

## Research Article

# The Impact of New Social Media Strategies on Vaccine Uptake and Coverage\_Do They Really Make a Difference?

Areesha Ahmad,<sup>1</sup> Aqsa Mustafa,<sup>2</sup> Ali Akram Qureshi,<sup>3</sup> Ansa Naseem,<sup>4</sup> Ali Raza Rana,<sup>5</sup> Marina Akhtar,<sup>6</sup> Alishba Rasool,<sup>7</sup> Umar Sadat,<sup>8</sup>

<sup>1-6</sup>King Edward Medical University/ Mayo Hospital, Lahore; <sup>8</sup>School of Clinical Medicine, University of Cambridge, United Kingdom;

### Abstract

**Objectives:** The information available about the use and effectiveness of new social media strategies remains ungauged. The objective of this systematic review is to gather and summarize the data available about the utility of new social media strategies and their impact on vaccine uptake and coverage. In addition, our aim is to give appropriate suggestions to the concerned authorities relating to the use of such social media strategies to cope with the rising incidences of myriads of diseases.

**Methodology:** The review considered articles from global sources. PRISMA guidelines were followed. PubMed and Google Scholar were queried. Inclusion and exclusion criteria about the new social media strategies in relation to vaccination were applied, and data extraction included author details, publication specifics, study populations, exposure measures, and outcomes.

**Results:** Out of 470 records, five studies met inclusion criteria, conducted between 2018 and 2022, focusing on different vaccines. Study designs encompassed randomized controlled trials, cohort studies, and mixed methods research, with interventions ranging from Facebook campaigns to web-based information and digital reminders. Social media interventions generally exhibited a positive influence on vaccine uptake and coverage, though outcomes varied based on specific interventions and target populations.

**Conclusion:** The data available is meagre. More research in this domain should be encouraged. However, we can conclude that social media can effectively increase vaccine uptake and coverage. To combat vaccine hesitancy and misinformation, government agencies and organizations should leverage social media's reach.

**Corresponding Author** | Dr. Alishba | Department of Community Medicine, KEMU, Lahore.

**Email:** alishbarasool001@gmail.com

**Keywords** | social media, vaccine uptake, vaccine coverage, vaccination, social media strategies

### Introduction

Social media is increasingly becoming the most powerful means of mass communication. Owing to its robust and easily accessible nature, it has enmeshed the whole world into an interconnected web. A study reports that globally, 4.76 billion people utilise social media as of January 2023, which is 59.4% of the current world population.<sup>1,2</sup> With the increase in world population, the prevalence and severity of different diseases are also increasing.

Vaccination has come out to be the best preventive means for protection against serious ailments.<sup>3</sup> But despite the explicit promising results, the rate of immunization is still very low. For example, as of 2018, the global Human Papilloma Virus (HPV) vaccine coverage was only 12.2%.<sup>4</sup> In fact, one of the top 10 risks to global human health in 2019, according to the World Health Organisation (WHO), is hesitation to be vaccinated.<sup>5</sup> Vaccination hesitancy is described as the act of delaying or refusing the administration or uptake of a vaccine despite it being freely and easily available, owing to different factors and views held by the person.<sup>6</sup>

Although vaccine hesitancy has been regarded as a big problem since long, it has become an alarming sign and has assumed a huge urgency when the disease of COVID-19 span over the whole world and manifested as a pandemic.<sup>7</sup>



### Production and Hosting by KEMU

<https://doi.org/10.21649/jspark.v3i1.361>

2959-5940/© 2024 The Author(s). Published by Journal of Society of Prevention, Advocacy and Research (JSPARK), King Edward Medical University Lahore, Pakistan.

This is an open access article under the CC BY4.0 license <http://creativecommons.org/licenses/by/4.0/>

To ameliorate this worrisome situation, intellectuals and policymakers have started thinking about using social media as a tool to increase the uptake and coverage of vaccines. Healthcare professionals use different social media sites to share their knowledge with their patients as well as the general public.<sup>8)</sup> On the other hand, it is also known that parents, young adults, and adolescents are increasingly obtaining health-related information from social media.<sup>9,10</sup> Hence social media facilitates the ability of both healthcare providers and laypeople to share their knowledge and experiences regardless of the accuracy of the information.

As compared to traditional media, social media content does not only consist of texts and images rather it has various social cues too attached to it. These include user ratings, the number of friends he has, and the number of likes, comments, and shares. Studies show that all these cues add to the credibility of the content and may enhance its effectiveness.<sup>11</sup> Likewise, studies have shown that health campaign messages may also influence the perception of credibility and in turn the effectiveness of health campaigns.<sup>12</sup>

Despite all these studies, no systematic review has yet been performed that includes the latest data about the effectiveness of social media in influencing vaccine uptake and coverage as a whole. This study aims to analyse the material that has already been published regarding the relationship between the usage of new social media methods and vaccination uptake and coverage, taking vaccination in its broad sense and not limiting it to a particular disease.

## Methods

A systematic review was conducted. A great way to stay current with new developments is to read systematic reviews, which combine data from various research articles about a particular subject to synthesize data and assert the significance of results.

Systematic reviews can also be used as guidelines in medical practice. We used the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) criteria while executing the review.

For extraction of articles, databases like PubMed and Google Scholar were utilized. The keywords like “social media”, “vaccination”, “attitude”, “uptake” and “coverage” were used while searching these databases. Only those articles that were published between March 2018 and February 2023 were selected for our study. In Google Scholar, only the first ten pages were selected for article screening.

Studies published in the last 5 years i.e., between March 2018 and February 2023 in the English language and having full text available were searched. Studies involving social media strategies i.e., Facebook, WhatsApp, Twitter,

Instagram, TikTok, YouTube, etc. involving the effects of social media strategies on the attitude of the masses may it be the change of mind or administration of a vaccine were selected. Studies involving only the positive or neutral correlation between new social media strategies and vaccine uptake were included.

Studies involving other media strategies like newspapers, pamphlets, etc. or not focusing on the effects of social media strategies on the attitude of the masses were excluded. Studies involving a negative correlation between new social media strategies and vaccine uptake and coverage were also excluded.

We equally divide all the articles, that are retrieved using the keywords in databases, among all the authors (M.A. Javed, M. Arqam, M.A. Usman, M. Anas, M. Asad). Every author initially screened the articles based on their title. Secondly, the abstracts of the shortlisted articles were read and scrutinized. After this, every author independently read the selected articles, applied the inclusion and exclusion criteria, and did the final selection of articles according to the PRISMA guidelines. In case of any discrepancy, (M.A. Javed) was there to sort it out.

From the selected studies, data was extracted systematically. The following information was noted: author name, journal of publication, year of publication, study population, country of origin, exposure measures (social media use and exposure to vaccination-related positive stuff), and outcome measures (change in attitude towards vaccination, rate of vaccination, etc.). The extracted data was then compiled and cross-checked, and a narrative was synthesized. The discrepancies were resolved by discussion with (M.A. Javed) as the mediator.

## Results

By scanning the chosen databases, namely PubMed and Google Scholar, and cataloguing the references of pertinent publications, we discovered over 470 items.

47 abstracts were retrieved after the duplicates were removed. As shown in Figure 1, papers were screened and chosen, leading to 57 full-text articles that were evaluated for eligibility and 5 studies were included in our systematic review.

Table 2 lists the features of the listed studies. Studies included were conducted in the 10-year tenure from 2012 to 2022. Most of the research was done in the United States (80%, n= 4) and one study included was conducted in the Apulia region of Italy (20%, n=1). Of the studies, four were experimental studies (80%, n= 4) and one was observational study (20%, n=1). Out of four experimental studies, two were Randomized Controlled Trials (RCTs) (40%, n=2), and one was a Cohort study (20%, n=1). and one was a Controlled,

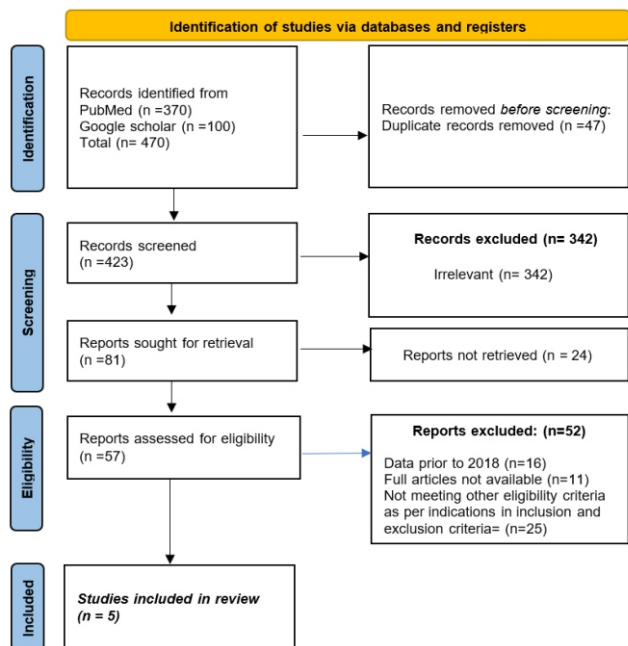


Figure 1: PRISMA Flow Diagram

Mixed Methods, Quasi-Experimental Study (20%, n=1). Of the studies included, two were focused on HPV, one was focused on COVID-19, one study included the Measles, Mumps, and Rubella vaccine (MMR) and one study included two vaccines i.e., Tdap and Influenza vaccine. The target populations included parents, caretakers, pregnant mothers, and medical students. The range of samples ranges from 58 to 2106.

Two studies (14,16) in results manifest the impact of Facebook campaigns on the adult population regarding HPV vaccination uptake. One retrieved study was conducted between June 2012 and July 2013. The other was conducted in 2020.

The first study<sup>(14)</sup> included the Facebook campaign named 3forME which involved 155,110 adolescents and 2106 adults. The advertising campaign was focused on the risk of Human Papilloma Virus (HPV) and encouraged the adults of Philadelphia to get vaccinated.

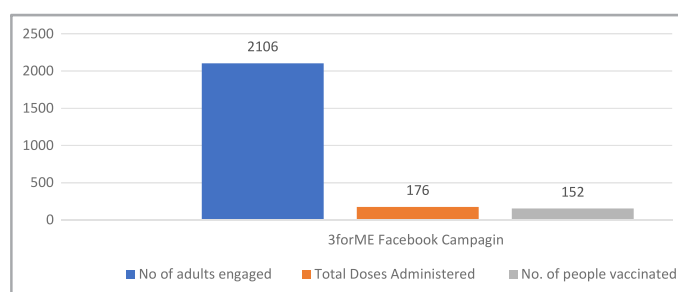
In the second study<sup>(16)</sup>, two undergraduate classes at a public institution in the Southeast of the United States took part in

Table 1: Data Extraction Table.

Sr No.	Article Title	Authors	Study Design	Duration of Study/ Setting	Participants	Region	Modality of social media used	Primary Outcome	Results
1	Addressing Parents' Vaccine Concerns: A Randomized Trial of a Social Media Intervention <sup>(13)</sup>	Matthew F. Daley, MD et. al.	RCT	September 2013 through November 2016	1,093 parents	Colorado	A website that contained vaccine information and had social media components too	Change in Parental vaccine attitudes	The mean change regarding vaccine benefits was 0.23 and that of vaccine risks was 0.22.
2	Using Facebook to reach adolescents for human papillomavirus (HPV) vaccination <sup>(14)</sup>	Salini Mohantyet. al.	Facebook-based observational study	2018	2106 adults	United States	Facebook campaigns	Engagement of adults in the campaign didn't bore anticipated results.	The campaign was well-received and far-fetched. But only 152 adults got vaccinated out of 2106 adults.
3	Efficacy of a Web-Based Intervention to Increase Uptake of Maternal Vaccines: An RCT <sup>(15)</sup>	Sean T.O'Leary, MD, MPH et. al.	RCT	September 2013-July 2016	462 pregnant women	Colorado	A website that contained vaccine information and also possessed interactive social media components	Tdap and influenza vaccination	57% percent women got themselves inoculated with the influenza vaccine and 71% with the Tdap vaccine.
4	Evaluating a Technology-Mediated HPV Vaccination Awareness Intervention: A Controlled, Quasi-Experimental, Mixed Methods Study <sup>(16)</sup>	Heather M. Brandt et. al.	A Controlled, Quasi-Experimental, Mixed Methods Study	2020	58 Under-graduate Students	A public university situated in the southeastern United States of America	Facebook based intervention	Change in attitude	Students welcomed this intervention positively (89%) and many of them wanted to share this useful information with their friends (78%).
5	Do social media interventions increase vaccine uptake? <sup>(17)</sup>	Francesca Maria Grosso et. al.	A prospective cohort study	16 December 2021 to 30 March 2022	Parents and Caretakers of 600 children of age 5-11	Two pediatric primary care offices (PPCOs) that were situated in the Apulia region	This study contrasted no organised digital intervention with social media- and DRS-based interventions.	Children in the exposed cohort were vaccinated more than the children in the unexposed cohort.	In the exposed cohort, 165 out of 277 children got vaccinated while in the unexposed cohort, 147 out of 323 children received Covid vaccine.

a controlled, quasi-experimental, mixed methods study to assess the efficacy of a technology-based intervention. All enrolled students in the two sections of the advanced health communication course were eligible to participate, and they all opted to do so. There were 29 pupils each section. The median age of the participants ( $n = 58$ ), who were juniors and seniors, was  $21.6 \pm 2.2$  years. Females (81%) and White people (90%) made up the majority of the participants.

In the first study<sup>(14)</sup>, six Facebook advertisements were run under the campaign named 3forME and these included (1) Taking ownership of one's health (2) Back to School (3) Disease Risk (4) Peer Support (5) Summer Protection (6) Philadelphia. The 3forME page was updated two to three times each week during this campaign, typically on the days that the vaccination clinics were held. The content and photos in these posts highlighted the advertising campaign. The queries were answered, and misinformation was dealt with promptly by the 3forME team.



**Figure 2A:** 3forME Campaign impact on adults

In the second study<sup>(16)</sup>, two programs were created, a cancer prevention program and a health promotion program. Each group served as the other group's control. In this experiment, interventions included weekly emails and posts to a private Facebook group as part of eight technology-mediated health promotion sessions that lasted nine weeks.

In the first study<sup>(14)</sup>, overall, 3400 adults became fans of the campaign, and 176 doses of HPV vaccines were administered to 152 adults. Out of these 152 adults, Black/African American were 68 (45%), Hispanic 38 (25%), Asian 27 (18%), White 5 (3%) and others 14 (9%). Gender proportion (M:F) was 99:53. This concludes that the Facebook campaign was not as effective as the researchers had anticipated.

Participants in the second study's HPV vaccine awareness condition<sup>(16)</sup> gave the intervention a positive assessment. Overall, 89% of participants stated they found the intervention to be useful, 78% said they would tell a friend about it, and 70% said they had fun with the program. The majority of participants (67%) were pleased with the number of lectures, the quantity and length of Facebook posts (both 56% and 63%), and the degree of interaction with health educators on the platform (81%).

Website Based Interventions and Their Outcome:

Two RCTs were included in this systematic review which dealt with the impact of website-based information on the parents and pregnant women. The first of these studies<sup>(13)</sup> were conducted from September 2013 through November 2016. The other one<sup>(16)</sup> was conducted from September 2013 through July 2016.

In the first RCT<sup>(13)</sup>, 5,302 parents were assessed for study eligibility, and 1,093 of them were found to be eligible and enrolled in the trial. The majority of participants in both study groups reported using the Internet at least occasionally to research health-related topics, and between 45.4% and 50.9% of individuals were expecting their first child.

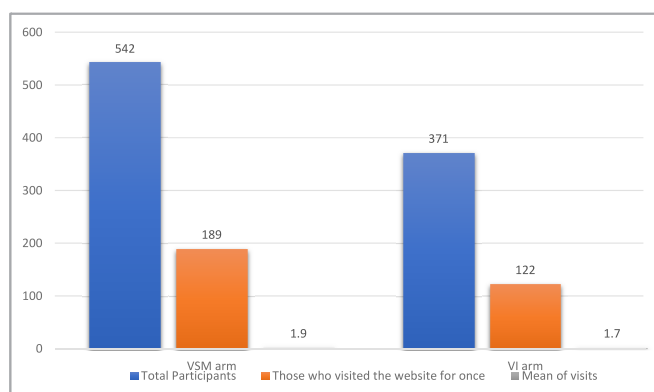
945 (86.5%) of the 1,093 participants in the study completed all three surveys; 107 (9.8%) did not finish the Timepoint 1 or 2 questionnaires; and 41 (3.8%) were not followed up with. The proportion of individuals who completed all three surveys in the VSM study arm (82.7% completion) was lower than in the VI (90.0%) and usual care (90.6%) arms ( $p < 0.001$ ). In addition, fewer parents who had shown vaccine hesitancy at the outset completed all three questionnaires (81.2% vs 87.3% completion, respectively;  $p = 0.04$ ).

The second RCT, a single-center RCT involving social media and vaccine awareness interventions aimed at lowering newborn under vaccination, was carried out. 1093 participants were randomly assigned to 1 of 3 groups: those receiving only customary care (UC), those receiving information about vaccines and interactive social media components (VSM), or those receiving information about vaccines only (VI).

In both RCTs, three groups were created. (1) Vaccine social media [VSM] (2) Vaccine Information [VI] (3) Usual Care only (UC) and it was observed the impact of social media and website-based intervention on the attitude of pregnant women to get vaccinated and parents to get their children vaccinated. The outcomes were compared to the Usual care only (UC).

189 (34.9%) of the 542 participants in the first RCT's VSM study arm visited the research website at least once, with a mean of 1.9 visits ( $SD = 1.8$ ) and having a range of 1 to 15. Although the distinction was not statistically significant ( $p = 0.24$ ), vaccine-hesitant individuals (41.2%) browsed the website more than non-hesitant participants (34.0%).

In the VI study arm, 122 (32.9%) of the 371 participants accessed the study website at least once, with visits ranging from one to 10, with a mean of 1.7 ( $SD = 1.5$ ). Vaccine-hesitant participants (43.4%) were more likely to visit the website than non-hesitant participants (31.1%;  $p = 0.08$  for the comparison).



**Figure 2B:** RCT Analysis

There were 1,093 participants that were randomized and included in the overall trial for the second RCT.<sup>15</sup> 94% of the 1,093 pregnant participants in the entire study population received the Tdap vaccine, whereas 74% were administered the influenza vaccine. A total of 173 women were fit for the criteria for the Tdap analysis (i.e., unvaccinated at enrolment) and were selected from the 952 women who were enrolled in the overall research at least 2 weeks before their projected due date and followed through the delivery of their infants. Of these, 82% had received Tdap before enrolment. 56% of the 657 participants who were enrolled during the influenza season had already had their vaccinations; this left 289 subjects for the examination of the influenza vaccine.

In total, 54% of the pregnant women who were eligible for the shot received it prior to delivery (155/289). In comparison to UC, influenza vaccination rates were higher in both intervention arms (VSM and VI). The influenza vaccine was more likely to be given to women receiving any type of intervention than the usual care arm (57% vs. 36%,  $p=0.01$ ). 57% of people in the VSM arm, 56% in the VI arm, and 36% in the UC arm received the influenza vaccine. 289 pregnant women were included in this investigation, and 21% of them were categorized as vaccine-hesitant. Among these, 27% obtained the flu shot compared to 61% of women who were not apprehensive. The odds of obtaining an influenza vaccine were twice as high in the VSM arm compared to the UC arm (OR=2.19, 95% CI=1.06, 4.53) and the VI arm compared to the UC arm (OR=2.20, 95% CI=1.03, 4.69). The intervention arms were identical to one another.

70% of the pregnant women who were eligible for the Tdap vaccine had it before giving birth (121/173). Tdap vaccine uptake did not significantly differ between trial arms. Tdap was administered to 71% of women in the VSM arm, 69% in the vaccine information arm, and 68% in the usual care arm. 25% of the 173 expectant mothers included in this investigation were labelled as hesitant to vaccine. Among them, 35% got the vaccination as opposed to 82% of the non-hesitant group. The ORs were not statistically significant at all.

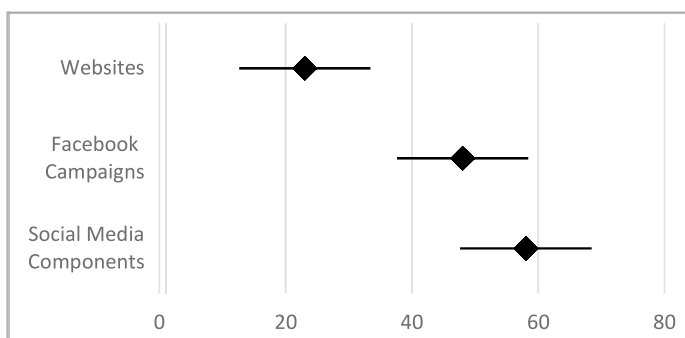
One of the studies<sup>17</sup> included in this systematic review is a cohort study that looked at the influence of social media interventions and digital reminder services on vaccine uptake versus no organized digital intervention. This study was carried out in two paediatric primary care offices (PPCO) in the Apulia region for four months, from 16 December 2021 to 30 March 2022.

The trial comprised 600 individuals in total, ages 5 to 11. There were 323 patients registered in the Palese PPCO (non-exposed cohort), with 45% being girls and 55% being boys. In comparison, the total number of patients registered at Margherita di Savoia's PPCO (exposed cohort) was 277, with 49% being boys and 51% being girls.

In these two PPCO cohorts, one cohort was exposed to social media interventions and Digital reminder services, and the other cohort was not exposed. Both cohorts received in-person and remote vaccination counseling.

In the exposed group, 165 patients were fully immunized (59.5%), 165 patients received no doses of the COVID-19 vaccine, and 23 patients received just one dose (8.5%). In the unexposed cohort, 147 individuals had received all three doses of the COVID-19 vaccine (45.5%), 147 had only gotten one dose (7.4%), and 152 had received none at all (47%).

In the exposed group, 59.5% of the children were fully immunized, compared to only 45.5% of the non-exposed cohort. There is substantial indication that the 14% difference between the two groups may not have just happened by chance (chi-square = 11.5016;  $p = 0.0006$ ). A value of 1.8 (95% CI: 1.2; 2.5) was obtained from the odds ratio calculation, indicating that parents who received this intervention are 80% more inclined to vaccinating their children.



**Figure 3:** Forest Plot / Vaccine uptake percentage

## Discussion

Our systematic review provides well-summarized evidence regarding effectiveness of social media on vaccination uptake and hesitation. According to the findings, there is evidence to suggest that using websites for immunisation campaigns, patient-held web portals, computerised reminders, and standing orders can boost the rate of immunisation coverage.

Examples of these methods include leveraging social media sites like YouTube and Facebook. Twitter and Facebook users were more likely to get immunized as compared to people who do not obtain their health information from Twitter or Facebook. This indicates there is an immense opportunity to utilize Twitter and Facebook on government levels to promote the uptake of vaccines.<sup>18</sup>

Our findings indicate that social media interventions for vaccine uptake are a nascent field; we can use innovative strategies to enhance vaccine uptake. Our results focused on various vaccines, so they are quite diverse. However, there are several key approaches that we were able to identify. Effective social media campaigns are important for vaccine behaviour, particularly actionable messaging and effective and proper posts on social media portals. In a study looking at how vaccine-related videos affect medical workers, particularly medical students, it was observed that they are comparatively immune to emotional vaccine-critical information on social media platforms.<sup>19</sup> Medical students and professionals have to be familiar with and master how to use social media platforms to tackle misinformation and be the source of valid information.<sup>20</sup>

In addition to social media usage, the impact of popup messages should not be belittled. A study conducted on vaccination of the Human Papilloma Virus indicated that the majority of participants thought the pop-up messages were acceptable, practical, and factual. Results revealed that being male, having positive attitudes towards HPV vaccination, exposure to HPV-related content on social media recently, believing social media information is credible, and sharing posts on social media regarding HPV were all associated with a higher probability of clicking a pop-up.<sup>21</sup>

Text messaging may also be used to inform parents of kids and teenagers, especially those from low-socioeconomic backgrounds, about health benefits of immunizations, as well as for reminder and recall purposes. Despite the extensive use of text messaging, which is predicted to be used by young people that lie in the 18 to 29 year-old age group to send and receive an average of 87.7 SMS each day, we find that these technologies are rarely used for health-related purposes.<sup>22</sup> There is little research on other social media platforms, such as social networks and smartphone apps. Two new smartphone applications have recently been created and released by the WHO Regional Office for Europe and the Centres for Disease Control and Prevention (CDC). The CDC one is intended for physicians and other healthcare professionals who deliver immunizations, and it serves to remind them of the vaccines that the Advisory Committee on Immunization Practise suggests for children, adolescents, and adults. The WHO initiative, which is geared toward parents, comprises a uni-

versal app code that countries can adapt into a smartphone application to alert parents when their children need immunizations based on the local immunization schedule.

On the other side, as the internet becomes more essential in linking people to knowledge, the negative consequences linked with the dissemination of incorrect or disparaging claims about immunisation among the general population have increased substantially.<sup>23</sup> Such negative information threatens the overall well-being of human society and increases the reluctance among parents toward vaccination.

Vaccine hesitancy has been a major issue in middle and low-income countries. Due to the increased use of social media in these countries, it is vital to understand the importance of social media campaigns in these settings. In third-world countries, a study conducted during the COVID-19 pandemic indicated the attitude of masses using social media toward vaccination that they were generally inclined toward vaccination. This suggests that social media can act as a medical education tool to educate the masses about vaccination uptake and eliminate the misinformation regarding vaccination.<sup>24</sup> Social media has not only played a great role in spreading information about vaccination but also in the diagnosis and management of COVID-19 patients.<sup>25</sup> Moreover, social media has also been shown to increase the uptake of personal protective measures during the coronavirus pandemic.<sup>26</sup> Social media is also being used to promulgate preventive measures for COVID-19.<sup>27</sup>

Exposure to fake news has an upper limit beyond which it has a detrimental effect on vaccination uptake. A news analysis system should be used to reduce the influence of fake news on the public while focusing public health policy on expanding vaccine coverage.<sup>28</sup> Social media's effect on vaccination uptake has its value but it has been observed that social media also holds great importance in dealing with information about diseases of different medical disciplines. The most significant of which is cancer awareness via computer-based strategies which increase the awareness of people about the importance of self-examination and early diagnosis.<sup>29</sup> Cancer is very prevalent in Pakistan.<sup>30</sup> Social media can be used to ameliorate the conditions in countries like Pakistan.

Our review, however, has limitations. There was a great deal of variation in study sites, study demographics, data collection, and method implementation. Some studies have small sample sizes. It was difficult to evaluate programs targeting vaccination hesitancy on social media, and the research included may have had selection bias.

Information and communication technology has expanded quickly recently and will do so going forward. More people have access to modern media today. We find that they provide

a promising chance to increase immunisation rates and coverage in nations with high and middle incomes. More investigations are needed, however, to assess the efficacy and utility of new media strategies, as well as how to successfully disseminate public health messages in the new telecommunication period.

### Conclusion

All the studies that are a part of this systematic review indicate that the effective use of social media can increase vaccine uptake and reduce hesitancy. Therefore, government agencies and non-government organizations should utilize this platform for effective vaccine uptake and should also try to eliminate misinformation regarding vaccines.

**Conflict of Interest:** The authors declare no conflict of interest.

**Funding Source:** None

**Ethical Approval:** Given

**Authors' Contribution**

All the authors contributed equally in accordance with ICMJE guidelines.

### References

1. DataReportal – Global Digital Insights. Global Social Media Statistics [Internet]. [cited 2023 Mar 5]. Available from: <https://datareportal.com/social-media-users>.
2. Kepios. Make sense of digital trends [Internet]. [cited 2023 Mar 5]. Kepios. Available from: <https://kepios.com>.
3. Services D of H& H. Vaccines [Internet]. Department of Health & Human Services; [cited 2023 Mar 5]. Available from: <http://www.betterhealth.vic.gov.au/health/healthy-living/vaccines>
4. Spayne J, Hesketh T. Estimate of global human papillomavirus vaccination coverage: analysis of country-level indicators. *BMJ Open*. 2021;11(9):1-5.
5. Wilson SL, Wiysonge C. Social media and vaccine hesitancy. *BMJ Global Health*. 2020;5(10):1-4.
6. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine*. 2015;33(34):4161-4.
7. Chadwick A, Kaiser J, Vaccari C, Freeman D, Lambe S, Loe BS, et al. Online social endorsement and Covid-19 vaccine hesitancy in the United Kingdom. *Social Media + Society*. 2021;7(2):1-6.
8. Ventola CL. Social media and health care professionals: benefits, risks, and best practices. *PT*. 2014;39(7): 491–520.
9. Fergie G, Hilton S, Hunt K. Young adults' experiences of seeking online information about diabetes and mental health in the age of social media. *Health Expect*. 2016;19(6): 1324–35.
10. Logsdon MC, Bennett G, Crutzen R, Martin L, Eckert D, Robertson A, et al. Preferred Health Resources and Use of Social Media to Obtain Health and Depression Information by Adolescent Mothers: Preferred Health Resources and Use of Social Media to Obtain Health and Depression Information by Adolescent Mothers. *J Child Adolesc Psychiatr Nurs*. 2014;27(4):163–8.
11. Tong ST, Van Der Heide B, Langwell L, Walther JB. Too Much of a Good Thing? The Relationship Between Number of Friends and Interpersonal Impressions on Facebook. *Journal of Computer-Mediated Communication*. 2008; 13(3): 531–49.
12. Chen L, Tang H, Liao S, Hu Y. e-Health Campaigns for Promoting Influenza Vaccination: Examining Effectiveness of Fear Appeal Messages from Different Sources. *Telemedicine and e-Health*. 2021;27(7):763–70.
13. Daley MF, Narwaney KJ, Shoup JA, Wagner NM, Glanz JM. Addressing Parents' Vaccine Concerns: A Randomized Trial of a Social Media Intervention. *Am J Prev Med*. 2018; 55(1): 44–54.
14. Mohanty S, Leader AE, Gibeau E, Johnson C. Using Facebook to reach adolescents for human papillomavirus (HPV) vaccination. *Vaccine*. 2018;36(40):5955–61.
15. O'Leary ST, Narwaney KJ, Wagner NM, Kraus CR, Omer SB, Glanz JM. Efficacy of a Web-Based Intervention to Increase Uptake of Maternal Vaccines: An RCT. *Am J Prev Med*. 2019;57(4):125–33.
16. Brandt HM, Sundstrom B, Monroe CM, Turner-McGrievy G, Larsen C, Stansbury M, et al. Evaluating a Technology-Mediated HPV Vaccination Awareness Intervention: A Controlled, Quasi-Experimental, Mixed Methods Study. *Vaccines (Basel)*. 2020;8(4):749.
17. Grosso FM, Baldassarre ME, Grosso R, Di Mauro F, Greco C, Greco S, et al. Do social media interventions increase vaccine uptake? *Front Public Health*. 2023;11(1):1-5
18. Ahmed N, Quinn SC, Hancock GR, Freimuth VS, Jamison A. Social media use and influenza vaccine uptake among White and African American adults. *Vaccine*. 2018;36(49): 7556–61.
19. Robichaud P, Hawken S, Beard L, Morra D, Tomlinson G, Wilson K, et al. Vaccine-critical videos on YouTube and their impact on medical students' attitudes about seasonal influenza immunization: a pre and post study. *Vaccine*. 2012; 30(25):3763–70.
20. Kamal Z, Imran N. Social Media: An Emerging Tool in Medical Education. *Ann King Edw Med Univ*. 2019;25(3):1-8.
21. Thompson EL, Galvin AM, Garg A, Moore JD, Litt DM. Exploring novel strategies for social media HPV vaccine information. *Hum Vaccin Immunother*. 2021; 17(12): 5397–401.
22. Smith A. Americans and Text Messaging. *Pew Research Center: Internet, Science & Tech*. 2011.
23. Zimmerman RK, Wolfe RM, Fox DE, Fox JR, Nowalk MP, Troy JA, et al. Vaccine criticism on the World Wide Web. *J Med Internet Res*. 2005;7(2):17.

24. Ali Khan A, Ali M, Baig M, Sahar T, Khurshid K, Haider Rizvi SA, et al. Jeelo Dobarā (Live Life Again): a cross-sectional survey to understand the use of social media and community experience and perceptions around COVID-19 vaccine uptake in three low vaccine uptake districts in Karachi, Pakistan. *BMJ Open*. 2023;13(1):1-5.
25. Waseem M, Aziz N. Role of Social Media in Diagnosis and Management of COVID-19; An Experience of a Pulmonologist. *Ann King Edw Med Univ*. 2020;26(Special Issue): 233-4.
26. Zubair K, Luqman M, Ijaz F, Hafeez F, Aftab RK. Practices of General Public Towards Personal Protective Measures During the Coronavirus Pandemic. *Ann King Edw Med Univ*. 2020;26(Special Issue):151-6.
27. Arshad A, Afzal S. An update on preventive measures of COVID-19 in Pakistan. *Ann King Edw Med Univ*. 2020; 26(1):1-2.
28. Chen YP, Chen YY, Yang KC, Lai F, Huang CH, Chen YN, et al. The Prevalence and Impact of Fake News on COVID-19 Vaccination in Taiwan: Retrospective Study of Digital Media. *J Med Internet Res*. 2022;24(4):1-4.
29. Thompson HS, Shelton RC, Mitchell J, Eaton T, Valera P, Katz A. Inclusion of underserved racial and ethnic groups in cancer intervention research using new media: a systematic literature review. *J Natl Cancer Inst Monogr*. 2013; 2013 (47): 216-23.
30. Arif F. Increasing Burden of Cancer in Pakistan. *Ann King Edw Med Univ*. 2020;26(1):88-88.