

# COVID-19 Vaccine Uptake among Healthcare Workers

Subjects: **Health Care Sciences & Services**

Contributor: Petros Galanis , Irene Vraka , Aglaia Katsiroumpa , Olga Siskou , Olympia Konstantakopoulou , Theodoros Katsoulas , Theodoros Mariolis-Sapsakos , Daphne Kaitelidou

The vaccine-induced immunity of healthcare workers (HCWs) is crucial to controlling the COVID-19 pandemic. The overall prevalence of COVID-19 vaccine uptake was 83.6% and 77.4% for physicians and nurses, respectively. Older age, white race, physicians' profession, seasonal influenza vaccine, direct COVID-19 patient care, and confidence in COVID-19 vaccine safety and effectiveness were positive predictors of vaccine uptake, while history of SARS-CoV-2 infection was a negative predictor. Deep understanding of the factors that influence HCWs' decisions to receive a COVID-19 vaccine is critical to implementing tailored communication strategies for HCWs who are at risk for not getting vaccinated.

COVID-19

vaccination

healthcare workers

predictors

## 1. Introduction

The emergence and spread of SARS-CoV-2 has caused significant morbidity and mortality across the globe. As of August 2022, the number of total worldwide confirmed COVID-19 cases is estimated to be over 600 million, and over 6.5 million COVID-19-related deaths have been recorded <sup>[1]</sup>. Moreover, the COVID-19 pandemic continues to threaten public health since breakthrough infections and new contagious variants of SARS-CoV-2 affect even fully vaccinated individuals <sup>[2][3]</sup>.

The impact of the pandemic on healthcare workers (HCWs) has been unprecedented; between 80,000 and 180,000 HCWs died from COVID-19 between January 2020 and May 2021 according to WHO data <sup>[4]</sup>. HCWs are at increased risk of COVID-19 and hospitalization due to close and long contact with COVID-19 patients and occupational exposure to SARS-CoV-2 <sup>[5]</sup>. "Front-door" and patient-facing HCWs are at higher risk for COVID-19-related outcomes <sup>[6][7]</sup>. According to a meta-analysis with 119,883 HCWs, 51.7% of HCWs became infected with SARS-CoV-2 <sup>[8]</sup>, while another meta-analysis with 230,398 HCWs found that 5% of COVID-19 cases in HCWs had severe complications, and 0.5% of HCWs died <sup>[9]</sup>.

Globally, HCWs were among the first groups to be offered the COVID-19 vaccines since they are a high-risk group during the pandemic. Although safety and effectiveness of COVID-19 vaccines are proven both in randomized clinical trials <sup>[10][11]</sup> and real-world studies <sup>[12][13]</sup>, COVID-19 vaccination hesitancy in HCWs worldwide continues to be a challenge <sup>[14][15][16]</sup>. For instance, the average prevalence of COVID-19 vaccination hesitancy worldwide in a total sample of 76,471 HCWs from 21 countries was 22.51%, ranging from 4.3 to 72% <sup>[14]</sup>. Sociodemographic factors (female gender, younger age, nurse profession, absence of history of influenza vaccination), concerns about vaccine safety and effectiveness, fear of adverse events, lack of information about vaccination, and mistrust of government and institutions are associated with COVID-19 vaccination hesitancy <sup>[14][17][18]</sup>.

## 2. COVID-19 Vaccine Uptake among Healthcare Workers

## 2.1. COVID-19 Vaccine Uptake

The overall prevalence of COVID-19 vaccine uptake among HCWs, 77.3%, is higher than that detected in the general population, 67.6% [19]. This finding is confirmed by the literature since HCWs are more likely than the general population to accept a COVID-19 vaccine [20][21]. Lack of scientific knowledge and low understanding of COVID-19 vaccines among non-healthcare workers could explain the higher acceptance rate of healthcare workers.

Although the study showed a high COVID-19 vaccine uptake rate among HCWs, not all of them received a COVID-19 vaccine. In particular, an important percentage (22.7%) of the HCWs refused vaccination despite availability and accessibility showing that HCWs are not immune to vaccine hesitancy. Indeed, the WHO defines vaccine hesitancy as 1 of the 10 most important threats to global health in 2019 [22]. It is necessary to increase the uptake of COVID-19 vaccination by HCWs since they provide care to COVID-19 patients, and high infection rate among HCWs could result in a significant reduction in this essential workforce. Moreover, vaccinated and well-informed HCWs are an important source of COVID-19 vaccine information and are more likely to recommend COVID-19 vaccination to families, colleagues, and their patients [23]. HCWs should inform individuals and especially patients about the safety and effectiveness of COVID-19 vaccination since their vaccine hesitancy may exacerbate patient hesitancy [24]. HCWs are trusted professionals and could serve as a role model of healthy behavior of the general population, improving vaccine coverage [25].

The findings demonstrate the highest prevalence of COVID-19 vaccine uptake among HCWs in North America (85.6%) and the lowest prevalence among those in Africa (65.6%). A similar trend is observed in the vaccination of the general population worldwide since the percentage of population to have received at least one dose of a COVID-19 vaccine is 80% in North America and Asia, 69% in Europe, and 27% in Africa [19]. The majority of the countries in Africa missed the WHO targets: 40% of a country's population should have been vaccinated by end December 2021, and 70% by mid-2022 [26]. Inconsistent supply of COVID-19 vaccines to Africa, low country-level preparedness against a pandemic, vaccine hesitancy, and distrust are the main reasons for the low vaccination uptake in Africa [26]. Africa's low vaccination rate is a threat to global effectiveness of COVID-19 vaccines since new variants could emerge from populations with low vaccine coverage. Therefore, positive attitudes of HCWs in Africa towards COVID-19 vaccination is paramount since they are a professional trusted source of information, and their opinion could improve vaccination coverage [27].

## 2.2. Predictors of COVID-19 Vaccine Uptake

Variation in vaccine uptake across races since white HCWs are more likely to receive a COVID-19 vaccine. Several studies in the general population confirm that COVID-19 vaccination uptake is higher among white individuals than ethnic minority groups and especially black individuals [28][29][30]. Reduced vaccine uptake in ethnic minority groups is not unique to COVID-19 since this phenomenon was also observed for the H1N1 flu pandemic in 2009 [31][32]. Ethnicity is interrelated with other barriers to COVID-19 vaccine uptake, such as lower educational level and socioeconomic status, religion, belief in conspiracy theories, and lack of trust in the government, healthcare systems, and employers [33][34][35]. These findings give significant cause for concern, since SARS-CoV-2 infection rate and COVID-19-related adverse outcomes are higher in these groups [6][36][37][38]. Thus, there is an urgent to implement targeted interventions in order to overcome barriers to COVID-19 vaccination in ethnic minority groups [34][35][39].

Physicians were more likely to be vaccinated than other staff groups. Moreover, the overall prevalence of COVID-19 vaccine uptake among physicians, 83.6%, is higher than that detected for nurses, 77.4%. Concerns about the safety, effectiveness, and side effects of COVID-19 vaccines and lack of perceived need for vaccination are the main reasons for vaccine hesitancy

among nurses [40][41]. Nurses' unwillingness to accept a COVID-19 vaccine is concerning since they are among the most trusted HCWs, and their attitudes towards vaccination can influence patient vaccination decisions [42][43]. Moreover, nurses are the frontline HCWs that provide direct care to COVID-19 patients, and thus nurses' occupational risk of exposure to SARS-CoV-2 is very high [44][45][46][47]. The situation is worse for the nurses in ethnic minority groups since they have already been disproportionately affected by the pandemic. For instance, Filipino nurses comprise 25% of COVID-19-related deaths among nurses in the USA, although they make up 4% of the nursing workforce in the country [48].

Confidence in COVID-19 vaccine safety and effectiveness was found to be a positive predictor of COVID-19 vaccine uptake. Negative attitudes towards COVID-19 vaccination, concerns for side effects and future effects, and lack of confidence in safety and effectiveness are more common among unvaccinated HCWs [49][50][51]. The novelty and the rapid production of COVID-19 vaccines worldwide could explain mistrust of HCWs [52]. It is reasonable that some HCWs may have delayed vaccination until new data emerged. Therefore, additional and updated information about safety and effectiveness of vaccines may increase vaccine acceptance among HCWs. Detailed data on safety and surveillance regarding the COVID-19 vaccines could help HCWs to overcome their fear and hesitancy.

Seasonal influenza vaccination is a positive predictor of COVID-19 vaccine uptake. Flu vaccination denotes a positive attitude of HCWs towards vaccines, and promotion of annual influenza vaccination may have a positive effect in future COVID-19 vaccine acceptance. A paper has already shown that influenza vaccination positively affects HCWs' intention to receive a COVID-19 vaccine [53]. However, since the flu vaccination rate among HCWs is low [54][55], investment and promotion of seasonal influenza vaccination is crucial.

Direct care for COVID-19 patients was associated with vaccine uptake among HCWs. The literature supports this finding since HCWs that provide care to COVID-19 patients are more likely to accept COVID-19 vaccines [14]. Direct patient care may be associated with higher severity perception of COVID-19, which drives nurses to be vaccinated more often [56].

It is not surprising that older age was a positive predictor of COVID-19 vaccine uptake among HCWs. Early studies in the general population of the USA confirm this finding since vaccination coverage is lower and increased more slowly over time among younger adults [29][57]. Older age is a well-known significant predictor of COVID-19 mortality [58][59]. Thus, older adults may feel more vulnerable to COVID-19, which probably encourages them to take a COVID-19 vaccine considering health benefits. On the other hand, younger adults may perceive a lower personal risk of COVID-19-related outcomes.

There is a prior SARS-CoV-2 infection is associated with a decrease in COVID-19 vaccine uptake. This finding can be explained by the fact that HCWs with a confirmed SARS-CoV-2 infection may believe that they have acquired sufficient immunological protection [60]. However, waning humoral immunity to SARS-CoV-2 in those who have had confirmed COVID-19 [61] and new variants of SARS-CoV-2 [2] threaten people's immunization and increase risk of infection over time.

### 3. Conclusions

It found that 77.3% out of 555,561 HCWs worldwide have received at least one dose of a COVID-19 vaccine. The overall prevalence of COVID-19 vaccine uptake was 83.6% and 77.4% for physicians and nurses, respectively. Being older, white, or a physician; receiving the seasonal influenza vaccine; providing care to COVID-19 patients; and trusting COVID-19 vaccines were enabling factors for the COVID-19 vaccine uptake. Deep understanding of the factors that influence HCWs' decisions to

receive a COVID-19 vaccine is critical to implementing tailored communication strategies for HCWs who are at risk for not getting vaccinated, e.g., HCWs who belong to ethnic minority groups.

## References

1. Worldometer COVID-19 Coronavirus Pandemic. 2022. Available online: <https://www.worldometers.info/coronavirus/> (accessed on 28 August 2022).
2. Chung, H.-Y.; Jian, M.-J.; Chang, C.-K.; Lin, J.-C.; Yeh, K.-M.; Chen, C.-W.; Hsieh, S.-S.; Hung, K.-S.; Tang, S.-H.; Perng, C.-L.; et al. Emergency SARS-CoV-2 Variants of Concern: Novel Multiplex Real-Time RT-PCR Assay for Rapid Detection and Surveillance. *Microbiol. Spectr.* 2022, 10, e02513-21.
3. Haque, A.; Pant, A.B. Mitigating COVID-19 in the Face of Emerging Virus Variants, Breakthrough Infections and Vaccine Hesitancy. *J. Autoimmun.* 2022, 127, 102792.
4. World Health Organization. The Impact of COVID-19 on Health and Care Workers: A Closer Look at Deaths; World Health Organization: Geneva, Switzerland, 2021; Available online: <https://apps.who.int/iris/bitstream/handle/10665/345300/WHO-HWF-WorkingPaper-2021.1-eng.pdf> (accessed on 28 August 2022).
5. Ferland, L.; Carvalho, C.; Gomes Dias, J.; Lamb, F.; Adlhoch, C.; Suetens, C.; Beauté, J.; Kinross, P.; Plachouras, D.; Hannila-Handelberg, T.; et al. Risk of Hospitalization and Death for Healthcare Workers with COVID-19 in Nine European Countries, January 2020–January 2021. *J. Hosp. Infect.* 2022, 119, 170–174.
6. Martin, C.A.; Patel, P.; Goss, C.; Jenkins, D.R.; Price, A.; Barton, L.; Gupta, P.; Zaccardi, F.; Jerina, H.; Duraisingham, S.; et al. Demographic and Occupational Determinants of Anti-SARS-CoV-2 IgG Seropositivity in Hospital Staff. *J. Public Health* 2022, 44, 234–245.
7. Shah, A.S.V.; Wood, R.; Gribben, C.; Caldwell, D.; Bishop, J.; Weir, A.; Kennedy, S.; Reid, M.; Smith-Palmer, A.; Goldberg, D.; et al. Risk of Hospital Admission with Coronavirus Disease 2019 in Healthcare Workers and Their Households: Nationwide Linkage Cohort Study. *BMJ* 2020, 371, m3582.
8. Gholami, M.; Fawad, I.; Shadan, S.; Rowaiee, R.; Ghanem, H.; Hassan Khamis, A.; Ho, S.B. COVID-19 and Healthcare Workers: A Systematic Review and Meta-Analysis. *Int. J. Infect. Dis.* 2021, 104, 335–346.
9. Gómez-Ochoa, S.A.; Franco, O.H.; Rojas, L.Z.; Raguindin, P.F.; Roa-Díaz, Z.M.; Wyssmann, B.M.; Guevara, S.L.R.; Echeverría, L.E.; Glisic, M.; Muka, T. COVID-19 in Health-Care Workers: A Living Systematic Review and Meta-Analysis of Prevalence, Risk Factors, Clinical Characteristics, and Outcomes. *Am. J. Epidemiol.* 2021, 190, 161–175.
10. Anand, P.; Stahel, V.P. Review the Safety of COVID-19 mRNA Vaccines: A Review. *Patient Saf. Surg.* 2021, 15, 20.
11. Pormohammad, A.; Zarei, M.; Ghorbani, S.; Mohammadi, M.; Razizadeh, M.H.; Turner, D.L.; Turner, R.J. Efficacy and Safety of COVID-19 Vaccines: A Systematic Review and Meta-Analysis of Randomized Clinical Trials. *Vaccines* 2021, 9, 467.

12. Liu, Q.; Qin, C.; Liu, M.; Liu, J. Effectiveness and Safety of SARS-CoV-2 Vaccine in Real-World Studies: A Systematic Review and Meta-Analysis. *Infect. Dis. Poverty* 2021, 10, 132.
13. Ma, Y.; Deng, J.; Liu, Q.; Du, M.; Liu, M.; Liu, J. Effectiveness and Safety of COVID-19 Vaccine among Pregnant Women in Real-World Studies: A Systematic Review and Meta-Analysis. *Vaccines* 2022, 10, 246.
14. Biswas, N.; Mustapha, T.; Khubchandani, J.; Price, J.H. The Nature and Extent of COVID-19 Vaccination Hesitancy in Healthcare Workers. *J. Community Health* 2021, 46, 1244–1251.
15. de Albuquerque Veloso Machado, M.; Roberts, B.; Wong, B.L.H.; van Kessel, R.; Mossialos, E. The Relationship between the COVID-19 Pandemic and Vaccine Hesitancy: A Scoping Review of Literature until August 2021. *Front. Public Health* 2021, 9, 747787.
16. Heyerdahl, L.W.; Dielen, S.; Nguyen, T.; Van Riet, C.; Kattumana, T.; Simas, C.; Vandaele, N.; Vandamme, A.-M.; Vandermeulen, C.; Giles-Vernick, T.; et al. Doubt at the Core: Unspoken Vaccine Hesitancy among Healthcare Workers. *Lancet Reg. Health Eur.* 2022, 12, 100289.
17. Bianchi, F.P.; Stefanizzi, P.; Brescia, N.; Lattanzio, S.; Martinelli, A.; Tafuri, S. COVID-19 Vaccination Hesitancy in Italian Healthcare Workers: A Systematic Review and Meta-Analysis. *Expert Rev. Vaccines* 2022, 21, 1289–1300.
18. Peterson, C.J.; Lee, B.; Nugent, K. COVID-19 Vaccination Hesitancy among Healthcare Workers—A Review. *Vaccines* 2022, 10, 948.
19. Our World in Data Coronavirus (COVID-19) Vaccinations. Available online: <https://ourworldindata.org/covid-vaccinations> (accessed on 28 August 2022).
20. Al-Metwali, B.Z.; Al-Jumaili, A.A.; Al-Alag, Z.A.; Sorofman, B. Exploring the Acceptance of COVID-19 Vaccine among Healthcare Workers and General Population Using Health Belief Model. *J. Eval. Clin. Pract.* 2021, 27, 1112–1122.
21. Wang, M.-W.; Wen, W.; Wang, N.; Zhou, M.-Y.; Wang, C.; Ni, J.; Jiang, J.; Zhang, X.; Feng, Z.-H.; Cheng, Y.-R. COVID-19 Vaccination Acceptance Among Healthcare Workers and Non-Healthcare Workers in China: A Survey. *Front. Public Health* 2021, 9, 709056.
22. World Health Organization. Ten Threats to Global Health in 2019; World Health Organization: Geneva, Switzerland, 2020; Available online: <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019> (accessed on 28 August 2022).
23. Wang, K.; Wong, E.L.Y.; Ho, K.F.; Cheung, A.W.L.; Chan, E.Y.Y.; Yeoh, E.K.; Wong, S.Y.S. Intention of Nurses to Accept Coronavirus Disease 2019 Vaccination and Change of Intention to Accept Seasonal Influenza Vaccination during the Coronavirus Disease 2019 Pandemic: A Cross-Sectional Survey. *Vaccine* 2020, 38, 7049–7056.
24. Bogart, L.M.; Dong, L.; Gandhi, P.; Klein, D.J.; Smith, T.L.; Ryan, S.; Ojikutu, B.O. COVID-19 Vaccine Intentions and Mistrust in a National Sample of Black Americans. *J. Natl. Med. Assoc.* 2022, 113, 599–611.
25. Paterson, P.; Meurice, F.; Stanberry, L.R.; Glismann, S.; Rosenthal, S.L.; Larson, H.J. Vaccine Hesitancy and Healthcare Providers. *Vaccine* 2016, 34, 6700–6706.

26. Bwire, G.; Ario, A.R.; Eyu, P.; Ocom, F.; Wamala, J.F.; Kusi, K.A.; Ndeketa, L.; Jambo, K.C.; Wanyenze, R.K.; Talisuna, A.O. The COVID-19 Pandemic in the African Continent. *BMC Med.* 2022, 20, 167.
27. Lin, C.; Mullen, J.; Smith, D.; Kotarba, M.; Kaplan, S.J.; Tu, P. Healthcare Providers' Vaccine Perceptions, Hesitancy, and Recommendation to Patients: A Systematic Review. *Vaccines* 2021, 9, 713.
28. Glampson, B.; Brittain, J.; Kaura, A.; Mulla, A.; Mercuri, L.; Brett, S.; Aylin, P.; Sandall, T.; Goodman, I.; Redhead, J.; et al. North West London COVID-19 Vaccination Programme: Real-World Evidence for Vaccine Uptake and Effectiveness. *medRxiv* 2021.
29. McCabe, S.D.; Hammershaimb, E.A.; Cheng, D.; Shi, A.; Shyr, D.; Shen, S.; Cole, L.D.; Cataldi, J.R.; Allen, W.; Probasco, R.; et al. Unraveling Attributes of COVID-19 Vaccine Hesitancy and Uptake in the U.S.: A Large Nationwide Study. *medRxiv* 2021.
30. Nguyen, L.H.; Joshi, A.D.; Drew, D.A.; Merino, J.; Ma, W.; Lo, C.-H.; Kwon, S.; Wang, K.; Graham, M.S.; Polidori, L.; et al. Racial and Ethnic Differences in COVID-19 Vaccine Hesitancy and Uptake. *medRxiv* 2021.
31. Ayers, C.K.; Kondo, K.K.; Williams, B.E.; Kansagara, D.; Advani, S.M.; Smith, M.; Young, S.; Saha, S. Disparities in H1N1 Vaccination Rates: A Systematic Review and Evidence Synthesis to Inform COVID-19 Vaccination Efforts. *J. Gen. Intern. Med.* 2021, 36, 1734–1745.
32. Burger, A.E.; Reither, E.N.; Mamelund, S.-E.; Lim, S. Black-White Disparities in 2009 H1N1 Vaccination among Adults in the United States: A Cautionary Tale for the COVID-19 Pandemic. *Vaccine* 2021, 39, 943–951.
33. Mills, M.; Rahal, C. COVID-19 Vaccine Deployment: Behaviour, Ethics, Misinformation and Policy Strategies.; Royal Society: London, UK, 2020.
34. Scientific Advisory Group for Emergencies. Factors Influencing COVID-19 Vaccine Uptake among Minority Ethnic Groups, 17 December 2020; Scientific Advisory Group for Emergencies: London, UK, 2021; Available online: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/952716/s0979-factors-influencing-vaccine-uptake-minority-ethnic-groups.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/952716/s0979-factors-influencing-vaccine-uptake-minority-ethnic-groups.pdf) (accessed on 28 August 2022).
35. Woolf, K.; McManus, I.C.; Martin, C.A.; Nellums, L.B.; Guyatt, A.L.; Melbourne, C.; Bryant, L.; Gogoi, M.; Wobi, F.; Al-Oraibi, A.; et al. Ethnic Differences in SARS-CoV-2 Vaccine Hesitancy in United Kingdom Healthcare Workers: Results from the UK-REACH Prospective Nationwide Cohort Study. *Lancet Reg. Health Eur.* 2021, 9, 100180.
36. Martin, C.A.; Jenkins, D.R.; Minhas, J.S.; Gray, L.J.; Tang, J.; Williams, C.; Sze, S.; Pan, D.; Jones, W.; Verma, R.; et al. Socio-Demographic Heterogeneity in the Prevalence of COVID-19 during Lockdown Is Associated with Ethnicity and Household Size: Results from an Observational Cohort Study. *EClinicalMedicine* 2020, 25, 100466.
37. Sze, S.; Pan, D.; Nevill, C.R.; Gray, L.J.; Martin, C.A.; Nazareth, J.; Minhas, J.S.; Divall, P.; Khunti, K.; Abrams, K.R.; et al. Ethnicity and Clinical Outcomes in COVID-19: A Systematic Review and Meta-Analysis. *EClinicalMedicine* 2020, 29–30, 100630.

38. Voysey, M.; Clemens, S.A.C.; Madhi, S.A.; Weckx, L.Y.; Folegatti, P.M.; Aley, P.K.; Angus, B.; Baillie, V.L.; Barnabas, S.L.; Bhorat, Q.E.; et al. Safety and Efficacy of the ChAdOx1 NCoV-19 Vaccine (AZD1222) against SARS-CoV-2: An Interim Analysis of Four Randomised Controlled Trials in Brazil, South Africa, and the UK. *Lancet* 2021, 397, 99–111.
39. Razai, M.S.; Osama, T.; McKechnie, D.G.J.; Majeed, A. COVID-19 Vaccine Hesitancy among Ethnic Minority Groups. *BMJ* 2021, 372, n513.
40. American Nurses Association COVID Vaccine Facts for Nurses Survey. Available online: <https://covidvaccinefacts4nurses.org/covid-19-survey> (accessed on 28 August 2022).
41. Gadoth, A.; Halbrook, M.; Martin-Blais, R.; Gray, A.; Tobin, N.H.; Ferbas, K.G.; Aldrovandi, G.M.; Rimoin, A.W. Cross-Sectional Assessment of COVID-19 Vaccine Acceptance Among Health Care Workers in Los Angeles. *Ann. Intern. Med.* 2021, 174, 882–885.
42. Ylitalo, K.R.; Lee, H.; Mehta, N.K. Health Care Provider Recommendation, Human Papillomavirus Vaccination, and Race/Ethnicity in the US National Immunization Survey. *Am. J. Public Health* 2013, 103, 164–169.
43. Zhang, J.; While, A.E.; Norman, I.J. Knowledge and Attitudes Regarding Influenza Vaccination among Nurses: A Research Review. *Vaccine* 2010, 28, 7207–7214.
44. Harrison, J.; Berry, S.; Mor, V.; Gifford, D. “Somebody Like Me”: Understanding COVID-19 Vaccine Hesitancy among Staff in Skilled Nursing Facilities. *J. Am. Med. Dir. Assoc.* 2021, 22, 1133–1137.
45. Kwok, K.O.; Li, K.-K.; Wei, W.I.; Tang, A.; Wong, S.Y.S.; Lee, S.S. Influenza Vaccine Uptake, COVID-19 Vaccination Intention and Vaccine Hesitancy among Nurses: A Survey. *Int. J. Nurs. Stud.* 2021, 114, 103854.
46. Lau, L.H.W.; Lee, S.S.; Wong, N.S. The Continuum of Influenza Vaccine Hesitancy among Nursing Professionals in Hong Kong. *Vaccine* 2020, 38, 6785–6793.
47. Wilson, A.M.; Abney, S.E.; King, M.-F.; Weir, M.H.; López-García, M.; Sexton, J.D.; Dancer, S.J.; Proctor, J.; Noakes, C.J.; Reynolds, K.A. COVID-19 and Use of Non-Traditional Masks: How Do Various Materials Compare in Reducing the Risk of Infection for Mask Wearers? *J. Hosp. Infect.* 2020, 105, 640–642.
48. Nazareno, J.; Yoshioka, E.; Adia, A.C.; Restar, A.; Operario, D.; Choy, C.C. From Imperialism to Inpatient Care: Work Differences of Filipino and White Registered Nurses in the United States and Implications for COVID-19 through an Intersectional Lens. *Gender Work Organ.* 2021, 28, 1426–1446.
49. Alya, W.A.; Maraqa, B.; Nazzal, Z.; Odeh, M.; Makhalfa, R.; Nassif, A.; Aabed, M. COVID-19 Vaccine Uptake and Its Associated Factors among Palestinian Healthcare Workers: Expectations Beaten by Reality. *Vaccine* 2022, 40, 3713–3719.
50. Di Gennaro, F.; Murri, R.; Segala, F.V.; Cerruti, L.; Abdulle, A.; Saracino, A.; Bavaro, D.F.; Fantoni, M. Attitudes towards Anti-SARS-CoV2 Vaccination among Healthcare Workers: Results from a National Survey in Italy. *Viruses* 2021, 13, 371.
51. Shaw, J.; Stewart, T.; Anderson, K.B.; Hanley, S.; Thomas, S.J.; Salmon, D.A.; Morley, C. Assessment of US Healthcare Personnel Attitudes Towards Coronavirus Disease 2019 (COVID-19) Vaccination in a Large

- University Healthcare System. *Clin. Infect. Dis.* 2021, 73, 1776–1783.
52. Viswanath, K.; Bekalu, M.; Dhawan, D.; Pinnamaneni, R.; Lang, J.; McLoud, R. Individual and Social Determinants of COVID-19 Vaccine Uptake. *BMC Public Health* 2021, 21, 818.
  53. Galanis, P.; Vraka, I.; Fragkou, D.; Bilali, A.; Kaitelidou, D. Intention of Healthcare Workers to Accept COVID-19 Vaccination and Related Factors: A Systematic Review and Meta-Analysis. *Asian Pac. J. Trop. Med.* 2021, 14, 543.
  54. Sheldenkar, A.; Lim, F.; Yung, C.F.; Lwin, M.O. Acceptance and Uptake of Influenza Vaccines in Asia: A Systematic Review. *Vaccine* 2019, 37, 4896–4905.
  55. Wang, Q.; Yue, N.; Zheng, M.; Wang, D.; Duan, C.; Yu, X.; Zhang, X.; Bao, C.; Jin, H. Influenza Vaccination Coverage of Population and the Factors Influencing Influenza Vaccination in Mainland China: A Meta-Analysis. *Vaccine* 2018, 36, 7262–7269.
  56. Akech, G.M.; Kanyike, A.M.; Nassozi, A.G.; Aguti, B.; Nakawuki, A.W.; Kimbugwe, D.; Kiggundu, J.; Maiteki, R.; Mukyala, D.; Bongomin, F.; et al. COVID-19 Vaccination Uptake and Self-Reported Side Effects among Healthcare Workers in Mbale City Eastern Uganda. *medRxiv* 2022.
  57. Diesel, J.; Sterrett, N.; Dasgupta, S.; Kriss, J.L.; Barry, V.; Vanden Esschert, K.; Whiteman, A.; Cadwell, B.L.; Weller, D.; Qualters, J.R.; et al. COVID-19 Vaccination Coverage Among Adults—United States, 14 December 2020–22 May 2021. *MMWR Morb. Mortal. Wkly. Rep.* 2021, 70, 922–927.
  58. Mehraeen, E.; Karimi, A.; Barzegary, A.; Vahedi, F.; Afsahi, A.M.; Dadras, O.; Moradmand-Badie, B.; Seyed Alinaghi, S.A.; Jahanfar, S. Predictors of Mortality in Patients with COVID-19, A Systematic Review. *Eur. J. Integr. Med.* 2020, 40, 101226.
  59. Sepandi, M.; Taghdir, M.; Alimohamadi, Y.; Afrashteh, S.; Hosamirudsari, H. Factors Associated with Mortality in COVID-19 Patients: A Systematic Review and Meta-Analysis. *Iran. J. Public Health* 2020, 49, 1211.
  60. Martin, C.A.; Marshall, C.; Patel, P.; Goss, C.; Jenkins, D.R.; Ellwood, C.; Barton, L.; Price, A.; Brunskill, N.J.; Khunti, K.; et al. SARS-CoV-2 Vaccine Uptake in a Multi-Ethnic UK Healthcare Workforce: A Cross-Sectional Study. *PLoS Med.* 2021, 18, e1003823.
  61. Anderson, R.M.; Vegvari, C.; Truscott, J.; Collyer, B.S. Challenges in Creating Herd Immunity to SARS-CoV-2 Infection by Mass Vaccination. *Lancet* 2020, 396, 1614–1616.

---

Retrieved from <https://www.encyclopedia.pub/entry/history/show/68778>