination.
5. *Activation*: The degree to which individuals are encouraged to be vaccinated.

4. Increasing Vaccination Model:

Noel T. Brewer and his colleagues developed the Increasing Vaccination Model which was later adopted by the World Health Organization. The model proposed that vaccination uptake results from *what people think and feel* in addition to *social processes* which lead to *motivation* that leads finally to *vaccination uptake* as shown in **Figure 4** [(11)]**.**

Figure 4: The WHO Increasing Vaccination Model [(11)]



5. The "5 Cs" vaccine hesitancy model:

In 2018, The **"3 Cs" vaccine hesitancy model** was revised which resulted in the introduction of the "5 Cs" vaccine hesitancy model. *Convenience* (in the "3 Cs model") was replaced with *Constraint* with adding *Collective responsibility* and *Calculation* as shown in **Figure 5**[(12)]**.**

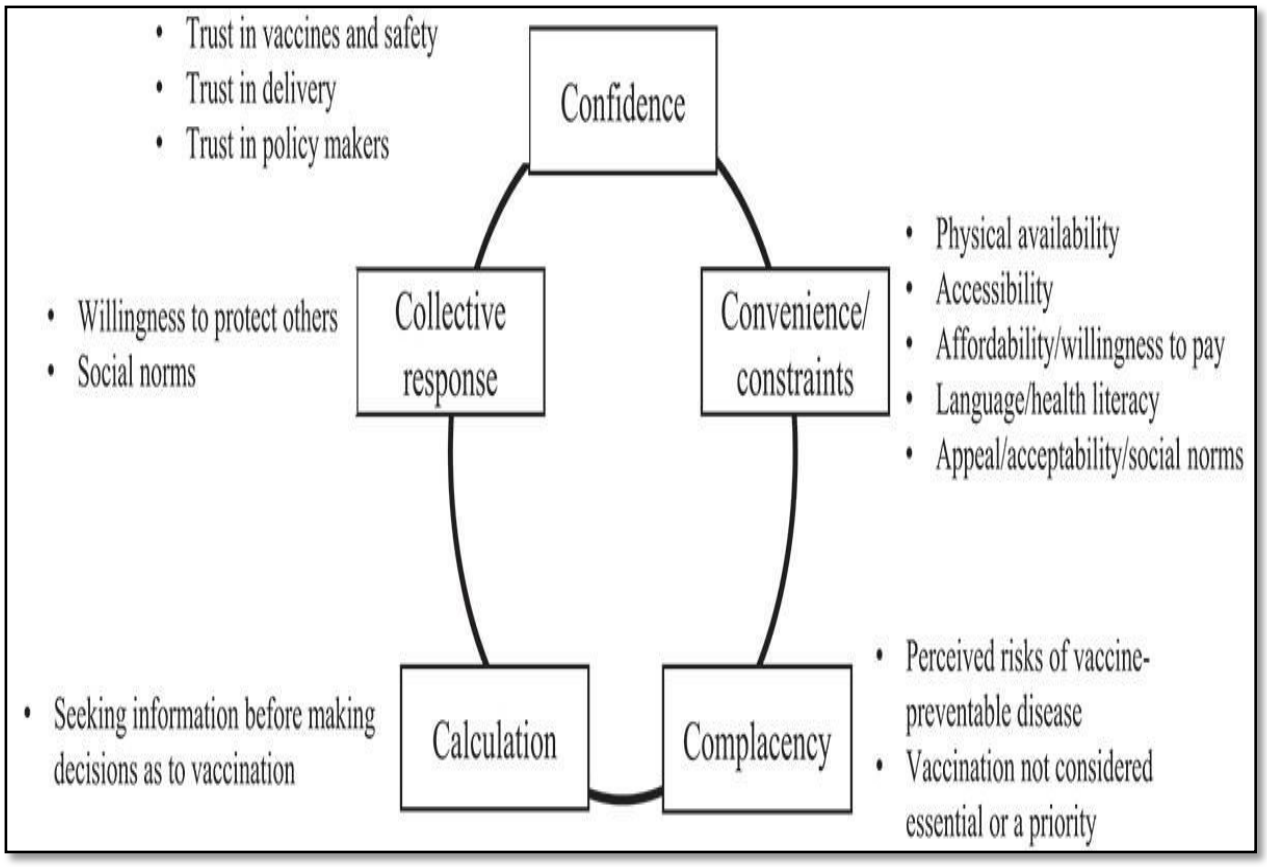


Figure 5: The "5 Cs model" for Vaccine Hesitancy [(12)]

6. The Journey to Immunization model:

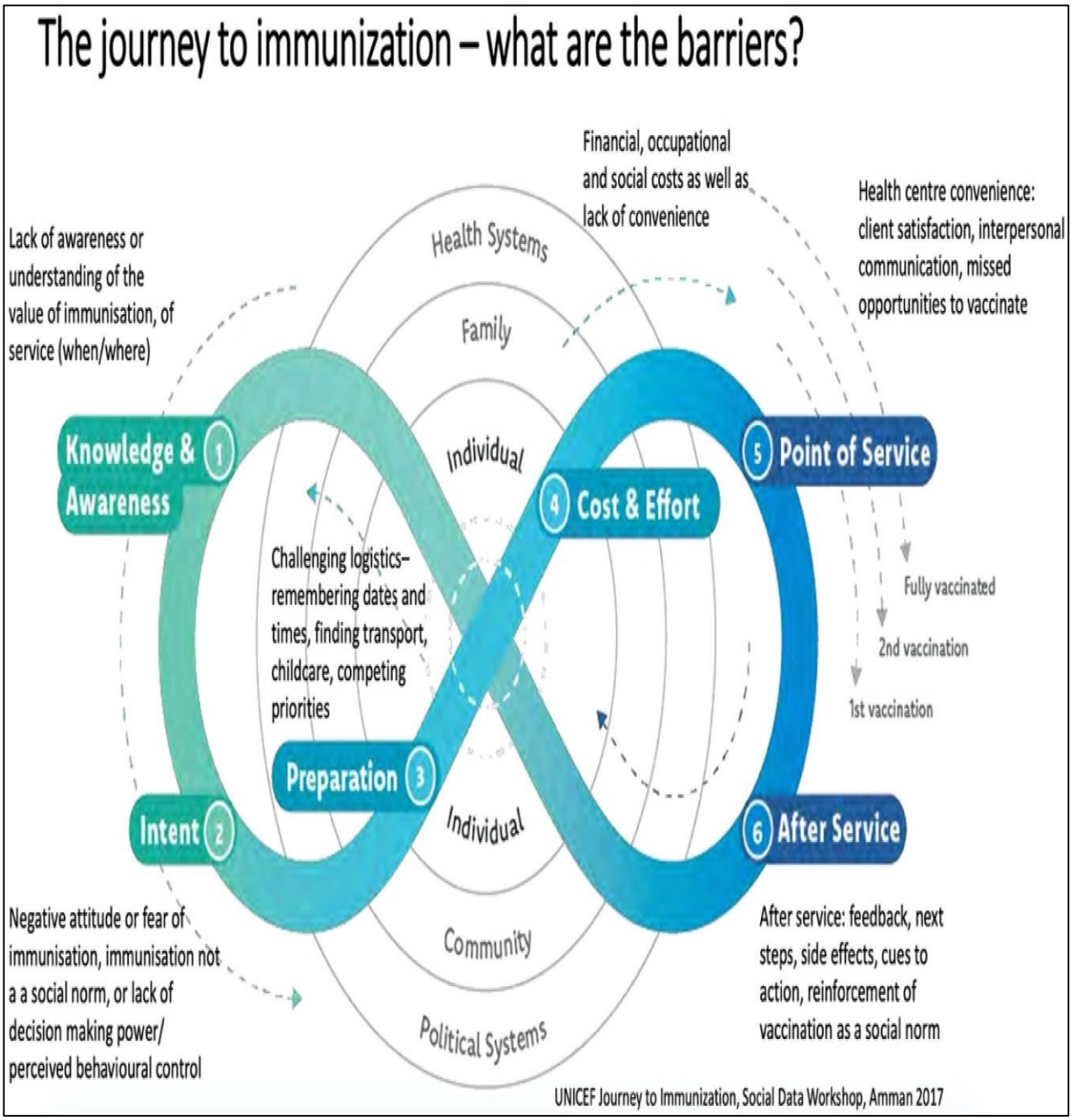
In 2018, The Journey to Immunization model was introduced to follow the journey of the vaccine recipient and healthcare provider till reaching the end (Immunization). It extends from the knowledge of vaccines to what occurs after vaccination within a socioecological framework including the individual, family, community, political, and healthcare systems.

It highlights six main factors during the vaccination journey which are *knowledge and awareness*, *intent*, *preparation*, *cost and effort*, *point of service*, and *after-service* as shown in **Figure 6[(13,14)].**

- *Knowledge and awareness factor* focuses on the health service/vaccine, its goal, and its details (such as where/when/how to receive it).
- *Intent factor* focuses on ending the gap between the intention of vaccination and taking action and receiving the vaccine. Readiness to receive the vaccine is influenced by attitude towards vaccination, subjective norms, and perceived behavioral control.
- *Preparation factor* considers planning for receiving the vaccine with determining the needed logistics such as finding transportation, and cost.
- *Cost and effort factor* relates to the costs of the vaccination (financial, occupational, and social), and lack of convenience.
- *Point of service factor* reflects all aspects of the experience of vaccination (such as communication with healthcare providers and client satisfaction).

- *After-service factor* includes short-term factors such as immediate feedback and reaching home. In addition, it involves long-term factors such as side effects, reminders, and social reinforcement.

Figure 6: The Journey to Immunization model [13,14]



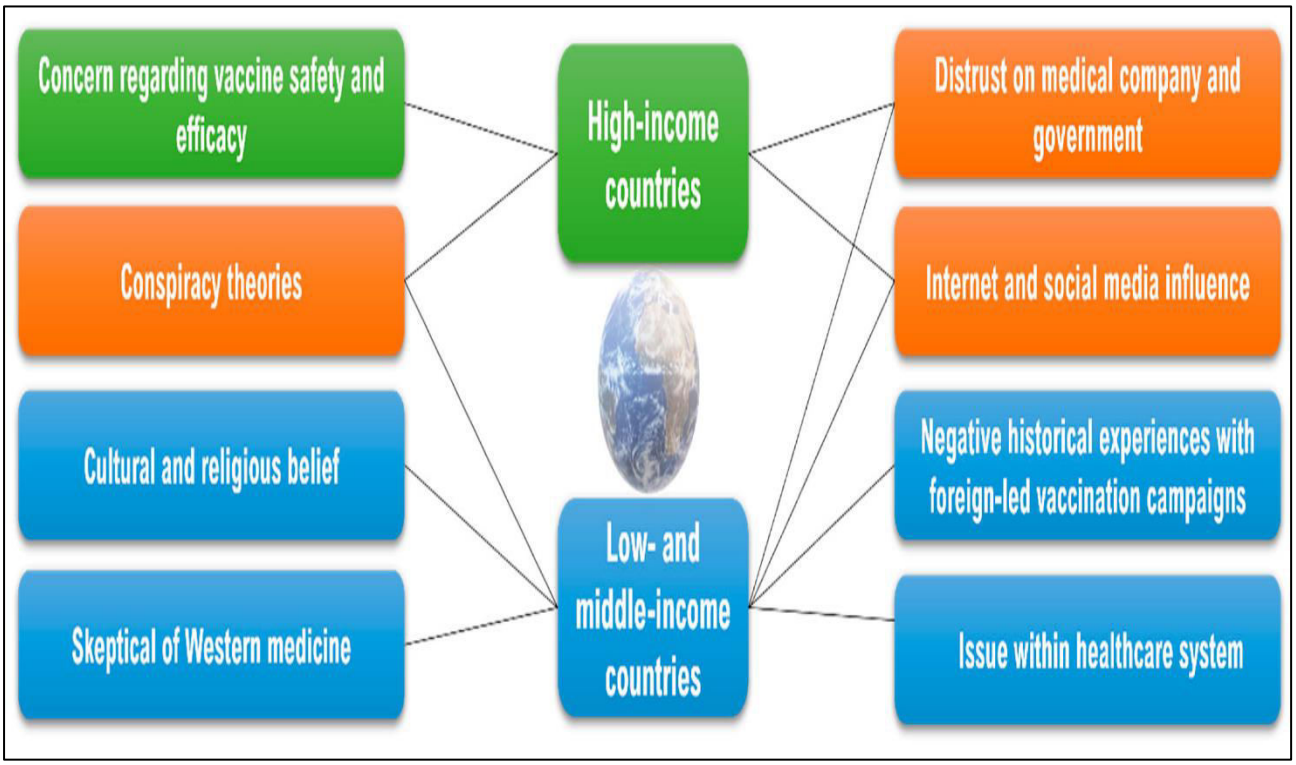
Drivers of Vaccine Hesitancy in different countries:

Vaccine Hesitancy is influenced by multiple socioeconomic factors in different countries. People in High-income countries show concern about the safety and efficacy of vaccines. While people in Low-income countries are influenced by some beliefs (Cultural and Religious), skepticism of Western Medicine, issues related to their healthcare systems, and negative historical experiences with vaccination campaigns. Conspiracy theories, Internet and social media misinformation, and distrust in the government and medical companies are both present in High-income and Low-income countries as shown in **Figure 7** [(1)]**.**

Figure 7: Drivers of Vaccine Hesitancy in different countries [(1)]

Measurement tools of vaccine hesitancy:

Several quantitative and qualitative methods were developed to measure vaccine hesitancy among the



individuals such as:

A) Quantitative methods:

1. **Brief assessment of vaccine hesitancy by 1-3 questions:** This method has been used in different studies by asking about vaccination willingness/hesitancy.
   - **a.** **'**Have you ever been reluctant or hesitated to get a vaccination for your child?' [(15)]**.**
   - **b.** 'As an adult, have you ever delayed getting a vaccine for reasons other than illness or allergy?' [(16)]**.**
2. **Using a validated instrument to assess vaccine hesitancy such as** Vaccine Hesitancy Scale (VHS), the Vaccination Attitude Examination (VAX) scale, and the vaccine acceptance instrument (VAI).
   - **a.** ***The Vaccine Hesitancy Scale (VHS)***was developed by the SAGE Working Group on Vaccine Hesitancy, and used by [(17)] to measure vaccine hesitancy. It is formed of ten items rated on a 5-point Likert scale: (the higher scores indicate greater vaccine hesitancy).
   - **b.** ***The Vaccination Attitude Examination (VAX) scale*** is a validated, short, twelve-item scale that can be used to evaluate vaccination behaviors and intentions. In addition, it can effectively identify vaccine-resistant individuals, and enable a more accurate understanding of their points of view [(18)]**.**

c. ***The vaccine acceptance instrument (VAI)*** is avalidated twenty-item instrument that can be used to assess vaccine acceptance with its five main factors (perceived safety, perceived effectiveness, and necessity of vaccination, acceptance of vaccine selection and scheduling, having positive values toward vaccines, and belief in mandating vaccinations) [19, 20].

d. ***The VAC-COVID-19 scale*** is a validated and reliable scale that can be used to measure the acceptance of the SARS-CoV-2 vaccines among the public. It can be useful to identify the reasons for vaccine adherence and hesitancy to develop strategies aiming to increase SARS-CoV-2 vaccination coverage rates. of public health to measure the perception of SARSCoV-2 vaccines acceptance [21]. In addition, the Arabic version of the VAC-COVID-19 scale was validated to be used in a Palestinian context [22].

B) Qualitative Methods:

Several studies used qualitative methods (such as open-ended questions) to explore the reasons for vaccine hesitancy among vaccine-hesitant individuals and understand their points of view.

1. *What are the reasons for your decision not to vaccinate your child?*[23]
2. *Why do you think vaccine hesitancy exists in our country?*[24]
3. *Why are you not vaccinated?***and***What factors could help you to take the decision of vaccination?*[25]

Consequences of vaccine hesitancy:

Vaccine hesitancy forms a barrier that complicates achieving herd immunity [5]. It hinders community efforts to control vaccine-preventable diseases such as the COVID-19 pandemic**.** Unvaccinated individuals pose a great danger to themselves and their communities as they act as reservoirs leading to further outbreaks, with more cases, hospitalizations, and deaths. Consequently, they cause a heavy burden on the healthcare system and wastage of public health resources [26,27].

How to overcome Vaccine Hesitancy?

Vaccine Hesitancy is a complex problem that hinders the huge efforts to control preventable diseases. There is an urgent need to tailor more effective strategies and interventions based on the needs of each targeted population [28] such as:

- Raising public awareness about the processes involved in vaccine development to gain the confidence of the public in vaccines [26].
- Providing the healthcare teams (physicians, nurses, and medical students) with adequate information about the different types of vaccines as they are a trusted source of information for their patients.
- Monitoring mass and social media to control the infodemic and misinformation concerning vaccines which can affect vaccine confidence among the public [29].
- Raising the capacity of the healthcare systems to provide health education programs regarding vaccination and its benefits [29].
- Launching a trusted information platform to be responsible to provide reliable and trusted information to the public regarding vaccination and help them get rid of their worries and concerns.
- Adopting an integrated public health policy involving all the sectors of the community is vital to overcome vaccine hesitancy.
- Engaging trained vaccinated individuals (especially influencing persons e.g., medical students) in the communication campaigns such as trained healthcare providers, sports champions, and community leaders [30].
- Focused research on vaccine hesitancy is needed to deeply understand how the community dynamics, socio-cultural influencing factors, deep beliefs, and criticisms about vaccines affect the acceptability of vaccines and how to overcome them properly [1].
- Providing positive reinforcement procedures for vaccinated people such as tax benefits [30].
- Conducting tailored communication campaigns (live and virtual) to reach high-risk and vulnerable groups [30].

- Obligation to apply mandatory vaccinations of some diseases such as COVID-19 vaccines.

Conclusion

Vaccine hesitancy is a multifactorial complex problem that threatens both individuals and communities forming a top global threat. Although been present for a long time, its harmful effects were exacerbated during the COVID-19 pandemic than ever before [31]. Several models were developed to understand the determinants of vaccine hesitancy. Governments, researchers, and all the other related stakeholders must develop multisectoral tailored effective strategies and interventions addressing the determinants of vaccine hesitancy to raise the vaccination coverage rates and reach herd immunity.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Nuwarda, R. F., Ramzan, I., Weekes, L., et al. (2022). Vaccine Hesitancy: Contemporary Issues and Historical Background. Vaccines, 10(10), 1595.
2. MacDonald, N. E., Eskola, J., Liang, X., et al. (2015). Vaccine hesitancy: Definition, scope and determinants. Vaccine, 33(34), 4161–4164. https://doi.org/10.1016/J.VACCINE.2015.04.036
3. Karafillakis, E., Van Damme, P., Hendrickx, G., & Larson, H. J. (2022). COVID-19 in Europe: new challenges for addressing vaccine hesitancy. The Lancet, 399(10326), 699-701.
4. Sallam, M., Al-Sanafi, M., Sallam, M. (2022). A Global Map of COVID-19 Vaccine Acceptance Rates per Country: An Updated Concise Narrative Review. Journal of Multidisciplinary Healthcare, 15, 21–45. https://doi.org/10.2147/JMDH.S347669
5. Omar, D. I., Hani, B. M. (2021). Attitudes and intentions towards COVID-19 vaccines and associated factors among Egyptian adults. Journal of Infection and Public Health, 14(10), 1481. https://doi.org/10.1016/J.JIPH.2021.06.019
6. World Health Organization. (2023). WHO Coronavirus (COVID-19) Dashboard. Available at: https://covid19.who.int/. Accessed 13 June 2023
7. Chan, N. N., Ong, K. W., Siau, C. S., Lee, K. W., Peh, S. C., Yacob, S., ... &Ooi, P. B. (2022). The lived experiences of a COVID-19 immunization programme: vaccine hesitancy and vaccine refusal. BMC Public Health, 22(1), 296
8. World Health Organization. (2014). Report Of The SAGE Working Group On Vaccine Hesitancy. Available at: https://www.asset-scienceinsociety.eu/sites/default/files/sage_working_group_revised_report_vaccine_hesitancy.pdf.

Accessed 12 June 2023

9. Thompson, S., Meyer, J. C., Burnett, R. J., & Campbell, S. M. (2023). Mitigating Vaccine Hesitancy and Building Trust to Prevent Future Measles Outbreaks in England. Vaccines, 11(2), 288.
10. Thomson, A., Robinson, K., &Vallée-Tourangeau, G. (2016). The 5As: A practical taxonomy for the determinants of vaccine uptake. Vaccine, 34(8), 1018-1024.
11. Brewer, N. T. (2021). What works to increase vaccination uptake. Academic Pediatrics, 21(4), S9-S16
12. Betsch, C., Schmid, P., Heinemeier, D., et al. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. PloS one, 13(12), e0208601.
13. Rodrigues, F., Block, S., & Sood, S. (2022). What determines vaccine hesitancy: Recommendations from childhood vaccine hesitancy to address COVID-19 vaccine hesitancy. Vaccines, 10(1), 80.
14. United Nations Children's Fund (UNICEF). (2018). Demand for Health Services Field Guide A human-centered approach. Available at: https://www.unicef.org/innovation/media/10051/file/Demand%20for%20Health%20Services:%20A%20Human-Centred%20Field%20Guide%20for%20Investigating%20and%20Responding%20to%20Challenges.pdf. Accessed 12

15. Larson, H. J., Jarrett, C., Schulz, W. S., Chaudhuri, M., Zhou, Y., Dube, E., ... & Wilson, R. (2015). Measuring vaccine hesitancy: the development of a survey tool. Vaccine, 33(34), 4165-4175.
16. Lucia, V. C., Kelekar, A., & Afonso, N. M. (2021). COVID-19 vaccine hesitancy among medical students. Journal of public health, 43(3), 445-449.
17. Shapiro, G. K., Tatar, O., Dube, E., Amsel, R., Knauper, B., Naz, A., ... &Rosberger, Z. (2018). The vaccine hesitancy scale: Psychometric properties and validation. Vaccine, 36(5), 660-667.
18. Martin, L. R., & Petrie, K. J. (2017). Understanding the dimensions of anti-vaccination attitudes: The vaccination attitudes examination (VAX) scale. Annals of Behavioral Medicine, 51(5), 652-660.
19. Oduwole, E. O., Pienaar, E. D., Mahomed, H., &Wiysonge, C. S. (2022). Overview of tools and measures investigating vaccine hesitancy in a ten year period: A scoping review. Vaccines, 10(8), 1198.
20. Sarathchandra, D., Navin, M. C., Largent, M. A., &McCright, A. M. (2018). A survey instrument for measuring vaccine acceptance. Preventive medicine, 109, 1-7.
21. Mejia, C. R., Rodriguez-Alarcon, J. F., Ticona, D., Flores-Lovon, K., Paredes-Obando, M., Avalos-Reyes, M. S., ... &Tovani-Palone, M. R. (2021). Validation of a Scale to Measure the Perception of SARS-CoV-2 Vaccines Acceptance: The VAC-COVID-19 Scale. Electronic Journal of General Medicine, 18(5).
22. Mahamid, F., & Veronese, G. (2022). The psychometric properties and the factorial structure of COVID-19 Vaccines Acceptance scale (VAC-COVID-19) within the Arabic language in a Palestinian contex. BMC Public Health, 22(1), 1-8.
23. Paterson, P., Chantler, T., & Larson, H. J. (2018). Reasons for non-vaccination: Parental vaccine hesitancy and the childhood influenza vaccination school pilot programme in England. Vaccine, 36(36), 5397-5401.
24. Sabahelzain, M. M., Moukhyer, M., Dubé, E., Hardan, A., van den Borne, B., &Bosma, H. (2019). Towards a further understanding of measles vaccine hesitancy in Khartoum state, Sudan: A qualitative study. PloS one, 14(6), e0213882.
25. Perrone, C., Fiabane, E., Maffoni, M., Pierobon, A., Setti, I., Sommovigo, V., & Gabanelli, P. (2023). Vaccination hesitancy: To be vaccinated, or not to be vaccinated, that is the question in the era of COVID-19. Public Health Nursing, 40(1), 90-96.
26. Iyengar, K. P., Vaishya, R., Jain, V. K., et al. (2022). BAME community hesitancy in the UK for COVID-19 vaccine: suggested solutions. Postgraduate Medical Journal, 98(e2), e134–e135. https://doi.org/10.1136/POSTGRADMEDJ-2021-139957
27. Centers for Disease Control and Prevention (CDC). (2023) Covid-19 vaccine confidence. Available at: https://www.cdc.gov/vaccines/covid-19/vaccinate-with-confidence.html. Accessed: 19 June 2023.
28. Betsch, C., Böhm, R., Chapman, G. B. (2015). Using Behavioral Insights to Increase Vaccination Policy Effectiveness. Policy Insights from the Behavioral and Brain Sciences, 2(1), 61–73.
29. World Health Organization. (2022). Strengthening COVID-19 vaccine demand and uptake in refugees and migrants: an operational guide to support all those responsible for planning and implementing the rollout of COVID-19 vaccine to refugees and migrants at national and local levels, 14 March 2022 (No. WHO/2019-nCoV/immunization/demand_planning/refugees_and_migrants/2022.1). World Health Organization.
30. Tuckerman, J., Kaufman, J., & Danchin, M. (2022). Effective Approaches to Combat Vaccine Hesitancy. The Pediatric Infectious Disease Journal, 41(5), e243.
31. Wiysonge, C. S., Ndwandwe, D., Ryan, J., Jaca, A., Batouré, O., Anya, B. P. M., & Cooper, S. (2022). Vaccine hesitancy in the era of COVID-19: could lessons from the past help in divining the future?. Human vaccines &immunotherapeutics, 18(1), 1-3.