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A survey of COVID-19 vaccine acceptance across 23 countries in 2022

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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) continued to mutate and spread in 2022 despite the introduction of safe, effective vaccines and medications. Vaccine hesitancy remains substantial, fueled in part by misinformation. Our third study of Coronavirus Disease 2019 (COVID-19) vaccine hesitancy among 23,000 respondents in 23 countries (Brazil, Canada, China, Ecuador, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom and the United States), surveyed from 29 June to 10 July 2022, found willingness to accept vaccination at 79.1%, up 5.2% from June 2021. Hesitancy increased in eight countries, however, ranging from 1.0% (United Kingdom) to 21.1% (South Africa). Almost one in eight (12.1%) vaccinated respondents are hesitant about booster doses. Overall support for vaccinating children under 18 years of age increased slightly but declined among parents who were personally hesitant. Almost two in five (38.6%) respondents reported paying less attention to new COVID-19 information than previously, and support for vaccination mandates decreased. Almost a quarter (24%) of those who became ill reported taking medications to combat COVID-19 symptoms. Vaccination remains a cornerstone of the COVID-19 pandemic response, but broad public support remains elusive. These data can be used by health system decisionmakers, practitioners, advocates and researchers to address COVID-19 vaccine hesitancy more effectively.

The Coronavirus Disease 2019 (COVID-19) pandemic persists despite reductions in disease severity, hospitalizations and deaths since the introduction of multiple vaccines that protect against COVID-19 and pharmaceuticals to treat its symptoms[1,2]. However, vaccine hesitancy and refusal continue to impede the effectiveness of these interventions[3,4]. Drivers of vaccine hesitancy are context-specific and include lower education, mistrust in science and governments[5–7] and misinformation[8,9]. Around two-thirds (66.4%) of the world's population had received at least one dose of a COVID-19 vaccine as of 30 June 2022, but only 17.4% of people in low-income countries had received a first dose[10], underscoring unequal access, availability and delivery[11,12].

Global rates of COVID-19 vaccination are gradually improving, albeit unevenly. Moreover, evidence suggests that the humoral response to vaccination is substantially reduced within 6 months[13], necessitating additional doses (that is, boosters) to achieve adequate levels of protection[14].

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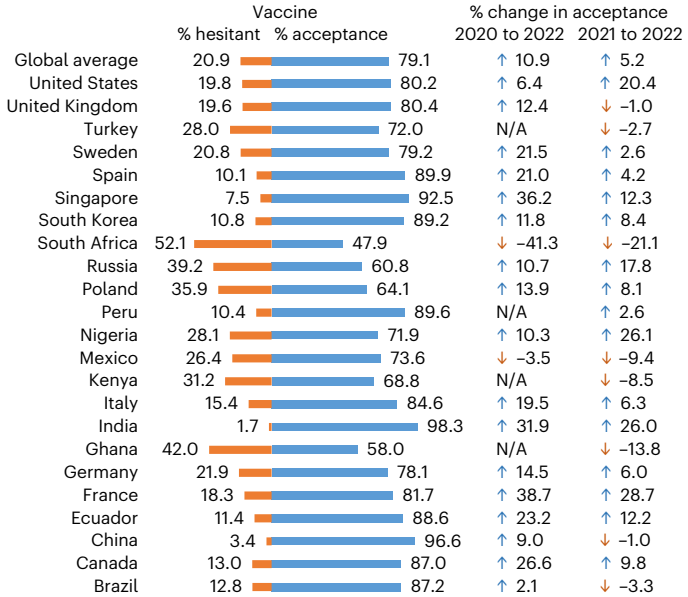

Fig. 1 | COVID-19 vaccine acceptance and hesitancy in June 2022, percent change from 2020 and 2021. COVID-19 vaccine acceptance in June 2021 and June 2022 was defined as having received at least one dose of a COVID-19 vaccine and, if not, willingness to take the COVID-19 vaccine when it is available to them. Vaccine hesitancy was defined as having reported 'no' to the question of whether they have received at least one dose of a COVID-19 vaccine and also 'unsure/no opinion', 'somewhat disagree' or 'strongly disagree' to the question of whether they would take a COVID-19 vaccine when available to them. COVID-19 acceptance in June 2020 was defined as willingness to take a vaccine if proven safe and effective. Four countries (Ghana, Kenya, Peru and Turkey) were not included in the 2020 global survey, denoted not applicable (N/A). Blue (up) arrows indicate % increase in acceptance of COVID-19 vaccination; orange (down) arrows indicate % decrease.

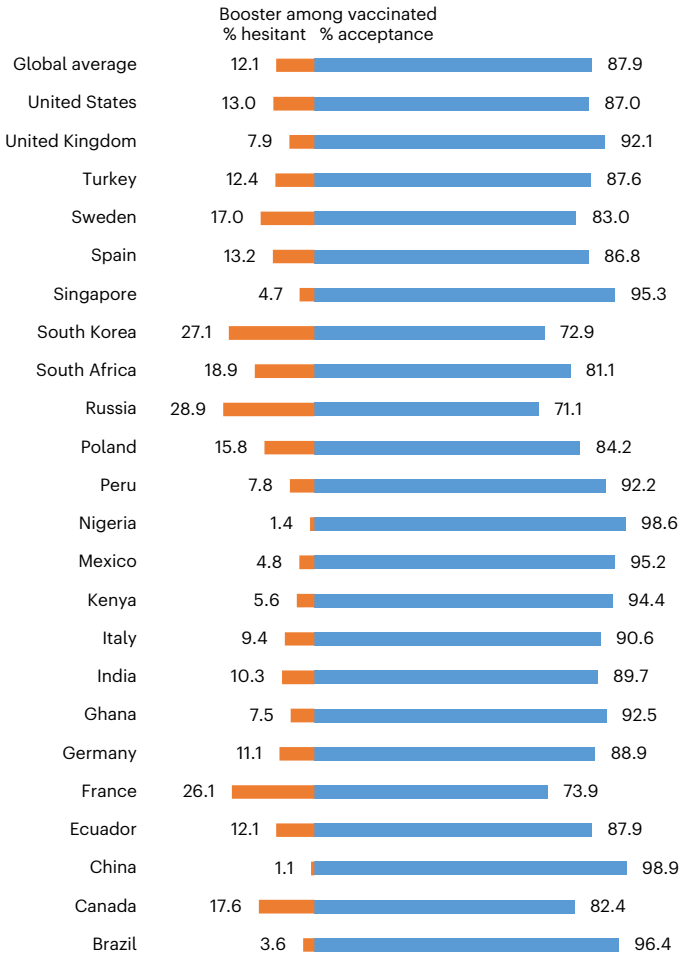

Fig. 2 | COVID-19 booster acceptance and hesitancy among vaccinated respondents in June 2022. COVID-19 booster acceptance among vaccinated in June 2022 was defined as having received at least one dose of a booster and, if not, willingness to take the booster when it is available to them. Booster hesitancy among vaccinated was defined as having reported 'no' to the question of whether they have received at least one booster dose and also 'unsure/no opinion', 'somewhat disagree' or 'strongly disagree' to the question of whether they would take a booster when available to them. Vaccination was defined as either partially or fully vaccinated.

Vaccine hesitancy is a complex phenomenon[15]; prior studies of influenza vaccine hesitancy have identified more than 70 factors that influence it, many of which are time-specific and context-specific[16]. Not surprisingly, the same factors that influence hesitancy to accept an initial COVID-19 dose also drive booster hesitancy: mistrust of government and health authorities, concerns about vaccine safety and efficacy and, in some countries, age and minority race or ethnicity[5,6,17]. The limited efficacy of current COVID-19 vaccines in preventing infection against new circulating variants could also influence acceptance[18]. Twice-yearly COVID-19 booster vaccinations are currently recommended in some countries based on eligibility and availability, and vaccines effective against new variants are in development[19]. Introducing updated vaccine formulations and frequent booster shots will intensify the challenge of convincing individuals and communities to accept new vaccines to maintain protective immunity, particularly as the risk perception of COVID-19 infection has decreased[20].

Some obstacles to effective vaccine science communication for lay audiences may include the need to continuously disseminate new safety and efficacy data in simple, understandable terms; to explain the justification for newly authorized or reformulated products; and to introduce changes in vaccination schedules, especially for new or expanded authorizations of childhood vaccinations[21]. Failure to convey this information clearly and consistently during the current pandemic may have confused audiences, eroded confidence in the science and reduced vaccine acceptance. The ongoing 'infodemic' of voluminous, high-speed information—accurate or not—further impedes vaccine literacy[22].

Vaccination acceptance may also be dampened by public perceptions that new COVID-19 variants are possibly less severe[23] or that recently authorized therapeutics may improve disease outcomes well enough to obviate the need to vaccinate in the first place[24]. Unfortunately, the emergence of highly infectious variants and the relaxation of public health and social containment measures in many countries will almost certainly trigger increased community transmission[25].

The aim of this large survey in 23 populous and heavily impacted countries, representing almost 60% of the world's population[26], was to track trends in global vaccine acceptance, to profile attitudes toward recently available COVID-19 boosters and pharmaceutical treatments and to assess attitudes toward several previously studied variables that appear to contribute to ongoing vaccine hesitancy at a critical time in the natural history of the pandemic.

Results

The global sample of 23,000 respondents included 1,000 participants from each of 23 countries surveyed (Brazil, Canada, China, Ecuador, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom and the United States) (Methods). Half of respondents (50.3%) were women, and one-fifth of respondents (22.2%)

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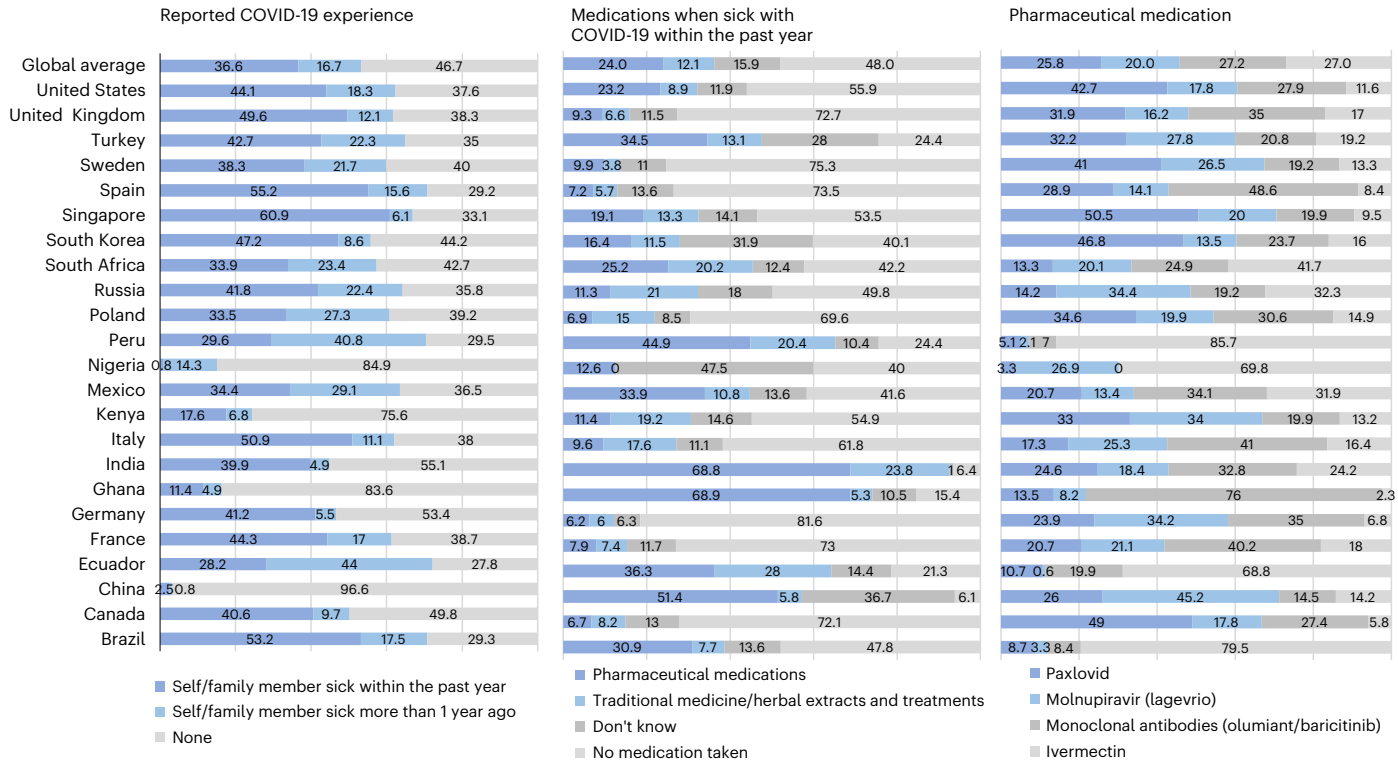

Fig. 3 | Reported COVID-19 experience and medication used for COVID-19 within the past year. Specific pharmaceutical medications are reported as % of pharmaceutical medications combined. Traditional medicine/herbal extracts and treatments were respondent-interpreted.

had a university degree. Age groups (18–29; 30–39; 40–49; 50–59; and 60+) were approximately equally represented (16.8–22.9%). Nearly half of all respondents reported income above their country's median (45.6%). Healthcare workers (HCWs) represented one in ten (10.8%) of all respondents (Extended Data Table 1).

Vaccine acceptance in 2022 was reported by 79.1% of the respondents, up from 75.2% 1 year earlier[6]. However, vaccine hesitancy increased in eight countries (range 1.0% in UK to 21.1% in South Africa) (Fig. 1). Booster hesitancy among those vaccinated was 12.1% (range 1.1% in China to 28.9% in Russia) (Fig. 2).

In total, 36.6% of all respondents reported COVID-19 illness (oneself or one's family) within the past year (range 0.8% in Nigeria to 60.9% in Singapore), and 24% reported receiving treatment with pharmaceuticals (range 6.2% in Germany to 68.9% in Ghana). Medications reported as having been used included monoclonal antibodies (olumiant/baricitinib) (27.2%), ivermectin (27%), Paxlovid (nirmatrelvir/ritonavir) (25.8%) and molnupiravir (lagevrio) (20%) (Fig. 3).

Vaccine hesitancy was significantly more likely to be associated with males in Nigeria and Peru (adjusted odds ratio (aOR = 4.42–5.24)) and females in China, Poland and Russia (aOR = 0.06–0.67) and not having a university degree in France, Poland, South Africa, Sweden and the United States (aOR = 0.15–0.60) (Table 1). Vaccine hesitancy was not universally associated with income distribution, as it was significantly higher among respondents earning less than their country's median income in the United States (aOR = 2.35) and conversely higher among those earning more than the median income in Ecuador and Ghana (aOR = 0.07–0.13) (Table 1). Belief in a vaccine's ability to prevent COVID-19 and in vaccine safety and trust in vaccine science remained strongly correlated with acceptance (Extended Data Table 7). Booster hesitancy among vaccinated respondents was significantly associated with younger age in France, Germany, Poland, South Korea, Spain and Sweden (aOR = 0.96–0.98) and with older age in Ecuador (aOR = 1.09); with male respondents in Ecuador (aOR = 5.69) and with female respondents in France and the United States (aOR = 0.53–0.57); with not having a university degree in Italy and South Africa (aOR = 0.28–0.52); and with earning less than the country's median income in Canada, Germany, Turkey and the United Kingdom (aOR = 1.81–11.14) (Table 1).

Parental willingness to vaccinate their children in the 23 countries studied increased slightly from 67.6% in 2021 (ref. 6), when COVID-19 vaccines for children were awaiting regulatory approval, to 69.5% in 2022. Over the past year, moreover, COVID-19 childhood vaccine hesitancy increased in eight countries (ranging from a 2.4% increase in Poland to 56.3% in Brazil) and remained greatest among parents who themselves were hesitant (Fig. 4). Childhood COVID-19 vaccination hesitancy was also significantly higher among older parents in Ecuador, India and South Africa (aOR = 1.03–1.19), among male respondents in Ecuador, Mexico and Peru (aOR = 3.41–5.33) and among respondents with less than the median national income in Canada, France, Germany and the United States (aOR = 1.86–2.96) (Table 1).

Support for COVID-19 vaccination mandates in 2021 ranged from 58.4% for vaccination of children to attend school to 74.4% for proof of vaccination for international travel[6]. Support for all vaccination mandates in the 2022 survey decreased compared to findings in our survey from the previous year, ranging from −2.6% for employers to require vaccination to −6.9% for proof of vaccination for international travel, although support for the latter remained strong (69.2%). Support for mandates to vaccinate children to attend school, for adults to attend university and indoor activities and for governments or employers to require vaccination decreased in most countries (Fig. 5). However, support for government mandates did increase in 11 of the 23 countries (range 0.2% in Canada to 14.8% in Poland) (Fig. 5).

Vaccine hesitancy among HCWs decreased from 8.1% in 2021 to 4.6% in 2022 but was significantly lower than for non-HCWs (4.6% versus 9.4%, aOR = 0.64, 95% confidence interval (CI) (0.53, 0.78), $P < 0.001$)[6]. Receipt of at least one booster dose was reported by 19.9% of HCWs compared to 40.3% of non-HCWs. Booster hesitancy among vaccinated

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Table 1 | Association between COVID-19 vaccine and booster hesitancy and socio-demographic factors (age, gender, education and income) and current COVID-19 experience. a, COVID-19 vaccine hesitancy among entire sample and booster hesitancy among those vaccinated. b, Hesitancy for booster vaccines and for children among parents

Country	Brazil	Canada	China	Ecuador	France	Germany	Ghana	India	Italy	Kenya	Mexico	Nigeria	Peru	Poland	Russia	South Africa	South Korea	Singapore	Spain	Sweden	Turkey	United Kingdom	United States
Outcome: vaccine hesitancy																							
aOR (95% CI)																							
Age	1.03 (1–1.05)	0.99 (0.97–1.01)	0.98 (0.96–1.01)	0.95 (0.9–1)	0.98 (0.96–0.99)	0.99 (0.98–1.01)	0.94 (0.9–0.97)	0.97 (0.92–1.02)	1.01 (0.99–1.03)	1.02 (0.95–1.08)	1.02 (0.99–1.05)	1 (0.92–1.08)	0.99 (0.95–1.03)	0.96 (0.95–0.97)	0.99 (0.98–1.01)	1.01 (1–1.03)	0.98 (0.96–0.99)	0.97 (0.95–0.99)	0.98 (0.96–1)	0.97 (0.96–0.99)	0.99 (0.95–1.03)	0.96 (0.95–0.98)	0.98 (0.97–0.99)
University degree	0.6 (0.25–1.42)	0.54 (0.28–1.02)	–	1.36 (0.26–7.18)	**0.59 (0.35–0.99)**	1.02 (0.57–1.82)	0.45 (0.16–1.28)	–	0.78 (0.47–1.29)	1.79 (0.52–6.21)	0.83 (0.34–2.08)	–	2.99 (0.92–9.73)	**0.6 (0.41–0.85)**	1.13 (0.8–1.61)	**0.15 (0.07–0.33)**	0.6 (0.33–1.11)	0.9 (0.17–4.76)	0.76 (0.38–1.52)	**0.56 (0.36–0.87)**	1.77 (065–4.83)	0.66 (0.32–1.38)	**0.48 (0.31–0.72)**
Man	1.67 (0.73–3.81)	0.87 (0.46–1.65)	**0.06 (0–0.89)**	3.44 (0.42–27.93)	0.86 (0.53–1.39)	0.76 (0.46–1.28)	0.39 (0.12–1.24)	7.05 (0.59–84.06)	0.65 (0.34–1.26)	1.12 (0.33–3.83)	2.02 (0.87–4.73)	**5.24 (1.03–26.71)**	**4.42 (1.62–12.02)**	**0.67 (0.47–0.96)**	**0.6 (0.41–0.89)**	0.78 (0.51–1.18)	0.76 (0.43–1.36)	1.33 (0.31–5.72)	0.78 (0.41–1.47)	0.98 (0.6–1.58)	1.02 (0.23–4.48)	1.29 (0.74–2.25)	0.9 (0.61–1.34)
Less than median	0.68 (0.25–1.87)	1.22 (0.58–2.57)	–	**0.07 (0.01–0.38)**	1.45 (0.82–2.57)	1.86 (1.01–3.44)	**0.13 (0.03–0.54)**	–	1.49 (0.71–3.12)	1.69 (0.43–6.56)	0.91 (0.35–2.36)	0.31 (0.03–2.78)	0.84 (0.15–4.65)	1.32 (0.92–1.89)	1.07 (0.73–1.59)	0.87 (0.51–1.51)	0.55 (0.29–1.06)	0.65 (0.13–3.25)	1.55 (0.73–3.27)	1.29 (0.71–2.33)	–	1.86 (1.01–3.41)	**2.35 (1.48–3.72)**
Refused	**4.42 (1.29–15.16)**	**7.34 (2.66–20.27)**	–	0.6 (0.06–5.79)	2.38 (0.92–6.13)	**3.44 (1.22–9.72)**	**0.2 (0.05–0.8)**	–	**5.36 (2.22–12.93)**	0.83 (0.16–4.43)	3.47 (0.96–12.47)	1.68 (0.15–18.71)	2.31 (0.57–9.34)	0.97 (0.39–2.4)	1.52 (0.65–3.56)	1.44 (0.73–2.86)	1.45 (0.61–3.46)	1.89 (0.23–15.48)	1.62 (0.41–6.37)	1.29 (0.46–3.63)	–	1.58 (0.56–4.46)	**4.53 (2.36–8.68)**
Self/family member sick more than 1 year ago	0.89 (0.29–2.69)	1.76 (0.71–4.35)	–	–	1.02 (0.52–1.98)	0.36 (0.1–1.26)	3.06 (0.48–19.36)	–	0.4 (0.07–2.16)	1.82 (0.4–8.32)	0.53 (0.21–1.33)	–	**0.09 (0.02–0.33)**	0.88 (0.57–1.35)	0.77 (0.48–1.24)	0.8 (0.48–1.32)	0.91 (0.29–2.84)	0 (0–0)	**0.31 (0.11–0.86)**	**0.41 (0.21–0.81)**	0.19 (0.03–1.02)	0.56 (0.23–1.35)	0.93 (0.55–1.57)
Self or family member sick within the past year	0.64 (0.25–1.62)	**0.37 (0.17–0.8)**	–	–	0.82 (0.47–1.42)	0.91 (0.53–1.57)	**0.08 (0.01–0.66)**	–	0.66 (0.35–1.24)	1.72 (0.4–7.45)	0.35 (0.12–1.02)	–	**0.09 (0.02–0.36)**	**0.65 (0.43–0.99)**	0.89 (0.59–1.35)	0.66 (0.42–1.05)	0.63 (0.35–1.12)	**0.19 (0.04–0.96)**	**0.33 (0.16–0.65)**	**0.49 (0.27–0.88)**	0.94 (0.20–4.52)	0.55 (0.3–1)	0.67 (0.44–1.03)
Outcome: booster hesitancy among vaccinated																							
aOR (95% CI)																							
Age	1 (0.98–1.03)	0.96 (0.95–0.98)	1.03 (1–1.05)	**1.09 (1.01–1.17)**	**0.98 (0.96–0.99)**	**0.96 (0.95–0.98)**	0.99 (0.96–1.02)	1.06 (1–1.12)	0.98 (0.96–1)	0.97 (0.92–1.02)	0.99 (0.96–1.02)	0.98 (0.91–1.06)	1.02 (0.98–1.06)	**0.96 (0.95–0.98)**	0.99 (0.97–1.01)	0.99 (0.98–1)	**0.98 (0.97–0.99)**	0.99 (0.96–1.02)	**0.97 (0.95–0.98)**	**0.96 (0.94–0.97)**	0.97 (0.93–1)	0.94 (0.92–0.95)	0.99 (0.97–1)
University degree	1.78 (0.87–3.61)	0.91 (0.61–1.35)	–	0.39 (0.1–1.59)	0.76 (0.52–1.1)	1.33 (0.66–2.69)	0.75 (0.23–2.42)	0.33 (0.07–1.52)	**0.52 (0.32–0.86)**	1.76 (0.73–4.28)	0.85 (0.32–2.25)	0.26 (0.02–3.54)	0.62 (0.29–1.29)	1.03 (0.66–1.6)	1.12 (0.67–1.89)	**0.28 (0.11–0.69)**	1.41 (1–1.99)	1.22 (0.54–2.72)	0.79 (0.5–1.27)	0.88 (0.58–1.31)	1.72 (0.68–4.34)	1.22 (0.68–2.2)	0.73 (0.45–1.19)
Man	1.31 (0.6–2.85)	0.77 (0.5–1.19)	2.51 (0.47–13.38)	**5.69 (1.33–24.28)**	**0.53 (0.36–0.78)**	0.72 (0.43–1.2)	0.31 (0.06–1.65)	2.49 (0.41–15.07)	0.78 (0.43–1.41)	1.97 (0.61–6.39)	1.13 (0.45–2.87)	0.69 (0.03–16.5)	1.11 (0.43–2.92)	0.75 (0.48–1.17)	0.79 (0.47–1.32)	0.91 (0.56–1.49)	0.8 (0.58–1.11)	1.17 (0.52–2.59)	0.98 (0.63–1.53)	0.8 (0.5–1.29)	0.44 (0.16–1.21)	0.68 (0.38–1.21)	**0.57 (0.35–0.94)**
Outcome: booster hesitancy among vaccinated																							
Less than median	1.06 (0.46–2.46)	**1.81 (1.16–2.84)**	–	2.67 (0.56–12.79)	1.2 (0.81–1.79)	**2.5 (1.35–4.64)**	0.41 (0.07–2.43)	4.34 (0.26–71.36)	1.94 (0.98–3.83)	1.96 (0.54–7.19)	1.31 (0.48–3.56)	0.34 (0.02–7.58)	1.04 (0.43–2.49)	0.78 (0.5–1.22)	1.59 (0.93–2.71)	0.63 (0.31–1.27)	1.34 (0.93–1.94)	1.81 (0.8–4.08)	1.55 (0.96–2.52)	1.73 (1–3.01)	**11.14 (2.98–41.64)**	**2.56 (1.32–4.98)**	1.48 (0.87–2.52)
Refused	1.45 (0.32–6.66)	1.33 (0.4–4.39)	–	1.67 (0.18–15.42)	1.78 (0.76–4.16)	1.48 (0.42–5.16)	2.98 (0.6–14.76)	1.12 (0.07–17.13)	1.64 (0.52–5.13)	1.62 (0.29–9.15)	**6.12 (1.61–23.29)**	0 (0–0)	1.86 (0.42–8.23)	0.39 (0.07–2.24)	1.19 (0.33–4.29)	1.31 (0.61–2.83)	2.56 (1.42–4.6)	2.68 (0.72–10.01)	0.89 (0.29–2.68)	1.18 (0.39–3.56)	3.02 (0.18–49.44)	1.25 (0.39–4.04)	1.68 (0.64–4.46)

Table 1 | (continued) Association between COVID-19 vaccine and booster hesitancy and socio-demographic factors (age, gender, education and income) and current COVID-19 experience. a, COVID-19 vaccine hesitancy among entire sample and booster hesitancy among those vaccinated. b, Hesitancy for booster vaccines and for children among parents

Country	Brazil	Canada	China	Ecuador	France	Germany	Ghana	India	Italy	Kenya	Mexico	Nigeria	Peru	Poland	Russia	South Africa	South Korea	Singapore	Spain	Sweden	Turkey	United Kingdom	United States
Self/ family member sick more than 1 year ago	1.92 (0.73–5.03)	1 (0.45–2.21)	–	2.08 (0.51–8.51)	1.08 (0.61–1.92)	1.92 (0.69–5.33)	1.87 (0.23–15.4)	0.93 (0.05–18.72)	1.5 (0.59–3.79)	1.6 (0.33–7.68)	2.97 (0.86–10.33)		0.4 (0.16–1.02)	0.83 (0.47–1.45)	1.63 (0.84–3.15)	1.45 (0.82–2.54)	0.51 (0.24–1.09)	1.75 (0.4–7.71)	1.38 (0.71–2.71)	1.06 (0.59–1.9)	**0.2 (0.05–0.79)**	1.5 (0.67–3.38)	1.22 (0.63–2.37)
Self or family member sick within the past year	0.75 (0.31–1.8)	1.08 (0.69–1.69)	–	0.65 (0.10–4.16)	0.87 (0.57–1.32)	1.38 (0.82–2.33)	0.25 (0.03–2.28)	10.21 (1.06–98.53)	1.67 (0.89–3.12)	0.42 (0.14–1.26)	2.3 (0.65–8.11)		0.97 (0.3–3.13)	0.66 (0.39–1.13)	1.38 (0.77–2.49)	1.35 (0.82–2.24)	1.07 (0.76–1.5)	0.48 (0.19–1.2)	1.23 (0.72–2.1)	0.6 (0.32–1.1)	0.41 (0.13–1.33)	1.11 (0.57–2.16)	1.2 (0.68–2.13)
Outcome: vaccine hesitancy for children among parents																							
aOR (95% CI)																							
Age	1.01 (0.98–1.05)	0.99 (0.97–1.02)	0.86 (0.82–0.89)	**1.19 (1.06–1.35)**	0.98 (0.96–1)	0.97 (0.95–0.99)	0.91 (0.87–0.96)	**1.05 (1.00–1.09)**	0.97 (0.94–1)	0.95 (0.89–1.01)	1.03 (0.99–1.07)	1.03 (.96–1.1)	1.02 (0.98–1.07)	0.96 (0.94–0.98)	0.99 (0.96–1.02)	**1.03 (1.01–1.05)**	0.99 (0.98–1.01)	1.01 (0.97–1.06)	0.96 (0.94–0.99)	1 (0.97–1.02)	0.96 (0.93–1)	0.96 (0.94–0.98)	1 (0.98–1.02)
University degree	0.64 (0.2–2.08)	0.54 (0.29–1.01)	–	0.45																			
(.06–3.61)	0.93 (0.56–1.54)	1.6 (0.8–3.21)	0.3 (0.07–1.31)	–	0.55 (0.27–1.1)	3.63 (0.76–17.46)	0.57 (0.18–1.77)	–	1.43 (0.41–5.03)	0.78 (0.5–1.21)	1.13 (0.65–1.98)	0.36 (0.17–0.73)	0.82 (0.48–1.41)	0.7 (0.24–2.05)	0.59 (0.26–1.32)	0.8 (0.46–1.38)	1.13 (0.32–3.94)	0.64 (0.35–1.15)	0.56 (0.33–0.93)				
Man	0.93 (0.31–2.74)	0.89 (0.45–1.79)	–	**03.41 (1.11–10.45)**	0.97 (0.56–1.68)	0.4 (0.22–0.73)	0.15 (0.03–0.67)	–	2.05 (0.83–5.04)	2.61 (0.49–13.94)	**4.04 (1.39–11.71)**	0.89 (.07–11.57)	**5.33 (1.85–15.35)**	0.49 (0.31–0.78)	0.57 (0.31–1.03)	0.44 (0.26–0.74)	0.63 (0.38–1.04)	0.91 (0.29–2.87)	0.58 (0.28–1.21)	0.6 (0.33–1.11)	1.03 (0.17–6.27)	0.86 (0.5–1.49)	0.86 (0.52–1.42)
Less than median	0.74 (0.22–2.53)	**2.16 (1.01–4.6)**	–	–	**1.86 (1.04–3.34)**	**2.96 (1.5–5.85)**	0.11 (0.02–0.71)	–	1.23 (0.51–2.95)	2.03 (0.35–11.62)	0.46 (0.14–1.48)	0.21 (0.02–2.24)	0.92 (0.21–4.12)	1.22 (0.75–1.97)	1.39 (0.79–2.44)	1.29 (0.66–2.54)	0.77 (0.41–1.44)	–	1.11 (0.48–2.53)	1.31 (0.68–2.53)	0.73 (0.19–2.75)	1.45 (0.82–2.57)	**2.64 (1.56–4.48)**
Refused	2.31 (0.4–13.2)	4.38 (0.9–21.41)	–	–	1.76 (0.51–6.1)	**4.07 (1.27–13.06)**	0.05 (0–1.32)	–	**5.53 (1.49–20.46)**	0.87 (0.08–8.98)	0.92 (0.18–4.71)	0 (0–0)	0.45 (0.08–2.41)	0.6 (0.17–2.05)	3.67 (0.85–15.77)	1.44 (0.47–4.43)	2.29 (0.86–6.14)	–	4.19 (0.87–20.31)	0.43 (0.08–2.37)	0.17 (0.03–1.09)	1.61 (0.45–5.77)	**4.9 (1.82–13.19)**
Self/ family member sick more than 1 year ago	0.85 (0.24–3)	0.8 (0.25–2.56)	–	–	1.05 (0.46–2.39)	0.38 (0.1–1.48)	**0.01 (0–0.18)**	–	1.07 (0.23–5.06)	0.81 (0.13–4.94)	0.45 (0.13–1.64)	–	**0.06 (0.02–0.25)**	1 (0.56–1.78)	1.3 (0.63–2.66)	1.07 (0.58–1.98)	1 (0.43–2.34)	0.35 (0.04–2.81)	0.51 (0.19–1.39)	0.51 (0.2–1.27)	1.54 (0.18–13.52)	0.48 (0.2–1.11)	0.53 (0.25–1.11)
Self or family member sick within the past year	0.85 (0.3–2.38)	0.59 (0.28–1.26)	–	–	0.88 (0.47–1.66)	0.8 (0.41–1.54)	**0.03 (0–0.45)**	–	1.17 (0.47–2.91)	4.27 (0.84–21.66)	**0.28 (0.1–0.83)**	–	**0.11 (0.03–0.42)**	**0.53 (0.31–0.91)**	1.47 (0.78–2.79)	0.58 (0.33–1.02)	0.81 (0.47–1.41)	**0.13 (0.04–0.45)**	**0.39 (0.17–0.9)**	**0.31 (0.14–0.7)**	**0.96 (0.94–0.98)**	**0.38 (0.2–0.71)**	**0.56 (0.32–0.97)**

aORs and 95% CIs are from weighted multivariable logistic regressions. Selected covariates were omitted from several country-specific models to allow model estimation. Reference categories: women, no university degree, more than median income and no COVID-19 sickness. Age was analyzed continuously. Statistically significant ($P<0.05$) associations are bolded.

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HCWs was lower (9.7%) compared to 12.4% of non-HCWs (aOR = 0.79, 95% CI (0.71, 0.88), $P < 0.001$). Booster hesitancy was lowest among physicians (2.7%) and followed by nurses (9.9%), community health workers (10.4%) and other HCWs (16.3%) (Extended Data Table 2).

Almost two in five (38.6%) of all respondents said they now pay less attention to new information about COVID-19 vaccines than 1 year ago (range 7.5% in India to 58.3% in Nigeria). Nonetheless, two-thirds of all respondents (66.6%) still prefer vaccination to prevent COVID-19 illness (range 40% in South Africa to 91.4% in China). In total, 16.2% of respondents preferred treating the disease with medication (range 2.8% in China to 31.2% in South Africa), and 53.2% believe that the vaccines can protect people from Long COVID (range 28.3% in Russia to 79.7% in India), but one-quarter (25.2%) of respondents indicated that they are now less likely to get vaccinated due to perceived lesser disease severity (range 4.2% in China to 43.1% in South Korea) (Extended Data Fig. 1 and Extended Data Tables 3–7).

Discussion

In the light of continued surges of COVID-19, policymakers around the world must decisively address vaccine hesitancy and resistance as a component of their overall prevention and mitigation strategy. This study provides international COVID-19 vaccine acceptance data over 3 years and found that acceptance of a COVID-19 vaccination in 23 countries was 79.1% in 2022, an increase from 75.2% in 2021 (ref. 6). However, in our survey, 12% of those already vaccinated were hesitant or reported refusal to receive a booster dose.

Among social and demographic determinants, our findings indicate that booster hesitancy is higher at younger ages[27–29], unlike some previous studies that reported greater booster hesitancy among older persons[30]. Our findings of greater hesitancy among those with lower educational attainment[31] and lower income[17] are consistent with the literature and unchanged from our previous reports[5,6]. Similarly, our booster coverage ranges align with the existing literature—for example, from 7% in China[32] to more than 40% in Jordan[33], Malaysia[30] and the United States[31]. These rates were included in country-specific reports using different data sources, methodologies and chronology, whereas ours are reported on 23 countries simultaneously using a standardized method of data collection and analysis.

Our findings also corroborate previous literature showing greater hesitancy among those reporting concerns about vaccine safety and efficacy, low trust in government[31,34] and the perception that COVID-19 is a low risk[35]. Despite overwhelming evidence supporting the safety and efficacy of COVID-19 vaccines[36], these concerns persist for vaccine boosters[29,37], which may present a serious challenge to anticipated routine COVID-19 immunization programs. The lowest vaccination rates identified in our results are also bimodal; they exist outside of low- and middle-income countries (LMICs) and, therefore, cannot be explained by lack of access alone. Public health strategies to enhance coverage will need to differ, sometimes radically, in different settings.

Parental hesitancy to vaccinate children younger than 18 years remained high in many high-income countries, including France, Germany, Sweden, the United Kingdom, the United States and South Korea, as well as some LMICs, such as Kenya and Nigeria. Key variables were low perception of vaccine safety[38,39] and younger parental age, which might represent potentially less-experienced parenting[40,41], as well as parents who themselves had not been vaccinated[38]. Interventions to improve parental intention to vaccinate their children include counseling or motivational interviewing by pediatricians or other healthcare providers, as well as narrative framing that presents the statistics on safety of these vaccines for the millions of children already vaccinated[39]. Further efforts to make the vaccine more accessible to children in LMICs will also be required.

Our findings also report on receipt of therapeutics for COVID-19 globally and compare respondent preference for medicinal treatment versus prevention with vaccines. Our respondents reported the use of ivermectin as frequently as the use of approved medications and products, despite the fact that ivermectin is not recommended by the World Health Organization (WHO) and other leading agencies to prevent or treat COVID-19 (ref. 42). Respondents who reported ivermectin use tended to reside in LMICs[43]. Further efforts will be required to discourage the use of ivermectin and other pharmaceuticals with no proven efficacy and potential toxicity.

To varying degrees, most respondents in our study support the use of mandates to contain COVID-19 in indoor spaces, the workplace, schools and universities and during international travel, although this support declined from the previous year[6]. Although vaccine mandates have shown effectiveness in improving coverage in some regions—for example, the United States[44] and Europe[45,46]—their future use, particularly among populations with high rates of vaccination, will require a careful balance between the need for community protection and the need to maintain public support and voluntary compliance. Communicating the rationale for instituting or reinstituting mandates for vaccination along with promoting vaccine literacy relative to preventive behaviors, such as face-masking and physical distancing, must improve, including the clarification of criteria for their relaxation or cessation.

It is well established and intuitively logical that frequent exposure to misinformation increases vaccine hesitancy[8,47]. Misrepresentation of COVID-19 vaccines on social media most commonly includes misinformation about the medical/health benefits, false content about vaccine development and conspiracy theories[48]. Those living in less developed countries may be more susceptible to misinformation[49], yet, to date, research investigating online COVID-19 misinformation has been conducted primarily in high-income countries[48,50], highlighting the need for similar research in LMICs, particularly those with high vaccine hesitancy and improved or improving access to vaccines[40], to increase uptake.

Intentional or not, misrepresentation and misinformation can derail progress in COVID-19 vaccination coverage, particularly if audiences choose not to seek COVID-19 information from official sources, such as WHO, the US Centers for Disease Control and Prevention or medical professional associations. These high-credibility sources of information face the additional challenges of pandemic fatigue[41]—or distress that may demotivate one to follow recommended protective behaviors—and, among some communities, low trust toward such institutions[5–7,34,51]. The characteristics of people who currently pay less attention to COVID-19 vaccine information than 1 year ago vary by country, highlighting the importance of tailored health communication techniques (Extended Data Table 3). As the pandemic continues, as new variants emerge and as public compliance with public health and social measures wanes, it is clear that those responsible for public health programs will need to develop more effective, personalized and sophisticated strategies to regain public attention and rebuild trust[52]. Such programs must also be designed to include monitoring and, where appropriate, to address misinformation, as well as to develop and test other novel, effective communication methods. Current efforts to fact-check online COVID-19 information have not kept pace with the ability of misinformation to reduce vaccine acceptance[49].

Our findings may offer insight to policymakers and public health officials regarding message content and targeting. Strategies to improve vaccine literacy could include messages that emphasize compassion over fear[53], message framing based on audience demographics and psychographics[54] as well as the use of trusted messengers[55], particularly healthcare providers[56,57], and various types of incentives[58]. Frequency, content and channels of dissemination are key factors in message transmission and receipt. Public health communicators should regularly test messages and the source (messenger) for optimal reach and uptake[59] and integrate vaccine literacy strategies using qualitative formative research, such as focus groups among target audiences[60], to assess content on current (for example, first-dose and

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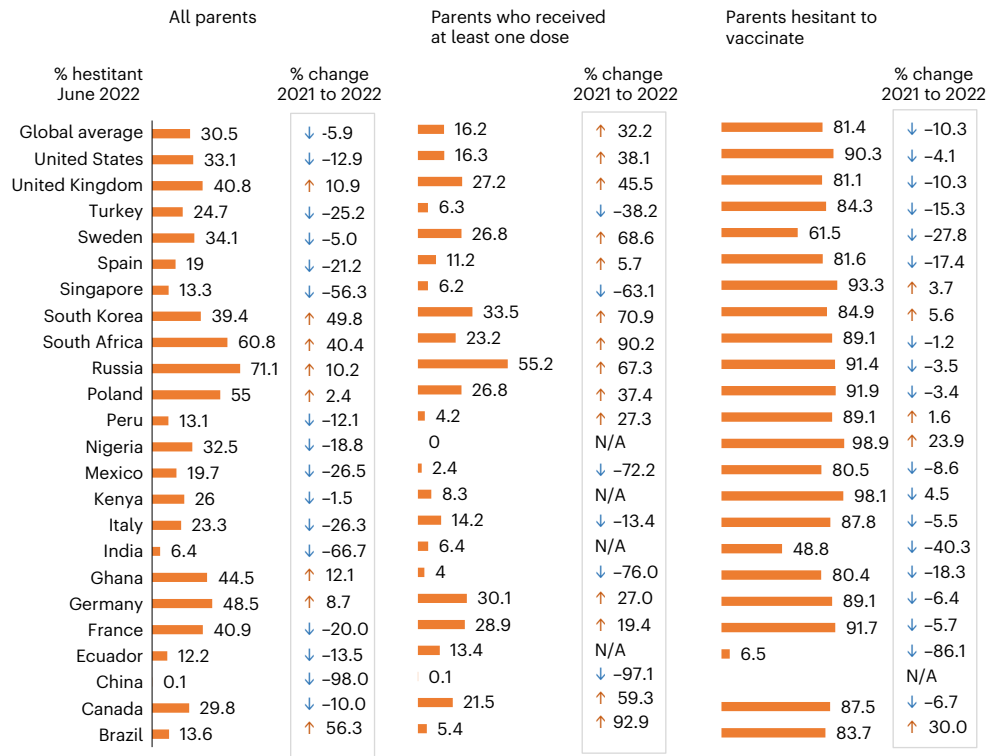

Fig. 4 | COVID-19 vaccine acceptance and hesitancy for children among parents in June 2021 and 2022. Vaccine hesitancy for children among parents was defined as having reported 'no' to the question of whether children received at least one dose of a COVID-19 vaccine and also 'unsure/no opinion', 'somewhat disagree' or 'strongly disagree' to the question of whether children will take a COVID-19 vaccine when available to them. Parental vaccine hesitancy was defined as having reported 'no' to the question of whether parents received at least one dose of a COVID-19 vaccine and also 'unsure/no opinion', 'somewhat disagree' or 'strongly disagree' to the question of whether the parent will take a COVID-19 vaccine when available to them. In Ecuador, India, Kenya and Nigeria, 0% of parents reported receiving at least one dose in June 2021, and, in China, 0.1% reported hesitancy in June 2022; thus, these are denoted not applicable (N/A). Orange (up) arrows indicate % increase in hesitancy toward COVID-19 vaccination; blue (down) arrows indicate % decrease.

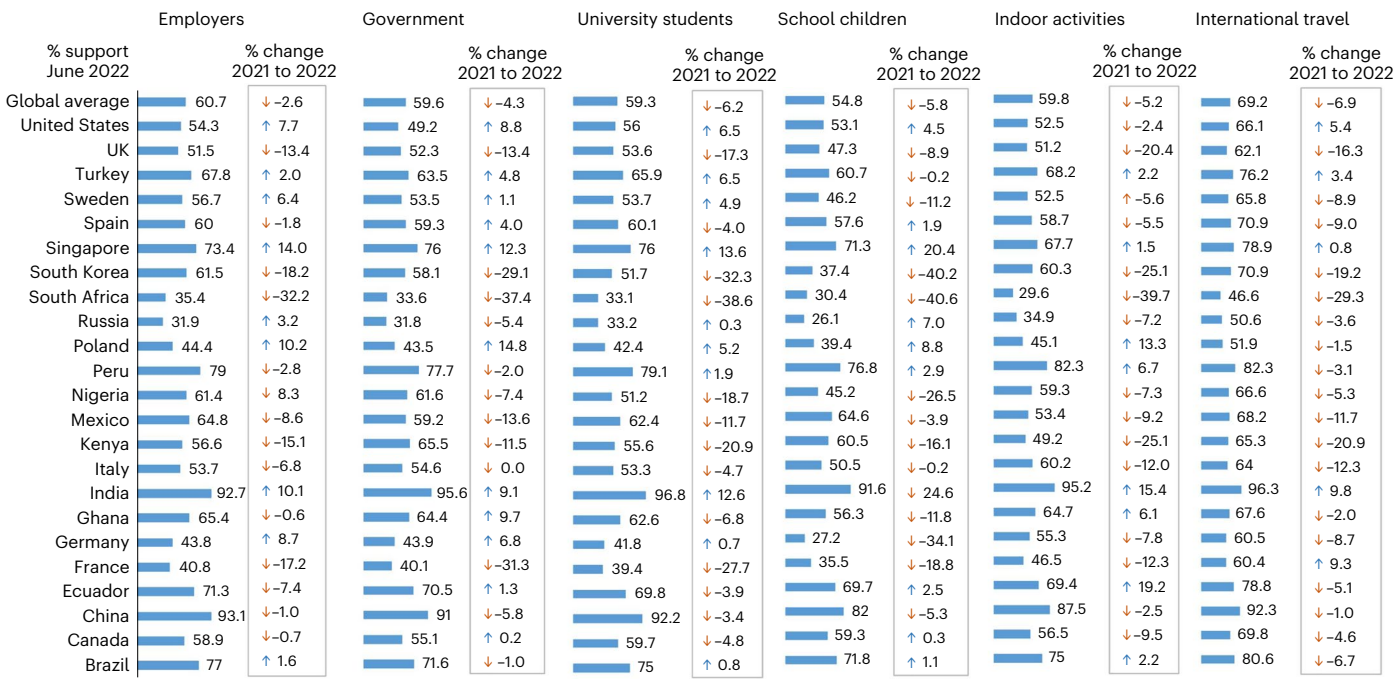

Fig. 5 | Support for COVID-19 vaccination mandates in June 2022, percent change from 2021. Blue (up) arrows indicate % increase in acceptance of COVID-19 vaccination mandates; orange (down) arrows indicate % decrease.

booster vaccination) and emerging (for example, mitigation of Long COVID) issues[61].

Our study has several limitations. First, our questionnaire asked about a general COVID-19 vaccine, whereas several COVID-19 vaccines, each with different efficacy results, are now being distributed globally. Next, although this study used state-of-the-art sampling methodology that aimed to achieve population representativeness, these samples may not adequately represent the most vulnerable segments of populations, including those with limited access to online technology, as they would be less likely to participate in research of this type. Additionally, we note that definitions for vaccine hesitancy do vary in the literature. We chose to categorize our data according to the 2014 Strategic Advisory Group of Experts on Immunization (SAGE) definition[15] rather than using the SAGE-endorsed Behavioral and Social Drivers (BeSD)[62] framing, which does not recognize the critical role of politics and/or political allegiance and orchestrated anti-vaccine networks/disrupters, all of which are critical issues influencing vaccine uptake during the COVID-19 pandemic. Additionally, although the BeSD framing acknowledges respect 'from' HCWs, it does not focus on the importance of mutual respect, despite the increases in aggression toward HCWs and scientists. The earlier WHO SAGE working group on vaccine hesitancy defines vaccine hesitancy as 'the delay in acceptance or refusal of vaccination despite availability of vaccination services', which we thought could be captured in our dataset and compared to prior years (as described in the Methods) in a way that the full model of BeSD could not. Although the choice to use the 2014 SAGE definition is a limitation in that it does not fully reflect the most contemporary literature at the time of publication, we note that it still permits comparative analysis of factors included in both models, such as complacency, convenience and confidence factors. Finally, this study was based on cross-sectional data; thus, study results cannot be interpreted causally.

The most promising finding of the 2022 global survey is that COVID-19 vaccine acceptance has continued to rise in most countries studied, reaching 79.1% overall. However, the wide variability of acceptance rates that we report could jeopardize efforts to control the pandemic. Our findings also show that, although most respondents accept booster shots and childhood vaccination, some unvaccinated individuals remain intractably opposed to immunizing themselves and their children. Decisionmakers, practitioners, advocates and researchers must collaborate more effectively to address these lingering disparities and pockets of resistance with novel, tailored, evidence-based policies and programs. To reverse trends of complacency and end the COVID-19 pandemic as a global public health threat, pandemic responses must include efforts to build trust and change the behaviors of unvaccinated, undervaccinated and indifferent people.

Online content

Any methods, additional references, Nature Portfolio reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at https://doi.org/10.1038/s41591-022-02185-4.

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Methods

Study design and data collection

This cross-sectional study used random stratified sampling, with strata established for age, gender, statistical regions and country-specific levels of education[63–67]. A minimum of 50 participants was set for each stratum, with target enrollment calculated to reflect the distribution of each subgroup in the general population[68,69]. Consensus Strategies recruited participants from international online panel providers using multiple panels to reduce coverage bias. Details on variable coding and weighting for strata and participant recruitment methods are described elsewhere[5,6]. Survey data were collected between 29 June and 10 July 2022 from 23,000 respondents aged ≥18 years from 23 countries: Brazil, Canada, China, Ecuador, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom and the United States. These countries were selected based on a combination of their impact on morbidity and mortality in 2020 and the desire to achieve strong regional representation[6]. This study was approved and the survey administered by Emerson College (institutional review board protocol no. 20-023-F-E-6/12-[R1], updated on 12 April 2021). No personally identifiable information was collected or stored. Informed consent was obtained on the information page before participants proceeded to the survey.

Survey instrument

The instrument was developed by an expert panel after a comprehensive literature review of COVID-19 vaccine hesitancy literature, as described in other studies[5,6,70,71]. The 30-question instrument (Supplementary Information 1) included questions regarding: (1) perceptions of risk, efficacy, safety and trust; (2) identification of vaccine acceptance or hesitancy, defined according to the WHO SAGE description[15], which continues to evolve[62,72–74], and coded based on Likert responses to questions regarding receipt of at least one dose of a COVID-19 vaccine or willingness to take a vaccine when it became available. Vaccine hesitancy was coded both for individual respondents and separately for respondents with children under 18 years of age; (3) booster acceptance and hesitancy-defining questions included receipt of at least one booster dose or willingness to take a booster when it becomes available, with booster hesitancy coded in the same way as vaccine hesitancy; (4) medication use when sick with COVID-19 within the past year; (5) support for COVID-19 vaccine mandates required (a) by employers and (b) by the government, for (c) university students, (d) for school children, (e) for attending indoor activities, such as programs in auditoriums, concerts or sports events, and (f) for international travel; (6) level of attention paid to new information about (a) COVID-19 vaccines compared to 1 year ago; (b) preference for illness prevention through vaccination versus treatment with medications after infection; (c) belief about vaccination protection against Long COVID; and (d) likelihood of vaccination in light of currently perceived disease severity; (7) COVID-19 experience (whether oneself or a family member became ill with COVID-19 within the past year or more than 1 year ago); and (8) demographic variables (that is, age, gender, education, income and HCW status).

Statistical analysis

Descriptive statistics were used to report vaccine hesitancy, booster hesitancy and hesitancy among parents regarding vaccination of their children, by country and across the 23-country sample, including the rate of change from 2020–2022. Socio-demographic factors associated with hesitancy were examined through weighted multivariable logistic regressions and reported as ORs and associated 95% CIs. Associations between beliefs in a vaccine's ability to prevent COVID-19, vaccine safety and trust in vaccine science with vaccine acceptance were examined using weighted univariate logistic regressions. We report descriptive statistics and the rate of change from 2021–2022 regarding requirements for proof of vaccination to travel internationally or to attend work, school or indoor events. Finally, we report descriptive statistics on medication used when sick with COVID-19 within the past year, attention to new information about COVID-19 vaccines compared to 1 year ago, preference for illness prevention (vaccination versus medication treatment), belief about vaccination as protection against Long COVID and likelihood of vaccination considering current perceived disease severity. All analyses were conducted in SAS version 9.4 software, and significance was set at $\alpha = 0.05$.

Ethics and inclusion statement

Data for this study, including from LMICs, were collected via online panels by an international polling agency, Consensus Strategies. One colleague (A.K.) is from an LMIC, and three others (A.E.-M., C.A.P. and K.W.) are originally from LMICs and are now based in high-income countries. We fully endorse the Nature Portfolio journals' guidance on LMIC authorship and inclusion. As this was the third annual iteration of this work, authorship was based, in part, on prior participation. However, we are strongly committed to the inclusion of more researchers from LMICs in future iterations.

This research is locally relevant to all studied countries given that it disaggregates findings by country and, thus, provides local decision-makers with socio-demographic data relative to several outcomes of interest, such as vaccine or booster hesitancy. The authors chose to focus on these variables based on the previous iterations of this study, which have been widely cited by researchers in LMICs, and evidence on COVID-19 vaccine hesitancy.

As our methodology employed online data collection panels for each country and was approved by Emerson College, additional local review was not required. This research was not restricted and originated in three of the countries (Spain, United States and the United Kingdom) that are current settings for the researchers. The data collection and analysis techniques employed raised no risks pertaining to stigmatization, incrimination, discrimination, animal welfare, the environment, health, safety, security or other personal risks. No biological materials, cultural artifacts or associated traditional knowledge has been transferred out of any country. In preparing the manuscript, the authors reviewed relevant studies from each of the 23 countries.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

The raw data generated in this study are available for download at https://doi.org/10.5281/zenodo.6875363. All authors had access to the raw data.

Code availability

All code for data analysis associated with the manuscript is available for download at https://doi.org/10.5281/zenodo.6875363. Any updates will also be published on Zenodo, and the final DOI will be cited in the manuscript.

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Author contributions

J.V.L. and A.E.-M. conceived of the study. K.W. was responsible for coding and data analyses, with input from T.M.W. J.V.L., T.M.W., C.A.P. and A.E.-M. wrote the first draft of the paper. T.M.W., C.A.P., K.W., K.R., J.V.L., A.E.-M., S.C.R., H.J.L. and L.O.G. edited subsequent revisions of the draft and approved the final manuscript.

Competing interests

The authors declare no competing interests.

Additional information

Extended data is available for this paper at https://doi.org/10.1038/s41591-022-02185-4.

Supplementary information The online version contains supplementary material available at https://doi.org/10.1038/s41591-022-02185-4.

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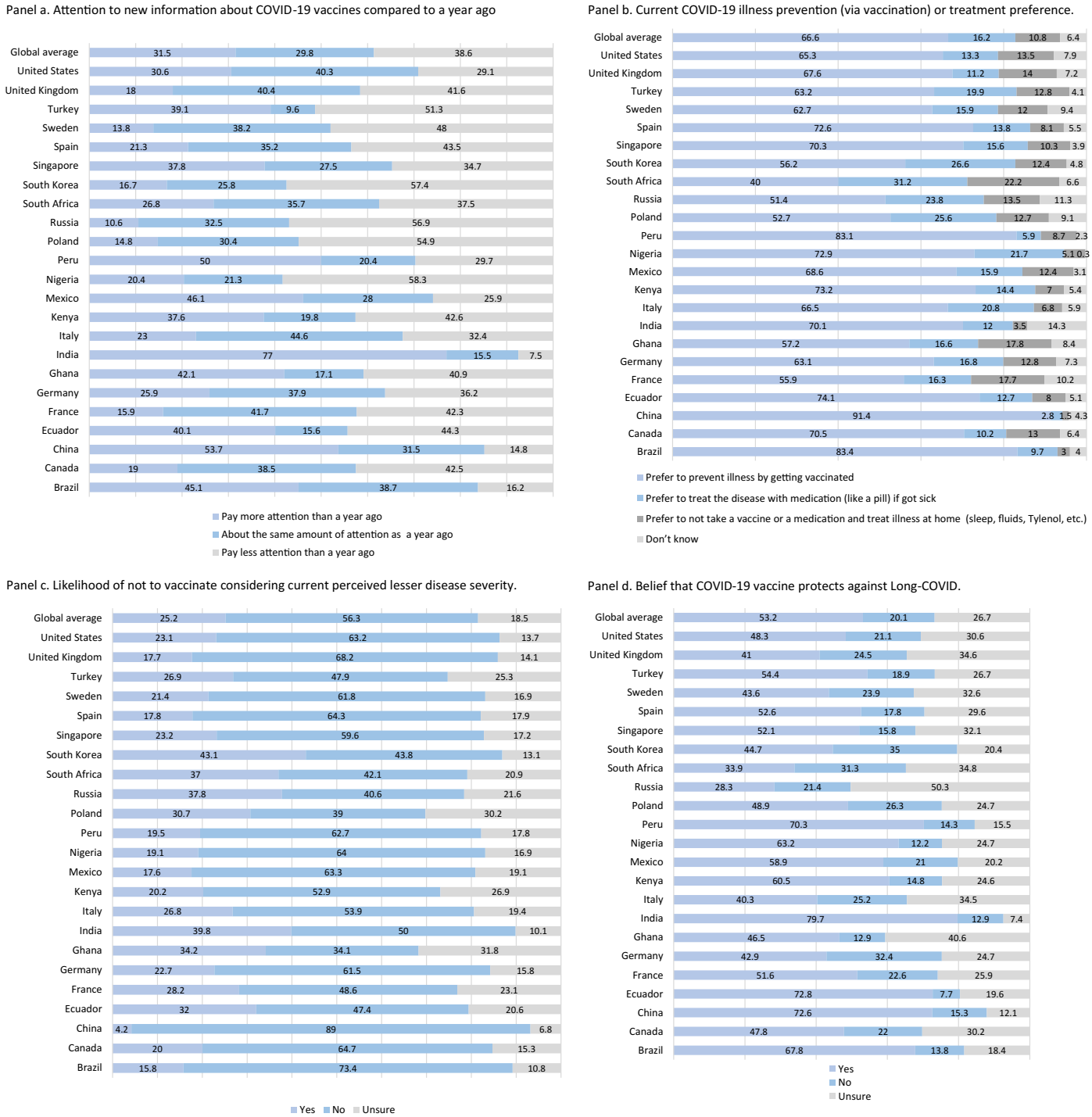

Extended Data Fig. 1 | Attention to new information about COVID-19 vaccines, current COVID-19 treatment preference, beliefs about vaccination for current disease severity and protection against long COVID by country and the global average. Panel a survey question was 'I continue to pay attention to new information about COVID-19 vaccines.' Panel b survey question was 'Thinking about treatments for the disease COVID-19, would you prefer to take a vaccine to prevent serious illness, only take medication once you are sick, or not take any medications at all?' Panel c survey question was 'I am less likely to take the COVID-19 vaccine because I believe the disease is not as severe as before.' Panel d survey question was 'Long-COVID has been defined as 'symptoms that can last for weeks or months after recovery from acute illness'. I believe the COVID-19 vaccine protects against Long-COVID'.

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Extended Data Table 1 | Sample characteristics by country (*n*=23) and the global average

Country	Brazil	Canada	China	Ecuador	France	Germany	Ghana	India	Italy	Kenya	Mexico	Nigeria	Peru	Poland	Russia	South Africa	South Korea	Singapore	Spain	Sweden	Turkey	United Kingdom	United States	Global average
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Age Groups																								
18-29	19.0	16.5	16.5	23.5	17.1	14.1	37.0	24.2	18.5	37.9	23.5	45.3	23.3	16.0	15.8	25.0	18.4	20.7	15.5	15.7	22.1	16.6	17.1	21.7
30-39	20.3	17.7	22.4	22.1	15.7	15.3	23.5	21.2	20.0	20.7	22.1	24.1	21.5	17.3	17.7	23.4	21.3	20.7	17.4	16.3	20.6	17.2	15.8	19.8
40-49	19.0	16.5	23.5	22.1	17.1	16.5	17.0	21.2	20.0	18.9	20.6	9.4	20.6	18.5	19.0	20.3	19.9	22.0	18.6	17.6	20.6	17.8	17.1	18.9
50-59	24.1	16.5	16.5	14.7	18.3	17.6	12.1	16.7	16.9	13.8	16.2	11.9	16.5	17.3	18.7	17.2	18.4	17.1	17.4	15.7	17.6	16.6	18.4	16.8
60+	17.7	32.9	21.2	17.6	31.8	36.5	10.4	16.7	24.6	8.8	17.6	9.2	18.0	30.9	28.8	14.1	22.0	19.5	31.1	34.7	19.1	31.8	31.6	22.9
Gender																								
Man	48.9	49.5	51.4	49.6	49.0	49.1	50.6	50.4	48.8	49.0	49.8	51.7	49.6	48.2	46.4	49.1	50.0	49.2	49.1	49.8	49.3	49.3	48.7	49.4
Woman	50.7	50.3	48.5	49.6	50.5	50.5	49.2	48.0	51.1	50.7	50.0	48.3	50.2	51.7	53.3	50.8	49.8	50.5	50.9	49.8	50.5	50.4	50.8	50.3
Prefer not to say/ Other	0.4	0.2	0.1	0.8	0.5	0.4	0.2	1.6	0.1	0.3	0.2	0	0.2	0.1	0.3	0.1	0.2	0.3	0	0.4	0.2	0.3	0.5	0.3
Education (university degree)																								
No	82.5	73.7	87.9	88.0	82.1	75.0	85.2	90.9	85.7	97.1	84.0	90.5	90.5	74.9	45.0	92.5	45.0	67.9	67.0	75.7	79.0	65.5	64.3	77.8
Yes	17.5	26.3	12.1	12.0	17.9	25.0	14.8	9.1	14.3	2.9	16.0	9.5	9.5	25.1	55.0	7.5	55.0	32.1	33.0	24.3	21.0	34.5	35.7	22.2
Income (country median)																								
Above Median	45.6	39.1	72.0	41.4	38.6	30.6	52.3	76.6	35.3	30.3	44.0	23.4	37.9	45.9	36.4	67.8	56.9	44.6	41.8	25.4	75.3	43.4	43.8	45.6
Below Median	44.7	54.7	25.7	34.0	54.0	62.8	29.7	20.0	51.6	25.9	46.0	54.8	39.6	50.3	59.9	19.8	33.9	45.4	53.6	67.8	22.3	50.6	46.7	43.2
Refused	9.7	6.2	2.2	24.7	7.3	6.6	18.1	3.4	13.0	43.7	10.0	21.8	22.6	3.8	3.7	12.4	9.2	10	4.5	6.8	2.4	6.0	9.5	11.2
Health care worker																								
Yes	6.9	9.5	4.0	6.5	11.5	11.8	11.7	28.5	8.5	19.1	6.8	5.3	8.2	5.6	5.0	13.9	11.2	14.6	8.0	15.2	9.6	9.1	16.8	10.8
No	93.1	90.5	96.0	93.5	88.5	88.2	88.3	71.5	91.5	80.9	93.2	94.7	91.8	94.4	95.0	86.1	88.8	85.4	92.0	84.8	90.4	90.9	83.2	89.2

Gender category 'Prefer not to say' and 'Other' are combined.

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Extended Data Table 2 | COVID-19 vaccine and booster acceptance and hesitancy among HCWs in 2021 and 2022

		Vaccine										Booster among vaccinated					
		At least one dose received	*Change from 2021*	Will take when available	*Change from 2021*	Vaccine acceptance	*Change from 2021*	Vaccine hesitancy	*Change from 2021*			At least one dose received	Will take when available	Booster acceptance	Booster hesitancy		
	n	%	%	%	%	%	%	%	%	p-value	aOR (95%CI)	%		%	%	p-value	aOR(95%CI)
Not HCW	19648	88.7	*+36.7*	1.7	*-29.3*	90.4	*+7.4*	9.6	*-7.4*			40.3	47.3	87.6	12.4		
All HCW	3352	94.5	*+22.1*	0.9	*-18.5*	95.4	*+3.6*	4.6	*-3.5*	<.001	0.64(.53, .78)	19.9	70.4	90.3	9.7	<.001	0.79(.71, .88)
Physician	933	97.9[a]	*+12.3*	0.3[a]	*-10.9*	98.2[a]	*+1.3*	1.8[a]	*-1.3*	<.001		13.6[a]	83.7[a]	97.3[a]	2.7[a]	<.001	
Nurse	667	93.6[b]	*+19.1*	1.0[a]	*-18.1*	94.6[b]	*+1.1*	5.4[b]	*-1.1*			19.7[b]	70.4[b]	90.1[b]	9.9[b]		
Community health worker	817	95.1[b]	*+25.5*	1.2[a]	*-21.3*	96.3[b]	*+4.1*	3.7[b]	*-4.1*			17.6[b]	71.9[b]	89.5[b]	10.4[b]		
Other health care worker	935	91.4[c]	*+29.8*	1.1[a]	*-23.4*	92.5[c]	*+6.4*	7.5[c]	*-6.4*			29.0[c]	54.7[c]	83.5[c]	16.3[c]		

Different superscripts denote statistically significant pairwise differences. aORs, 95% CIs and *P* values (two-sided) are from multivariable logistic model (outcome: vaccine hesitancy or booster hesitancy) after adjusting for demographic variables, COVID- 19 experience and clustering of HCWs in countries.

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Extended Data Table 3 | Characteristics of respondents who reported paying less attention to new information about COVID-19 vaccines

Country	Brazil	Canada	China	Ecuador	France	Germany	Ghana	India	Italy	Kenya	Mexico	Nigeria	Peru	Poland	Russia	South Africa	South Korea	Singapore	Spain	Sweden	Turkey	United Kingdom	United States	Global average
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Age Groups																								
18-29	28.4	47.2	12.3	42	63.5	60	41.2	14.7	51.5	50.7	37.3	64.7	31.5	74.4	53.2	37.1	61.5	45.2	53.6	62.2	74.9	59.1	36.1	47.9
30-39	17.4	50.3	32.4	39.2	47.6	44.3	59.9	12.5	31.2	53.4	23.5	60.6	32.4	69.3	52	42.4	59.7	31	47.4	63.4	54.3	39.6	31.8	43.3
40-49	13.9	48.3	11.2	24.3	42.6	38.9	53.1	2.8	35.9	45.8	17	74.3	29.2	61.7	55.6	31.4	69.2	38	50.6	49.1	48.2	42.1	23	39.4
50-59	13.2	41.4	6.5	36.4	38	35.7	13.8	2.7	21.2	24.7	21.2	23	30.7	49.8	67.7	36.2	55.7	40.7	40.6	42.6	54.1	42.7	30	33.4
60+	8.3	33.5	8.5	85.2	30.8	22.7	7.9	1.3	23.8	2.9	28.3	50.3	23.5	35.4	55.7	40.2	42.7	18.4	33.6	36.2	21.5	32.5	26.8	29.1
Gender																								
Man	69.2	66.5	92.5	38.9	48.2	66.8	24.7	39.5	56.6	56.3	59.1	57.5	60.5	41.6	43.8	44.1	48	58.5	66.5	60.4	44.4	69.6	61.9	55.4
Woman	77.2	62.9	85.2	56.2	49.3	56.4	43.6	60.9	51.2	49.9	67.3	71.1	64.9	36.7	37.8	40	39.3	60.7	62.1	62.9	51.4	66.7	64.6	57.3
Prefer not to say/ Other	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Education (university degree)																								
No	15.3	44	14.4	46.7	42	36.3	42.8	6.1	32.6	42.7	26.2	57.7	29.8	52.7	53.5	38.8	52.9	31	44.8	46.7	49.3	43.2	27.7	38.1
Yes	20.2	38	17.8	26.5	44	36.1	29.8	21.5	30.9	36.6	24.4	64.4	28.7	61.3	59.7	20.6	61.2	42.3	40.8	52.1	58.7	38.5	31.6	38.5
Income (country median)																								
Above Median	11.9	42.3	15	47.3	40.5	36.8	49.6	6.7	30.8	47.6	25.7	52.1	33.2	58.9	56.4	38.5	56.8	29.7	39.3	54.3	50.9	39.8	26.4	38.7
Below Median	18.1	43	9.7	50.9	43	36.4	36.6	9.1	31.7	41.3	23.1	67.7	25.1	51.2	58.4	36.3	57.4	40.3	47.5	46.5	48.3	42.8	33	39.0
Refused	27.5	38.4	66.7	30	47.4	31.2	22.6	14.2	39.2	39.8	39.5	41.4	31.8	53.3	36.8	33.6	61.6	31.6	34.4	39.2	91.1	44	22.1	39.9

Statistics reflect percent of respondents within each demographic stratum who indicated that they pay less attention to new information about COVID-19 vaccines compared to 1year ago. Statistics were not computed for Gender = 'Prefer not to say/Other' due to small sample sizes.

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Extended Data Table 4 | Current preference for COVID-19 prevention (via vaccination) by demographic variables

Country	Brazil	Canada	China	Ecuador	France	Germany	Ghana	India	Italy	Kenya	Mexico	Nigeria	Peru	Poland	Russia	South Africa	South Korea	Singapore	Spain	Sweden	Turkey	United Kingdom	United States	Global average
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Age Groups																								
18-29	28.4	47.2	12.3	42	63.5	60	41.2	14.7	51.5	50.7	37.3	64.7	31.5	74.4	53.2	37.1	61.5	45.2	53.6	62.2	74.9	59.1	36.1	47.9
30-39	17.4	50.3	32.4	39.2	47.6	44.3	59.9	12.5	31.2	53.4	23.5	60.6	32.4	69.3	52	42.4	59.7	31	47.4	63.4	54.3	39.6	31.8	43.3
40-49	13.9	48.3	11.2	24.3	42.6	38.9	53.1	2.8	35.9	45.8	17	74.3	29.2	61.7	55.6	31.4	69.2	38	50.6	49.1	48.2	42.1	23	39.4
50-59	13.2	41.4	6.5	36.4	38	35.7	13.8	2.7	21.2	24.7	21.2	23	30.7	49.8	67.7	36.2	55.7	40.7	40.6	42.6	54.1	42.7	30	33.4
60+	8.3	33.5	8.5	85.2	30.8	22.7	7.9	1.3	23.8	2.9	28.3	50.3	23.5	35.4	55.7	40.2	42.7	18.4	33.6	36.2	21.5	32.5	26.8	29.1
Gender																								
Man	69.2	66.5	92.5	38.9	48.2	66.8	24.7	39.5	56.6	56.3	59.1	57.5	60.5	41.6	43.8	44.1	48	58.5	66.5	60.4	44.4	69.6	61.9	55.4
Woman	77.2	62.9	85.2	56.2	49.3	56.4	43.6	60.9	51.2	49.9	67.3	71.1	64.9	36.7	37.8	40	39.3	60.7	62.1	62.9	51.4	66.7	64.6	57.3
Prefer not to say/ Other	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Education (university degree)																								
No	15.3	44	14.4	46.7	42	36.3	42.8	6.1	32.6	42.7	26.2	57.7	29.8	52.7	53.5	38.8	52.9	31	44.8	46.7	49.3	43.2	27.7	38.1
Yes	20.2	38	17.8	26.5	44	36.1	29.8	21.5	30.9	36.6	24.4	64.4	28.7	61.3	59.7	20.6	61.2	42.3	40.8	52.1	58.7	38.5	31.6	38.5
Income (country median)																								
Above Median	11.9	42.3	15	47.3	40.5	36.8	49.6	6.7	30.8	47.6	25.7	52.1	33.2	58.9	56.4	38.5	56.8	29.7	39.3	54.3	50.9	39.8	26.4	38.7
Below Median	18.1	43	9.7	50.9	43	36.4	36.6	9.1	31.7	41.3	23.1	67.7	25.1	51.2	58.4	36.3	57.4	40.3	47.5	46.5	48.3	42.8	33	39.0
Refused	27.5	38.4	66.7	30	47.4	31.2	22.6	14.2	39.2	39.8	39.5	41.4	31.8	53.3	36.8	33.6	61.6	31.6	34.4	39.2	91.1	44	22.1	39.9

Statistics reflect percent of respondents within each demographic stratum who indicated their preference for vaccination (versus medication, self-treatment of illness at home with sleep, fluids, Tylenol, etc. or don't know). Statistics were not computed for Gender = 'Prefer not to say/Other' due to small sample sizes.

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Extended Data Table 5 | Likelihood of not vaccinating considering current perceived lesser disease severity by demographic variables

Country	Brazil	Canada	China	Ecuador	France	Germany	Ghana	India	Italy	Kenya	Mexico	Nigeria	Peru	Poland	Russia	South Africa	South Korea	Singapore	Spain	Sweden	Turkey	United Kingdom	United States	Global average
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Age Groups																								
18-29	8.8	30.1	8.3	32.6	41.4	29.9	35.5	21.5	26.9	28.3	12.7	0	25.8	50.4	33.7	29.8	51.8	29	26.3	36.3	19	34.5	28.6	27.9
30-39	19.4	27.5	1	26.6	36.4	35.3	61.7	43.2	28.2	25.5	16.3	32.9	18	38.4	49.1	41.8	53.2	33	29.4	27	24	27.6	32.1	31.6
40-49	15.2	24.6	2.6	10.6	35.7	26.1	19.8	33.2	38.8	6.7	7	34.8	17.5	28	39.1	35.7	49.9	26.8	15.7	31.5	14.9	18.9	30.9	24.5
50-59	19.5	18.6	7	10.3	24.2	13.8	14.7	40.2	22.1	20.2	26.8	14.8	21.2	26.9	35	47.3	36.3	15.5	15	14.8	30.7	13.8	21.3	22.2
60+	15.1	9.4	4.1	83.3	15.5	17.5	13.2	70.2	18.9	1.6	30	66.9	14.1	20	34.1	30.9	25.7	9.5	10	9.9	48.4	4.8	12.3	24.6
Gender																								
Man	51.8	19.5	57.7	37.7	18.6	31	42.4	83.9	22.5	30.1	48.5	26.4	51	17.6	10.5	29.3	21.6	42.7	24.8	16.9	27.9	20.3	34.4	33.4
Woman	38.8	18.5	49.3	43.1	13.2	21.2	41.8	69	23.5	45	43.9	13.9	49.2	12.1	10.7	24.6	11.9	33.2	18	10.5	50.2	15.7	27.3	29.8
Prefer not to say/ Other	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Education (university degree)																								
No	16.3	21.4	4.2	33.7	27.7	24.5	36.5	38.4	27.4	19.5	17.8	14.6	19.4	30.5	41	37.6	43.4	23.4	17	19.7	26.7	18.5	23.2	25.3
Yes	13.5	16.2	4.4	19.9	30.9	17.5	20.5	54.2	23.1	43.4	16.6	62.2	20.2	31.6	35.2	29.4	42.9	22.9	19.4	26.5	27.6	16	22.8	26.8
Income (country median)																								
Above Median	12	21.9	2.6	34	27.8	22.8	33.4	46.5	27.6	22.2	18.6	37.3	19.4	31.6	40.1	36.6	45.3	32.4	18.2	32.1	23.2	20.8	28.7	27.6
Below Median	20.5	16.7	9.1	29.9	29.5	22.7	25.9	19.6	27.8	33.8	10.7	6.2	17.1	30.6	35.4	39.5	43.2	19	17.5	18.8	41.9	15.6	19.3	23.9
Refused	12.8	37.4	1.3	31.7	21.3	22.9	49.7	8	20.5	10.8	45.2	32.1	24.1	22.3	55.1	34.8	29.8	1.8	18.8	6.8	0.5	12.4	15.9	22.4

Statistics reflect percent of respondents within each demographic stratum who indicated they are less likely to take the COVID-19 vaccine because they believe the disease is not as severe as before. Statistics were not computed for Gender = 'Prefer not to say/Other' due to small sample sizes.

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Extended Data Table 6 | Belief that COVID- 19 vaccine protects against Long COVID by demographic variables

Country	Brazil	Canada	China	Ecuador	France	Germany	Ghana	India	Italy	Kenya	Mexico	Nigeria	Peru	Poland	Russia	South Africa	South Korea	Singapore	Spain	Sweden	Turkey	United Kingdom	United States	Global average
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Age Groups																								
18-29	72.5	46.9	83.1	69.1	47.5	47.8	39.3	34.5	41.4	52.8	60.1	86.8	66.3	37	30.3	32	42.4	60.4	59.5	40.7	50.2	43.5	49.2	51.9
30-39	75.8	44.9	78	55.7	43.6	43.6	41.4	88.9	36	66.5	59.5	56	72.5	37.6	24.3	32.8	44.7	61.5	44.4	44.4	52.3	43.6	49.3	52.1
40-49	63.9	51.7	73.3	83.6	50.6	41	48.6	99.1	42.9	86.9	76.3	0.1	78.3	54.8	28.9	44.5	42	35.8	50	36.1	54.4	37.8	52.4	53.6
50-59	63.8	52	63	61.8	49.6	34.2	65.4	91.2	37.1	51.3	47.4	51.8	66.7	47.1	22.9	27.7	43.6	49.3	51.8	39.2	54	33.7	46.1	50.0
60+	63.2	45.8	65.4	94.7	59.4	45.8	57.7	97.6	43.2	37.4	46.5	45	66.7	59	32.7	31.5	49.9	54.1	55.6	50.1	61.9	43.7	46.3	54.5
Gender																								
Man	71	48.1	77.1	69.7	54.6	49.8	43.3	89.3	44.2	56.4	57.3	54.3	64.4	53.7	32.6	35.1	51	58.3	55.6	47.4	46.6	46.3	52.3	54.7
Woman	48.8	0	100	10.4	22.1	41.6	39.9	81.5	0	0	100	0	100	0	19.9	100	0	16.3	0	80.6	0	72.8	0	59.6
Prefer not to say/ Other	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Education (university degree)																								
No	67.3	46.4	75.3	74	50.7	41.3	47	79.8	39.3	61	58.6	67.4	70.5	46.8	28.2	31.8	45.3	53.1	49.8	41.9	54.7	36.4	43	52.6
Yes	70.1	51.9	53.2	64	55.7	47.6	43.3	78.7	46.8	45.1	60.2	23.2	68.9	55.5	28.4	59.7	44.2	49.9	58.2	48.5	53.2	49.6	57.8	52.8
Income (country median)																								
Above Median	69	59.8	73.1	66.1	60.4	54.2	37.5	78.1	51	69.4	57.9	43	76	51.5	32.8	35.3	50.9	59.8	57.7	54.7	59.5	48.5	59.5	56.8
Below Median	70	41.8	73	77.2	46	40.1	63.4	94.7	38.2	33.5	65.6	69.3	67.7	47.8	26	35.2	38.8	47.6	48.8	39.8	41.4	35.5	42.4	51.5
Refused	52.1	25.9	52.6	77.9	46.1	16.8	44.5	27.9	19.9	70.5	31.9	69.4	65.1	33.3	20.1	23.9	27.6	38.2	49.8	39	15.8	33.2	25.1	39.4

Statistics reflect percent of respondents within each demographic stratum who indicated that they believe that COVID- 19 vaccine protects against Long COVID. Statistics were not computed for Gender = 'Prefer not to say/Other' due to small sample sizes.

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Extended Data Table 7 | Correlates of COVID-19 vaccine hesitancy with beliefs in a vaccine's ability to prevent COVID-19, safety and trust in the vaccine science

	COVID-19 is a dangerous health threat.		COVID-19 can be prevented by vaccination.		The risks of COVID-19 disease are greater than the risks of the vaccine		The COVID-19 vaccines available to me are safe		I trust that my government is able to deliver the COVID-19 vaccine to everyone, everywhere in my country, equally.		I trust the science behind the COVID-19 vaccines.	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Brazil	5.67	(3.03-10.61)	3.40	(2.41-4.79)	3.00	(2.27-3.96)	7.80	(4.39-13.85)	1.08	(0.75-1.55)	4.47	(2.86-6.98)
Canada	2.29	(1.82-2.88)	3.83	(2.61-5.64)	2.65	(2.09-3.38)	5.41	(3.59-8.17)	3.32	(2.51-4.4)	4.66	(3.13-6.93)
China	0.29	(0.02-5.3)	2.34	(1.54-3.57)	2.15	(1.5-3.07)	3.88	(2.49-6.06)	6.91	(2.55-18.69)	6.43	(4.26-9.69)
Ecuador	0.90	(0.36-2.22)	2.17	(0.88-5.36)	1.47	(0.88-2.46)	6.50	(3.57-11.82)	1.74	(0.74-4.11)	3.79	(1.64-8.78)
France	2.03	(1.65-2.5)	2.83	(2.31-3.46)	3.36	(2.77-4.08)	4.21	(3.34-5.31)	2.75	(2.25-3.35)	3.61	(2.95-4.42)
Germany	2.36	(1.91-2.92)	2.94	(2.36-3.66)	4.74	(3.66-6.13)	7.69	(5.56-10.64)	2.89	(2.33-3.59)	5.15	(3.98-6.64)
Ghana	1.44	(0.66-3.16)	1.32	(0.79-2.2)	1.70	(0.93-3.09)	2.96	(1.46-5.98)	2.71	(1.51-4.84)	4.75	(1.75-12.92)
India	1.86	(0.46-7.54)	5.91	(1.42-24.63)	0.88	(0.34-2.31)	6.68	(1.86-24.02)	1.81	(1.11-2.94)	4.09	(1.46-11.44)
Italy	2.48	(1.88-3.29)	4.00	(3.07-5.21)	3.33	(2.57-4.32)	5.64	(4.09-7.79)	2.82	(2.16-3.7)	5.42	(3.98-7.38)
Kenya	0.99	(0.53-1.86)	1.81	(0.86-3.82)	2.49	(1.31-4.72)	16.93	(4.65-61.6)	2.08	(1.28-3.39)	11.05	(3.69-33.11)
Mexico	2.57	(1.86-3.56)	3.98	(2.8-5.67)	2.42	(1.78-3.27)	6.63	(3.8-11.55)	2.43	(1.74-3.38)	4.82	(2.99-7.76)
Nigeria	2.73	(0.69-10.81)	1.06	(0.3-3.77)	1.97	(0.85-4.53)	11.66	(1.77-76.63)	1.24	(0.58-2.66)	1.55	(0.75-3.23)
Peru	4.00	(2.5-6.4)	4.87	(3.24-7.31)	3.32	(1.89-5.83)	5.59	(3.23-9.66)	3.51	(2.1-5.89)	5.51	(3.32-9.14)
Poland	2.96	(2.41-3.64)	3.84	(3.09-4.78)	3.68	(3.06-4.42)	4.70	(3.69-5.99)	1.73	(1.5-1.98)	4.22	(3.41-5.23)
Russia	1.79	(1.52-2.12)	3.05	(2.44-3.8)	2.42	(2-2.94)	3.93	(3.15-4.9)	2.08	(1.73-2.5)	2.84	(2.37-3.41)
South Africa	2.20	(1.73-2.81)	2.32	(1.88-2.87)	2.66	(2.18-3.23)	4.62	(3.37-6.35)	2.36	(1.92-2.91)	3.76	(2.91-4.87)
South Korea	1.98	(1.54-2.54)	2.71	(2.05-3.59)	2.85	(2.21-3.67)	3.51	(2.58-4.77)	2.36	(1.82-3.05)	3.45	(2.61-4.55)
Singapore	2.18	(1.06-4.48)	4.27	(2.72-6.7)	2.33	(1.33-4.11)	7.60	(3.4-16.98)	3.62	(2.11-6.21)	7.38	(3.72-14.62)
Spain	2.26	(1.77-2.88)	3.49	(2.74-4.45)	3.09	(2.39-4)	5.37	(3.66-7.88)	2.58	(2.07-3.23)	4.41	(3.11-6.25)
Sweden	1.71	(1.41-2.07)	3.88	(2.99-5.03)	2.86	(2.32-3.53)	4.10	(3.1-5.41)	2.60	(2.11-3.2)	3.50	(2.78-4.42)
Turkey	2.69	(1.29-5.63)	4.78	(2.8-8.13)	3.18	(1.89-5.34)	5.31	(2.85-9.91)	1.29	(0.89-1.88)	3.07	(1.87-5.06)
United Kingdom	1.67	(1.34-2.09)	2.94	(2.36-3.67)	3.31	(2.57-4.27)	6.02	(4.22-8.58)	2.90	(2.3-3.66)	5.81	(4.13-8.16)
United States	1.92	(1.66-2.23)	2.98	(2.56-3.46)	3.26	(2.7-3.9)	6.03	(4.63-7.85)	2.53	(2.17-2.96)	4.16	(3.47-4.98)
All countries combined	1.89	(1.73-2.08)	2.54	(2.27-2.84)	2.43	(2.21-2.68)	4.46	(4.02-4.94)	2.13	(1.94-2.34)	3.52	(3.12-3.98)

Unadjusted ORs and 95% CIs are from weighted univariable logistic regressions.

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☐	☒ A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒ For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐ Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	Authors used no software for data collection.
Data analysis	Analyses were conducted in SAS 9.4.

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The raw data generated in this study are available for download at https://doi.org/10.5281/zenodo.6875363. All authors had access to the raw data.

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☐ Life sciences ☒ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	Cross-sectional random sample general population survey of 23,000 individuals in 23 countries
Research sample	23,000 individuals representative of the general public in terms of gender, age, education level and region within country, aged 18 or older, in Brazil, Canada, China, Ecuador, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom (UK) and the United States (US); selected to understand factors associated with vaccine hesitancy in the general populations of these countries.
Sampling strategy	Strata were established by age (using the following age groups: 18–24, 25–54, 55–64 and 65 years and older); self-reported gender (man, woman, transgender, and "other,"); and level of education (based on each country's educational system), which was calculated from data provided by UNESCO, the Organisation for Economic Co-operation and Development, and country data from Sweden, the United Kingdom, and the United States. Educational level was coded into three groups of low, medium and high. "Low" included people who reported not finishing a secondary education (high school); "medium" included those who had completed secondary, vocational, technical, professional associate or high school degree; the "high" group consisted of those who had completed a tertiary or bachelor's degree and postgraduate work. Each country was divided into regions based on city/town, province or state unit of analysis. The number of participants who could enrol in each of these strata was calculated to reflect the distribution in the general population based on census/survey estimates provided by the World Bank and CIA World Factbook. Data were weighted by strata with each stratum requiring a minimum of 50 participants. Sample sizes were based on the minimum sample needed for the largest country (China, 1.426 billion population in 2022) to be statistically reliable with a margin of error of 3.1 percentage points and a 95% confidence level.
Data collection	Online panels provided responses from 23,000 respondents aged >18 years from 23 countries (n=1,000 per country), comprised of those countries included in the 2020 study (n=19), augmented by four additional countries with high disease incidence (Ghana, Kenya, Peru, and Turkey) and representing regions not represented in the first of the three studies. The 23 countries are: Brazil, Canada, China, Ecuador, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom (UK) and the United States (US). Researchers were not present for data collection, nor were they blinded to the study design or hypothesis.
Timing	Survey data were collected between 29 June-10 July 2022.
Data exclusions	Based on sampling strategy, if a stratum was full or if participants did not meet the minimum age requirement
Non-participation	No participants dropped out/declined participation.
Randomization	Stratified random sampling was employed. For each demographic stratum, a minimum of 50 responses were established as a quorum. Beyond this minimum quorum, target probabilities were established for each stratum, working backward from 1000 total responses for each country, to equal the country's characteristics, as described in the Sampling strategy above. Respondents were then randomly selected within each stratum. For example, if 51% of a country's demography is female, 510 responses were reserved for females.

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Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☐	☒ Human research participants
☒	☐ Clinical data
☒	☐ Dual use research of concern

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Human research participants

Policy information about studies involving human research participants

Population characteristics	Demographic information (i.e., age, gender, income, and education) were collected for all participants via self-reporting as well as country of response. Strata for these characteristics were established to ensure that, for each country, the sample population characteristics represent the country's general population. For each demographic stratum, a minimum of 50 responses were established as a quorum. Beyond this minimum quorum, target probabilities were established for each stratum, working backward from 1000 total responses for each country, to equal the country's characteristics. For example, if 51% of a country's demography are women, 510 responses were reserved for women. Gender, education, age group, and income level distributions of the sample are presented at the country-level and 23-country average in Extended Table 1. In the 23,000-respondent sample, 50.3% are women, 77.8% do not have a university diploma, 21.7% are aged 18-29, and 45.6% earned above the median income in their country.
Recruitment	Participants were recruited through international online panel providers via online email address, telephone and direct mail solicitation. Unique responses were verified using respondent IP addresses or mobile phone numbers to ensure that each participant was real and unique upon registration. Self-selection bias may have been present using this methodology, which could impact the results if people who are are more or less likely to be vaccine hesitant were motivated to respond, or not (non-response bias) to the survey upon learning this focus.
Ethics oversight	This study was approved and the survey administered by Emerson College, Boston, USA (institutional review board protocol no. 20–023-F-E-6/12-[R1] updated April 12, 2021). Informed consent was obtained on the information page before participants proceeded to the survey.

Note that full information on the approval of the study protocol must also be provided in the manuscript.