

COVID-19 Vaccination in the Gaza Strip: a Cross-sectional Study of Vaccine Coverage, Hesitancy, and Associated Risk Factors Among Community Members and Healthcare Workers

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Abstract

Background: The Gaza Strip, like other settings of complex humanitarian emergencies, faces immense challenges in vaccinating its population against COVID-19. This study was conducted in October 2021 and aimed to estimate coverage of COVID-19 vaccination, levels of vaccine hesitancy, and associations with risk factors among the adult population and healthcare workers (HCWs).

Methods: The study used a mixed methods design comprised of a cross-sectional survey of adults, purposive survey of HCWs, and qualitative discussions with key informants and community members. Quantitative data was summarized as univariable descriptive statistics with unweighted and weighted point estimates. Logistic regression was used to evaluate associations of risk factors with vaccination status and vaccine hesitancy.

Results: A total of 1,075 individuals were reached in the survey, of whom 906 were community members. Population-weighted vaccine coverage was estimated to be 49.08% (95% CI: 43.10-55.08). 89.35% of HCWs were vaccinated. Population-weighted vaccine hesitancy was estimated to be 34.08% (95% CI: 28.14-40.56) among both vaccinated and unvaccinated respondents, and 67.24% (95% CI: 49.04-81.41) among the unvaccinated. In logistic regression vaccination was independently associated with male sex (aOR 1.88, 95% CI: 1.20-2.95), older age (40 or more years old) (aOR: 1.92, 95% CI: 1.73-2.13), higher education (aOR 2.19, 95% CI: 1.51-3.17), and confidence in the safety of the vaccine (aOR 13.8, 95% CI: 10.1-18.8). Risk factors for hesitancy were similar, however hesitant individuals were more likely to obtain vaccine information from family members (aOR: 1.20, 95% CI: 1.00-1.67) and less likely to trust healthcare providers (aOR: 0.58, 95% CI: 0.49-0.68). Qualitative interviews corroborated the survey results, although skepticism expressed by HCWs interviewed raises the possibility of hidden hesitancy.

Conclusions: The continued emergence of SARS-CoV-2 variants reinforces the importance of achieving high levels of vaccination coverage globally – a uniquely challenging objective in Gaza. This study estimated half of Gaza’s adult population received at least one dose of any COVID-19 vaccine by October 2021, and the majority of unvaccinated individuals were hesitant. Disparities in vaccination across the territory’s demographic groups underscores the need for targeted outreach to these populations and messaging through community-based channels to permeate social networks of the unvaccinated.

Background

The development of highly efficacious vaccines against the SARS-CoV-2 virus in 2020 was heralded as a potential end to the pandemic that has caused more than 5.69 million deaths globally as of February 2022 [1]. However even where vaccines are widely available, roll-out has proceeded slowly due to persistent vaccine hesitancy among vaccine target groups. Vaccine hesitancy is defined by the WHO as “delay in acceptance or refusal of vaccination despite availability of vaccination services” [2]. Varying levels of vaccine hesitancy are reported globally; a review from February 2021 reported vaccine hesitancy across more than 30 assessed countries ranging from 10.0–57.8% [3, 4]. Among countries in the Middle

East, data on vaccine acceptance is sparse, or relies on data collection using methods like web-based surveys that may exclude certain population groups, potentially resulting in biased estimates. A non-representative, web-based survey in Kuwait found vaccine hesitancy at 26% [5], while another online survey from December 2020 estimated vaccine acceptance at 31.8% in Saudi Arabia, 38.4% in Jordan, and 23.6% in Kuwait [6]. It is also critical to understand drivers of vaccine hesitancy to address barriers to uptake among populations who remain skeptical, misinformed, or fearful of vaccine risks. Surveys conducted to date have identified factors such as government trust, sex, education level, risk perception, and use of social media for COVID-19 information, among others, to be associated with vaccine hesitancy [4, 6, 7].

Gaza Strip, the 362 sq km Palestinian territory bordering Israel and Egypt, faces immense challenges with the vaccine roll-out given its fractured and poorly resourced health system and political obstacles to the importation of medical supplies [8, 9]. By January 2022, it is estimated that 26% of the population has been vaccinated since the campaign started in February 2021 based on Palestinian Ministry of Health statistics [10]. Little data exists on vaccine hesitancy and its risk factors in Gaza; a web-based survey conducted in October 2020 found 63% of respondents would accept the vaccine, with women and young adults less likely to be vaccine hesitant [9]. However to our knowledge no recent data has been collected since the vaccination campaign began, and no population-representative study has been conducted.

The international non-governmental organization International Medical Corps (IMC) commissioned an external consultant epidemiologist to conduct a mixed methods vaccine hesitancy study in the Gaza Strip. The study was carried out between October 1–30, 2021 across all governorates Gaza in collaboration with IMC partners, Ministry of Health (MoH) key informants, and community leaders. The study aimed to investigate community members' and healthcare workers' perceptions of the COVID-19 vaccine; barriers and enablers associated with vaccine acceptance; and an updated estimate of COVID-19 vaccination coverage along with predictors of uptake. The results of the study provide new evidence on HCW and population perceptions that can inform COVID-19 services and information campaigns in Gaza.

Methods

The study was conducted using a closed-ended survey coupled with key informant interviews and focus group discussions with community members to investigate factors associated with vaccine uptake and hesitancy among healthcare workers and the general population of Gaza.

Quantitative methods

We carried out a population-based, cross-sectional survey of households across all five governorates. Multi-stage, stratified cluster sampling was used to select a representative sample of households for the community-based survey. Based on Gaza's population demographics (1.99 million residents in 2019) we estimated the study population size to be 1,034,800 adults 18 years and over [11]. The sample size was calculated using EpiInfo (CDC) (v7.2.4.0) for a population survey with parameters set at 95% level of

confidence, 50% estimated proportion, 5% margin of error, and a design effect of 2. Given lack of data from previous population surveys in Gaza, a conservative non-response rate of 15% was added. The resulting sample size was 884 households, while 906 were actually surveyed. For the HCW component of the survey, we visited five health care facilities that are financially supported by IMC and provide different levels of healthcare: Caritas Gaza Health Center (primary), Ahli Arab Hospital (secondary), Saint John's Eye Hospital (specialized), Karama Hospital (secondary), and European Gaza Hospital (a governmental Hospital where hospitalized COVID-19 cases are treated). Based on the limited number of HCWs in each facility and the restriction to IMC-supported facilities, we estimated a feasible sample size of between 30 to 40 HCWs per facility. 169 HCWs were ultimately interviewed as interest in completing the survey was high.

Multi-stage stratified sampling was used to select households for the community-based survey. First, we compiled a list of geo-locations¹ and the type of location (urban, rural, and refugee camp) for all governorates using administrative data. From this list, we used simple random sampling to select two urban geo-locations, two refugee camps, and two rural geo-locations. In the second stage, we used simple random sampling to select four clusters (administrative units comprised of blocks in the camp settings and neighborhoods in the urban and rural areas) from each geo-location for a total of 24 clusters. The total sample size of 903 households was proportionally allocated to each selected cluster based on the population size of Gaza's governorates [11] (see Supplemental File 1). At the third stage, simple random sampling was employed to select households in the selected clusters using the Palestinian Central Bureau of Statistics' (PCBS) demographic list and with replacement if a house was unoccupied. Within each household, the enumerators selected a household member who was eligible for the vaccine – those above 18 years of age – and expressed availability for the study. The targeting of adults through convenience sampling within households was justified based on experience in Gaza that that members of the household share similar attitudes and behaviors.

For the HCW component of the survey, respondents were identified through a combination of convenience and purposive sampling. Based on consultations with the facility administrators, HCWs were approached to be interviewed based on their availability to respond as well as the position held to ensure representation from a broad cadre of health providers. IMC enumerators administered the survey to the selected HCWs in person at the facilities.

A questionnaire (see Supplemental File 2) was developed based on the World Health Organization (WHO) recommended vaccine hesitancy assessment methodology [12]. Table 1 presents the variables considered in the analysis. The questionnaire was translated into Arabic, and administered using the electronic data collection platform KoBoCollect (UNOCHA). Enumerators entered data using tablets, and data was reviewed for completion and consistency on a daily basis.

Table 1
Thematic areas investigated through vaccine hesitancy instruments

Primary outcome measures and determinants	Variables
Primary outcome: Vaccination status	Vaccinated: Defined as a head of household above 18 years-old who received at least one dose of any COVID-19 vaccine prior to the survey
Primary outcome: Vaccine hesitancy	Vaccine hesitant: defined as lack of intent to receive a COVID-19 vaccine ² .
Demographic variables	Sex Age Governorate Highest level of education Health care worker vs. community member
Information sources and needs	Perception of adequate information on COVID-19 vaccine Information needs (eligibility, timeline, side effects, effectiveness, registration) Current information sources (HCWs, CHWs, radio, television, newspapers, social media, friends and colleagues, local leaders, religious leaders, civil society organizations) Trusted sources (HCWs, CHWs, local leaders, religious leaders, family, neighbors and relatives, organizations, media, radio, television) Use of social media and types Sharing information on social media
Perceived risk	Self-perceived risk to get COVID-19 infection Self-perceived risk to develop severe disease following COVID-19 infection Perception of safety of the COVID-19 vaccine Past event with a vaccine dissuades from receiving the vaccine Knowledge of someone with severe outcome from not being vaccination Preference for herd immunity / natural immunity Belief in better ways to prevent COVID-19 than the vaccine

HCWs = healthcare workers, CHWs = community health workers

Qualitative methods

We also collected qualitative data to gather deeper insights on barriers to vaccine acceptance for triangulation with the household. We conducted in-depth qualitative interviews with key informants (KIs) and focus group discussions (FGDs) with community members using custom interview guides developed for the qualitative component (Supplemental file 2).

Seven in-depth interviews were conducted with KIs who included public health officials (2), a clinician, religious leaders (2), a school director, and a community leader (“mokhtar”). Interviews focused on KIs’ current knowledge and information sources on COVID-19 vaccines, and their perceptions of the public’s vaccine acceptance. Key informants were identified using purposive sampling based on consultation between the consultant epidemiologist leading the data collection and IMC technical staff.

Ten FGDs were conducted across the five governorates with different interest groups, including patients with chronic conditions, people with disabilities, younger and older adults, and elderly community. Each group was convened separately according to sex and consisted of between 7–14 people. Cumulatively 103 people (53 females, 50 males) were consulted through FGDs. Discussions focused on enablers and barriers to vaccine uptake, including current information sources, level of trust in vaccines and the health system, key community influencers on vaccination, and recommendations for improving demand for vaccines. Participants for the focus groups were identified through purposive sampling based on consultations with focal points at the facilities attended by members of the interest groups. Young adults were identified from Al Azhar University and Al Ata’a Society, while patients with chronic diseases, people with disabilities, and other adults were identified from four civil society organizations located in three governorates. See supplemental File 3 for further information on participants in qualitative discussions.

Data collection

Ten survey enumerators (5 men, 5 women) and 2 focus group facilitators (1 male, 1 female) with clinical backgrounds were recruited to collect the qualitative and quantitative data, with six teams formed consisting of two members each. The research consultant provided a one-day training on the quantitative and qualitative tools, interview and sampling protocols, and COVID-19 prevention measures, and followed up regularly during data collection. Oral informed consent was sought from all participants in the surveys, KIs, and qualitative discussions using standard formats. Two staff members from IMC’s monitoring, evaluation, accountability and learning (MEAL) department supervised all data collection in the field, providing daily on-job support and data quality assurance. The teams were required to adhere to COVID-19 preventive measures recommended by the WHO and IMC (physical distancing, mask-wearing, and hand hygiene) during data collection.

Data analysis

The primary outcomes used in the analysis were “COVID-19 vaccination status” and “COVID-19 vaccine hesitancy”. Individuals were classified as vaccinated if they responded “yes” to the question, “Have you already received COVID-19 vaccine?” with at least one dose of any vaccine considered vaccinated. Vaccine hesitancy was classified based on response to the question “If the vaccine was available, would you get it?” according to the SAGE Working Group definition of vaccine hesitancy [2]. For the primary

analysis, COVID-19 “vaccine acceptance” was defined as having a “yes” response to the question or being previously vaccinated. “Vaccine hesitancy” was categorized having a response of either “no” or “don’t know”. In sub-analysis, vaccine hesitancy was analysed for the unvaccinated population only using the same response categorization.

Analyses were conducted using R version 4.0.5 [13] and RStudio version 1.4.1106 [14] with the packages *survey* [15] for all statistics and *gtsummary* [16] for the tables. All statistics described in the Results sections represent population-weighted estimates. Data were weighted to the population using 2017 administrative data provided to IMC by the Palestinian Central Bureau of Statistics, using cluster sampling weights and household weights, and to account for stratification by type of geo-location (rural, urban, and refugee camp). As population in each cluster was not available, cluster weights within each selected geo-location were calculated using average cluster population in the selected geo-location (Supplemental File 4).

Demographic characteristics of the survey respondents are presented in Table 2. Demographic characteristics are presented as both unweighted and weighted univariable statistics, stratified by vaccination status (Table 3) and vaccine hesitancy status (Table 6). Univariable descriptive statistics with both unweighted and weighted results are presented for all other variables in Tables 4 (vaccination status) and 6 (vaccine hesitancy). Distributions of demographic characteristics and risk factor variables were compared using chi-square test with Rao & Scott's second-order correction.

Qualitative data from interviews and focus group discussions (FGDs) was summarized in Word (MS 21) based on review of trends in statements related to vaccine hesitancy and vaccine uptake barriers and enablers. Results of qualitative interviews are triangulated against the survey results.

¹ Geo-locations are comparable to administrative level 3, below the governorate level.

² This survey item had three possible responses (yes, no, unsure). For this analysis, two definitions of hesitancy were applied. For the main analysis, COVID-19 “vaccine acceptance” was defined as someone who either 1) received the vaccine or 2) answered “yes” to the question, “If you could get a COVID-19 vaccine this week, would you get it?”. In sub-analysis, “vaccine hesitancy” was restricted to the non-vaccinated population and categorized as not being vaccinated and having a response of either “no” or “unsure”, according to SAGE Working Group definition of vaccine hesitancy as “delay in acceptance or refusal of vaccination despite the availability of vaccination services.”

Results

Respondent Characteristics

1,075 people (906 community members and 169 health professionals) participated in the survey (Table 1). Females represented 45% of total respondents. The geographic distribution of community member respondents generally mirrors the population of Gaza; the largest proportion of respondents were

from Gaza City (29%) and the lowest from Rafah (9%). 53% of community members and 95% of HCWs held a university-level education.

Table 2
Demographic characteristics of survey respondents

Characteristic	Overall, N = 1,075 ¹	Community Member, N = 906	HCW, N = 169
Age, n (%)			
18–39	659 (61.30)	527 (58.17)	132 (78.11)
40+	416 (38.70)	379 (41.83)	37 (21.89)
Geo-location, n (%)			
Gaza City	313 (29.12)	313 (34.55)	0 (0.00)
Healthcare Facility	169 (15.72)	0 (0.00)	169 (100.00)
Jabalia	190 (17.67)	190 (20.97)	0 (0.00)
Khanyunis	173 (16.09)	173 (19.09)	0 (0.00)
Nuseirat	133 (12.37)	133 (14.68)	0 (0.00)
Rafah	97 (9.02)	97 (10.71)	0 (0.00)
Strata, n (%)			
Camp	323 (30.05)	323 (35.65)	0 (0.00)
Healthcare Facility	168 (15.63)	0 (0.00)	168 (99.41)
Rural	163 (15.16)	162 (17.88)	1 (0.59)
Urban	421 (39.16)	421 (46.47)	0 (0.00)
Sex, n (%)			
Female	480 (44.65)	408 (45.03)	72 (42.60)
Male	595 (55.35)	498 (54.97)	97 (57.40)
Highest education level, n (%)			
Primary or None	83 (7.72)	81 (8.94)	2 (1.18)
Secondary or College / Vocational	353 (32.84)	347 (38.30)	6 (3.55)
University	639 (59.44)	478 (52.76)	161 (95.27)
¹ n (%)			

Vaccine status and characteristics

Population-weighted vaccination coverage was 49.08% (95% CI: 43.10-55.08). Table 3 presents the unweighted and weighted distribution of the characteristics of the population by vaccination status. Males were more likely to be vaccinated than females (54.87% vs 41.45%, OR: 1.72 [95% CI: 1.37–2.16]). Older adults (40 years and older) were more likely to be vaccinated than younger adults (52.96 vs 47.04%, OR: 1.31 [95% CI: 1.14–1.51]). There was an increasing trend in vaccination with higher levels of education; respondents with university degrees were twice as likely to be vaccinated compared to those with primary or no education (OR: 2.12, 95% CI: 1.85–2.42) and those with secondary or college/vocational education were 28% more likely to be vaccinated than those with primary or no formal education (OR: 1.27, 95% CI: 1.03–1.57).

Table 3
Demographic characteristics by vaccination status, community members only

Characteristic	Received Vaccine (Unweighted)			Received Vaccine (Weighted)		
	no, N = 451 ¹	yes, N = 455 ¹	p-value ²	no ³	yes ³	p-value ²
Age			0.008			0.032
<i>18–39</i>	282 (53.51%)	245 (46.49%)		53.83%	46.17%	
<i>40+</i>	169 (44.59%)	210 (55.41%)		47.04%	52.96%	
Sex			< 0.001			0.018
<i>Female</i>	238 (58.33%)	170 (41.67%)		58.55%	41.45%	
<i>Male</i>	213 (42.77%)	285 (57.23%)		45.13%	54.87%	
Highest education level			< 0.001			0.007
<i>Primary or None</i>	49 (60.49%)	32 (39.51%)		62.70%	37.30%	
<i>Secondary or College / Vocational</i>	194 (55.91%)	153 (44.09%)		56.88%	43.12%	
<i>University</i>	208 (43.51%)	270 (56.49%)		44.25%	55.75%	
Governorate			0.66			
<i>Gaza City</i>	159 (50.80%)	154 (49.20%)				
<i>Jabalia</i>	101 (53.16%)	89 (46.84%)				
<i>Khanyunis</i>	80 (46.24%)	93 (53.76%)				
<i>Nuseirat</i>	62 (46.62%)	71 (53.38%)				
<i>Rafah</i>	49 (50.52%)	48 (49.48%)				
Strata			0.12			

	Received Vaccine (Unweighted)		Received Vaccine (Weighted)
<i>Camp</i>	163 (50.46%)	160 (49.54%)	
<i>Rural</i>	69 (42.59%)	93 (57.41%)	
<i>Urban</i>	219 (52.02%)	202 (47.98%)	
¹ n (%)			
² chi-squared test with Rao & Scott's second-order correction			
³ %			

Table 4 presents the unweighted and weighted distribution of risk factors by vaccination status and Table 5a presents the unadjusted odds ratios. Certain perceptions of the risks and trade-offs of the COVID-19 vaccination were associated with vaccination status. The vaccinated had 15 times higher odds of considering the vaccines safe (OR: 15.4 [95% CI: 12.1–19.50]). They were also less likely to express concerns about side effects and less likely prefer natural immunity to the vaccine. The unvaccinated reported concerns specifically about physical disability (27.98%) and death (59.20%) at higher levels than the unvaccinated, while concerns about fever, body aches, and infertility were commonly reported.

Table 4

Knowledge, beliefs, and other factors associated with vaccination status, community members only

Characteristic	N	Received Vaccine (Unweighted)		p-value ²	Received Vaccine (Weighted)		p-value ²
		no, N = 451 ¹	yes, N = 455 ¹		no ¹	yes ¹	
Have enough information about COVID-19 vaccine	906			< 0.001			0.009
<i>Yes</i>		36.09%	63.91%		37.29%	62.71%	
<i>No or Don't know</i>		58.93%	41.07%		61.10%	38.90%	
Information needed	905						
<i>Eligibility criteria</i>		52.79%	47.21%	0.21	50.09%	49.91%	0.84
<i>Timeline for vaccine roll-out</i>		54.69%	45.31%	0.42	56.18%	43.82%	0.18
<i>Knowing when it's my turn to get the vaccine</i>		73.58%	26.42%	< 0.001	69.49%	30.51%	0.007
<i>Doses needed</i>		56.00%	44.00%	0.070	57.14%	42.86%	0.057
<i>Risks and side effects</i>		52.28%	47.72%	< 0.001	52.51%	47.49%	0.22
<i>Effectiveness of the vaccines</i>		50.15%	49.85%	0.75	51.03%	48.97%	0.92
<i>How to register for the vaccine</i>		74.29%	25.71%	< 0.001	62.05%	37.95%	0.038
Common source of information about health and vaccines	904						
<i>Health care providers</i>		45.00%	55.00%	< 0.001	47.00%	53.00%	0.21
<i>Community health care workers</i>		44.34%	55.66%	0.071	45.58%	54.42%	0.26
<i>Radio</i>		57.66%	42.34%	0.077	52.37%	47.63%	0.67
<i>Television</i>		52.42%	47.58%	0.30	54.48%	45.52%	0.38
<i>Newspapers</i>		43.48%	56.52%	0.54	37.96%	62.04%	0.072
<i>Mass events</i>		71.43%	28.57%	< 0.001	79.47%	20.53%	0.014
<i>Family</i>		58.99%	41.01%	0.002	56.04%	43.96%	0.12

	N	Received Vaccine (Unweighted)			Received Vaccine (Weighted)		
<i>Neighbors, friends, colleagues</i>		59.03%	40.97%	< 0.001	59.32%	40.68%	0.008
<i>Local leaders</i>		39.13%	60.87%	0.30	36.73%	63.27%	0.27
<i>Religious leaders</i>		33.33%	66.67%	0.044	34.51%	65.49%	0.028
<i>Social media</i>		51.52%	48.48%	0.22	50.80%	49.20%	0.95
<i>Organizations</i>		31.08%	68.92%	< 0.001	33.96%	66.04%	0.10
Trusted source of information	906						
<i>Health care providers</i>		45.12%	54.88%	< 0.001	47.40%	52.60%	0.053
<i>Community health care workers</i>		46.46%	53.54%	0.25	47.16%	52.84%	0.19
<i>Local leaders</i>		66.67%	33.33%	0.41	53.51%	46.49%	0.96
<i>Religious leaders</i>		45.45%	54.55%	0.77	51.33%	48.67%	0.99
<i>Family members</i>		59.52%	40.48%	0.20	56.24%	43.76%	0.24
<i>Neighbors, friends, colleagues</i>		66.67%	33.33%	0.016	72.42%	27.58%	0.10
<i>Organizations</i>		34.69%	65.31%	< 0.001	36.14%	63.86%	0.067
<i>Media</i>		66.09%	33.91%	< 0.001	62.30%	37.70%	0.17
<i>Radio</i>		44.00%	56.00%	0.56	64.77%	35.23%	0.067
<i>Television</i>		54.65%	45.35%	0.34	57.50%	42.50%	0.31
<i>Other</i>		58.62%	41.38%	0.16	53.92%	46.08%	0.61
Trust health providers and CHWS to provide with accurate information about the COVID-19 vaccine	903			< 0.001			0.007
<i>No or Don't know</i>		60.77%	39.23%		62.67%	37.33%	
<i>Yes</i>		42.83%	57.17%		43.70%	56.30%	
<i>Somewhat</i>		58.37%	41.63%		57.01%	42.99%	

	N	Received Vaccine (Unweighted)			Received Vaccine (Weighted)		
Follow social media platforms to get info about vaccine	906			> 0.99			0.81
<i>No or Don't know</i>		49.77%	50.23%		52.18%	47.82%	
<i>Yes</i>		49.78%	50.22%		50.61%	49.39%	
Social media platforms used to get info about vaccine	685						
<i>Facebook</i>		50.30%	49.70%	0.052	50.99%	49.01%	0.057
<i>Twitter</i>		43.09%	56.91%	0.10	38.48%	61.52%	0.057
<i>Instagram</i>		51.72%	48.28%	0.43	51.00%	49.00%	0.87
<i>YouTube</i>		47.53%	52.47%	0.51	46.97%	53.03%	0.14
Shares information related to vaccine on social media network	863	35.84%	64.16%	< 0.001	34.70%	65.30%	0.061
How do you know info about vaccine from social media is true	906			< 0.001			0.003
<i>I do not verify</i>		64.73%	35.27%		68.79%	31.21%	
<i>Other</i>		55.22%	44.78%		49.23%	50.77%	
<i>Verify from reputable website or health care provider</i>		41.62%	58.38%		41.70%	58.30%	
Do leaders (religious, political, teachers, health care workers) in your community support the COVID-19 vaccines?	525			0.061			0.62
<i>No or Don't know</i>		55.80%	44.20%		51.79%	48.21%	
<i>Yes</i>		46.51%	53.49%		49.53%	50.47%	
Most people you know interested in getting the COVID-19 vaccine?	906			< 0.001			< 0.001
<i>No or Don't know</i>		65.25%	34.75%		68.58%	31.42%	
<i>Yes</i>		33.55%	66.45%		33.88%	66.12%	
<i>Somewhat</i>		52.65%	47.35%		53.64%	46.36%	

	N	Received Vaccine (Unweighted)		Received Vaccine (Weighted)	
How many people in your community are concerned about COVID-19 in the community	691			0.022	0.015
<i>Few or some people, less than half</i>		53.85%	46.15%	49.17%	50.83%
<i>Most people</i>		58.22%	41.78%	66.55%	33.45%
<i>Some people – more than half</i>		46.44%	53.56%	45.51%	54.49%
COVID-19 vaccines will or are being rolled out equitably in community	902			0.056	0.17
<i>No or Don't know</i>		56.25%	43.75%	53.98%	46.02%
<i>Yes</i>		48.21%	51.79%	49.86%	50.14%
Knows somebody that had a serious negative reaction to a vaccine that makes them reluctant to get COVID-19 vaccine	905			< 0.001	0.052
<i>Yes</i>		59.03%	40.97%	60.15%	39.85%
<i>Somewhat</i>		54.78%	45.22%	54.11%	45.89%
<i>No or Don't know</i>		43.43%	56.57%	43.19%	56.81%
Consider COVID-19 vaccines safe	905			< 0.001	0.001
<i>No or Don't know</i>		73.13%	26.87%	77.16%	22.84%
<i>Yes</i>		17.39%	82.61%	17.95%	82.05%
<i>Somewhat</i>		40.54%	59.46%	38.22%	61.78%
Concerned about risks or side effects with COVID-19 vaccines	906			< 0.001	< 0.001
<i>No or Don't know</i>		22.27%	77.73%	21.43%	78.57%
<i>Yes</i>		67.23%	32.77%	71.92%	28.08%
<i>Somewhat</i>		28.66%	71.34%	28.46%	71.54%
Type of risks or side effects concerned about	693				

	N	Received Vaccine (Unweighted)			Received Vaccine (Weighted)		
<i>Fever</i>		57.91%	42.09%	0.89	63.78%	36.22%	0.56
<i>Body aches</i>		59.25%	40.75%	0.46	64.84%	35.16%	0.28
<i>Infertility</i>		65.06%	34.94%	0.039	67.44%	32.56%	0.11
<i>Physical disability</i>		70.11%	29.89%	< 0.001	78.18%	21.82%	0.007
<i>Death</i>		70.23%	29.77%	< 0.001	73.18%	26.82%	0.035
<i>Other</i>		63.81%	36.19%	0.20	68.05%	31.95%	0.15
Type of COVID vaccine preferred	905			< 0.001			0.001
<i>Other</i>		0.00%	100.00%		0.00%	100.00%	
<i>No preference</i>		70.25%	29.75%		70.99%	29.01%	
<i>Pfizer</i>		41.14%	58.86%		44.13%	55.87%	
<i>Sputnik</i>		38.22%	61.78%		36.37%	63.63%	
<i>Moderna</i>		14.29%	85.71%		13.91%	86.09%	
<i>Unsure</i>		75.86%	24.14%		87.14%	12.86%	
<i>Sinopharm</i>		63.64%	36.36%		46.72%	53.28%	
Believe there are other (better) ways to prevent COVID-19 instead of vaccine	906			< 0.001			0.033
<i>No or Don't know</i>		30.03%	69.97%		27.78%	72.22%	
<i>Yes</i>		65.85%	34.15%		68.60%	31.40%	
<i>Somewhat</i>		42.76%	57.24%		49.78%	50.22%	
Better ways to prevent COVID-19 instead of vaccine	448						
<i>Social distance</i>		64.99%	35.01%	0.38	67.60%	32.40%	0.49
<i>Handwashing</i>		65.13%	34.87%	0.55	68.79%	31.21%	0.82
<i>Infection prevention and control</i>		67.34%	32.66%	0.55	72.31%	27.69%	0.15
<i>Ventilation</i>		67.31%	32.69%	0.54	71.95%	28.05%	0.060
<i>Wearing face masks</i>		64.39%	35.61%	0.22	67.05%	32.95%	0.10

	N	Received Vaccine (Unweighted)		Received Vaccine (Weighted)	
Know any person with a serious disease / disability that happened because they were NOT vaccinated	905		0.25		0.66
<i>Yes</i>		45.26%	54.74%	47.31%	52.69%
<i>No or Don't know</i>		50.65%	49.35%	51.80%	48.20%
Think it is better to get COVID-19 and develop natural immunity than to get the vaccine	905		< 0.001		< 0.001
<i>No</i>		29.34%	70.66%	30.33%	69.67%
<i>Don't know</i>		58.82%	41.18%	52.89%	47.11%
<i>Yes</i>		73.42%	26.58%	73.76%	26.24%
<i>Somewhat</i>		48.84%	51.16%	50.14%	49.86%
Think you are at risk to get COVID-19	905		0.36		0.58
<i>No</i>		42.70%	57.30%	51.39%	48.61%
<i>Don't know</i>		50.00%	50.00%	46.86%	53.14%
<i>Yes</i>		50.67%	49.33%	51.30%	48.70%
Think you can get seriously ill, hospitalized or die if you get COVID-19	906		0.034		0.78
<i>No</i>		44.57%	55.43%	49.41%	50.59%
<i>Don't know</i>		53.90%	46.10%	52.63%	47.37%
<i>Yes</i>		52.73%	47.27%	51.26%	48.74%
	1%				
² chi-squared test with Rao & Scott's second-order correction					

More than 80% of both groups believed they were at risk from COVID-19 infection, which did not vary significantly among the vaccinated and unvaccinated population ($p > 0.05$). Less than one-third believed they were at risk of severe illness and hospitalization (OR: 0.86, 95% CI: 0.59–1.24). This suggests perceptions of risk of infection are universally high; however, people do not believe they are at risk of developing serious disease, and this perception is more widely held among the unvaccinated population.

Generally, there was wide consensus in the focus group discussions on the benefits of the vaccine, which did not vary among the different demographic groups consulted.

“If there were no vaccine, the disease would have significantly spread; thanks to God and the vaccine, the vaccine reduced the disease. In the beginning, we heard that the vaccine was not perfect, and we [were] afraid, but later we have received it. – FGD, adult male, Diwan Community, Middle Governorate

Perceptions of adequate vaccine information and the channels used to access information differed among the vaccinated and unvaccinated population. 54.62% of vaccinated individuals reported having enough information about the vaccine, while 31.30% of the unvaccinated believed they received sufficient information. Those who reported having inadequate information had 60% lower odds of being vaccinated (OR: 0.38. [95% CI 0.20–0.52]). Among both vaccinated and unvaccinated individuals, information on side effects and effectiveness of the vaccines was the most requested information, with more than 85% of both groups requesting this information. Notably slightly more than 11% of the unvaccinated expressed interest in information on how to register for the vaccine (Table 8).

Sources of information on COVID-19 vaccines varied among vaccinated and unvaccinated respondents. Social media was the most common source of information overall (61.64% among the vaccinated and 61.33% among the unvaccinated). Among the respondents receiving information from social media, nearly all used Facebook and around half referenced Instagram. However when asked about information sources on the vaccine, media including social media, television, radio and newspapers were not associated with vaccine status in the weighted analysis (p-value < 0.05). There was no difference in social media use among vaccinated and unvaccinated individuals or in the use of specific platforms.

Other common sources were healthcare workers (65.31% of the vaccinated vs 55.83% of the unvaccinated, p = 0.21); neighbors, friends, and colleagues (35.40% of the vaccinated vs 49.73% of the unvaccinated, p < 0.01); and family (30.26% of the vaccinated vs 37.18% of the unvaccinated, p = 0.12). Those who were vaccinated were more likely to report commonly receiving information on the vaccine from newspapers, religious leaders, civil society organizations, and to trust the information received from healthcare providers (OR p-values < 0.05). The unvaccinated were more likely to receive information from mass events, family, and neighbors, friends, and colleagues (OR p-values < 0.05).

Similar to community members, KIs widely cited health authorities as trustworthy sources of information. A school director interviewed stated that he trusted the Ministry of Health, but does not trust Facebook and YouTube because many videos portray the virus as a conspiracy.

“The available information was superficial and not in-depth about the necessity of vaccination because it reduces the harmful effects of the virus.” – KII, School Director, Gaza

A community leader (Mokhtar) also expressed confidence in the MoH and official health sources:

“I follow the news, websites, health bulletins, MoH, WHO in numbers of infected people and deaths, the causes or complications resulting from not receiving the vaccine.”- KII, Mokhtar, Gaza

Multivariable regression provided further evidence for demographic characteristics as independent determinants of vaccination status (Table 5b). In the adjusted model, vaccination was around twice as likely among males (aOR: 1.88, 95% CI: 1.20–2.95), older compared to younger adults (aOR: 1.92, 95% CI: 1.73–2.13), and the university educated compared to those with primary or no education (aOR: 2.10, 95% CI: 1.51–3.17). The vaccinated were less likely to report having insufficient information on the vaccine (aOR: 0.62, 95% CI: 0.48–0.80) as well as more likely to consider the vaccines safe (aOR: 13.8 (10.1–18.8) or somewhat safe (aOR: 5.41, 95% CI: 3.69–7.94). However perception of severe risk was not independently significantly associated with vaccination status (aOR 0.86, 95% CI: 0.59–1.24), nor were sources of information, after controlling for demographic characteristics and other risk factors.

Table 5

a. Unadjusted Odds ratios of vaccine receipt by respondent characteristics, weighted

Characteristic	OR (95% CI)¹	p-value
Sex		< 0.001
<i>Female</i>	–	
<i>Male</i>	1.72 (1.37 to 2.16)	
Age		< 0.001
<i>18–39</i>	–	
<i>40+</i>	1.31 (1.14 to 1.51)	
Highest education level		< 0.001
<i>Primary or None</i>	–	
<i>Secondary or College / Vocational</i>	1.27 (1.03 to 1.57)	
<i>University</i>	2.12 (1.85 to 2.42)	
Have enough information about COVID-19 vaccine		< 0.001
<i>Yes</i>	–	
<i>No or Don't know</i>	0.38 (0.28 to 0.52)	
Information needed		
<i>Eligibility criteria</i>	1.07 (0.56 to 2.05)	0.83
<i>Timeline for vaccine roll-out</i>	0.79 (0.60 to 1.04)	0.087
<i>Knowing when it's my turn to get the vaccine</i>	0.42 (0.33 to 0.55)	< 0.001
<i>Doses needed</i>	0.72 (0.58 to 0.89)	0.003
<i>Risks and side effects</i>	0.59 (0.30 to 1.15)	0.12
<i>Effectiveness of the vaccines</i>	0.98 (0.69 to 1.39)	0.91
<i>How to register for the vaccine</i>	0.61 (0.46 to 0.80)	< 0.001
Common source of information about health and vaccines		
<i>Health care providers</i>	1.49 (0.91 to 2.45)	0.12
<i>Community health care workers</i>	1.29 (0.90 to 1.84)	0.17
<i>Radio</i>	0.94 (0.70 to 1.24)	0.64
<i>Television</i>	0.81 (0.55 to 1.20)	0.30

Characteristic	OR (95% CI)¹	p-value
<i>Newspapers</i>	1.71 (1.16 to 2.52)	0.007
<i>Mass events</i>	0.25 (0.14 to 0.44)	< 0.001
<i>Family</i>	0.73 (0.55 to 0.98)	0.033
<i>Neighbors, friends, colleagues</i>	0.55 (0.46 to 0.66)	< 0.001
<i>Local leaders</i>	1.82 (0.76 to 4.35)	0.18
<i>Religious leaders</i>	2.04 (1.43 to 2.92)	< 0.001
<i>Social media</i>	1.01 (0.70 to 1.47)	0.94
<i>Organizations</i>	2.35 (1.13 to 4.88)	0.022
Trusted source of information		
<i>Health care providers</i>	1.54 (1.17 to 2.03)	0.002
<i>Community health care workers</i>	1.23 (0.97 to 1.56)	0.088
<i>Local leaders</i>	0.56 (0.37 to 0.84)	0.005
<i>Religious leaders</i>	0.74 (0.46 to 1.19)	0.22
<i>Family members</i>	0.80 (0.59 to 1.08)	0.14
<i>Neighbors, friends, colleagues</i>	0.37 (0.16 to 0.87)	0.022
<i>Organizations</i>	0.90 (0.03 to 28.6)	0.95
<i>Media</i>	0.98 (0.17 to 5.84)	0.99
<i>Radio</i>	0.59 (0.32 to 1.06)	0.077
<i>Television</i>	2.05 (1.23 to 3.40)	0.006
<i>Other</i>	0.88 (0.57 to 1.36)	0.57
Follow social media platforms to get info about vaccine		0.79
<i>No or Don't know</i>	—	
<i>Yes</i>	1.06 (0.67 to 1.68)	
Social media platforms used to get info about vaccine	0.09 (0.01 to 0.64)	0.016
<i>Facebook</i>	1.82 (1.23 to 2.70)	0.003
<i>Twitter</i>	0.97 (0.72 to 1.32)	0.85
<i>Instagram</i>	1.21 (1.00 to 1.45)	0.046
<i>YouTube</i>		0.004

Characteristic	OR (95% CI) ¹	p-value
Shares information related to vaccine on social media network	—	
<i>No</i>	2.20 (1.29 to 3.75)	
<i>Yes</i>		0.60
How do you know info about vaccine from social media is true		< 0.001
<i>I do not verify</i>	—	
<i>Other</i>	2.27 (1.87 to 2.76)	
<i>Verify from reputable website or health care provider</i>	3.08 (2.31 to 4.11)	
Think you can get seriously ill, hospitalized or die if you get COVID-19		< 0.001
<i>No</i>	—	
<i>Don't know</i>	15.4 (12.2 to 19.6)	
<i>Yes</i>	5.46 (3.56 to 8.38)	
Consider COVID-19 vaccines safe		< 0.001
<i>No or Don't know</i>	—	
<i>Yes</i>	2.27 (1.87 to 2.76)	
<i>Somewhat</i>	3.08 (2.31 to 4.11)	
¹ OR = Odds Ratio, CI = Confidence Interval		

Table 5
b. Adjusted Odds ratios of vaccine receipt by respondent characteristics

Characteristic	OR (95% CI) ¹	p-value
Sex		0.006
<i>Female</i>	—	
<i>Male</i>	1.88 (1.20 to 2.95)	
Age		< 0.001
<i>18–39</i>	—	
<i>40+</i>	1.92 (1.73 to 2.13)	
Highest education level		< 0.001
<i>Primary or None</i>	—	
<i>Secondary or College / Vocational</i>	1.39 (0.92 to 2.09)	
<i>University</i>	2.19 (1.51 to 3.17)	
Have enough information about COVID-19 vaccine		< 0.001
<i>Yes</i>	—	
<i>No or Don't know</i>	0.62 (0.48 to 0.80)	
Common source of information about health and vaccines		
<i>Health care providers (ref: no)</i>	1.03 (0.50 to 2.14)	0.93
<i>Family (ref: no)</i>	1.11 (0.66 to 1.86)	0.70
<i>Social media (ref: no)</i>	0.86 (0.62 to 1.19)	0.37
Trust health care providers for information on COVID-19 vaccine	1.24 (1.00 to 1.54)	0.052
Consider COVID-19 vaccines safe		< 0.001
<i>No or Don't know</i>	—	
<i>Yes</i>	13.8 (10.1 to 18.8)	
<i>Somewhat</i>	5.41 (3.69 to 7.94)	
Think you can get seriously ill, hospitalized or die if you get COVID-19		0.62
<i>No</i>	—	
<i>Don't know</i>	1.02 (0.78 to 1.32)	
<i>Yes</i>	0.86 (0.59 to 1.24)	

Characteristic	OR (95% CI) ¹	p-value
¹ OR = Odds Ratio, CI = Confidence Interval		

Vaccine hesitancy and risk factors

Vaccine hesitancy was 34.08% (95% CI: 28.14–40.56) among both vaccinated and unvaccinated respondents³, and 67.24% (95% CI: 49.04–81.41) among the unvaccinated (n = 449)⁴. Table 6 presents the unweighted and weighted distribution of the characteristics of the population by vaccine hesitancy status. Among the overall population, males were less likely to report hesitancy (OR: 0.66 [95%CI: 0.59–0.75]). Other demographic characteristics were not significantly associated with vaccine hesitancy (p > 0.05) (Table 6).

Table 6
Demographic characteristics by vaccine hesitancy status, community members only

Characteristic	Vaccine Hesitant (Unweighted)			Vaccine Hesitant (Weighted)		
	no, N = 604 ¹	yes, N = 300 ¹	p-value ²	no ³	yes ³	p-value ²
Age			0.075			0.22
<i>18–39</i>	339 (64.45%)	187 (35.55%)		63.15%	36.85%	
<i>40+</i>	265 (70.11%)	113 (29.89%)		69.63%	30.37%	
Sex			0.082			0.006
<i>Female</i>	259 (63.79%)	147 (36.21%)		60.68%	39.32%	
<i>Male</i>	345 (69.28%)	153 (30.72%)		69.90%	30.10%	
Highest education level			0.001			0.18
<i>Primary or None</i>	40 (50.00%)	40 (50.00%)		46.80%	53.20%	
<i>Secondary or College / Vocational</i>	227 (65.42%)	120 (34.58%)		63.26%	36.74%	
<i>University</i>	337 (70.65%)	140 (29.35%)		71.58%	28.42%	
Governorate			0.060			
<i>Gaza City</i>	199 (63.58%)	114 (36.42%)				
<i>Jabalia</i>	124 (65.96%)	64 (34.04%)				
<i>Khanyunis</i>	132 (76.30%)	41 (23.70%)				
<i>Nuseirat</i>	87 (65.41%)	46 (34.59%)				
<i>Rafah</i>	62 (63.92%)	35 (36.08%)				
Strata			0.14			
<i>Camp</i>	211 (65.73%)	110 (34.27%)				

	Vaccine Hesitant (Unweighted)		Vaccine Hesitant (Weighted)
<i>Rural</i>	119 (73.46%)	43 (26.54%)	
<i>Urban</i>	274 (65.08%)	147 (34.92%)	
¹ n (%)			
² chi-squared test with Rao & Scott's second-order correction			
³ %			

Table 7 presents the unweighted and weighted distribution of the risk factors for vaccine hesitancy and Table 8a provides the unadjusted Odds Ratios. The main factors the vaccine hesitant reported as barriers to getting the vaccine were stress associated with the vaccine (50.99%), lack of social acceptance (31.08%), and lack of information on the vaccines (20.41%). Notably, these were not statistically different from barriers reported by non-hesitant individuals suggesting it represents a broader trend.

Table 7

Knowledge, beliefs and other factors associated with vaccine hesitancy, community members only

Characteristic	N	Vaccine hesitant (Unweighted)		p-value ²	Vaccine hesitant (Weighted)		
		no, N = 604 ¹	yes, N = 300 ¹		no, N = 925,538 ¹	yes, N = 478,414 ¹	p-value ²
Have enough information about COVID-19 vaccine	904			< 0.001			0.041
<i>Yes</i>		76.58%	23.42%		77.33%	22.67%	
<i>No or Don't know</i>		60.26%	39.74%		57.40%	42.60%	
Information needed	903						
<i>Eligibility criteria</i>		63.61%	36.39%	0.15	64.86%	35.14%	0.85
<i>Timeline for vaccine roll-out</i>		64.06%	35.94%	0.63	65.72%	34.28%	0.96
<i>Knowing when it's my turn to get the vaccine</i>		52.83%	47.17%	0.027	55.66%	44.34%	0.035
<i>Doses needed</i>		60.57%	39.43%	0.053	59.23%	40.77%	0.094
<i>Risks and side effects</i>		65.45%	34.55%	0.045	65.53%	34.47%	0.77
<i>Effectiveness of the vaccines</i>		66.86%	33.14%	0.92	66.45%	33.55%	0.30
<i>How to register for the vaccine</i>		48.57%	51.43%	< 0.001	56.45%	43.55%	0.052
Common source of information about health and vaccines	902						
<i>Health care providers</i>		70.34%	29.66%	0.003	70.02%	29.98%	0.062
<i>Community health care workers</i>		70.62%	29.38%	0.19	68.52%	31.48%	0.44
<i>Radio</i>		55.86%	44.14%	0.009	58.08%	41.92%	0.10
<i>Television</i>		63.20%	36.80%	0.13	60.51%	39.49%	0.42
<i>Newspapers</i>		60.87%	39.13%	0.54	62.45%	37.55%	0.45
<i>Mass events</i>		54.10%	45.90%	0.029	47.28%	52.72%	0.10
<i>Family</i>		59.53%	40.47%	0.009	58.14%	41.86%	0.029
<i>Neighbors, friends, colleagues</i>		57.93%	42.07%	< 0.001	58.14%	41.86%	0.070

	N	Vaccine hesitant (Unweighted)			Vaccine hesitant (Weighted)		
<i>Local leaders</i>		78.26%	21.74%	0.24	83.43%	16.57%	0.42
<i>Religious leaders</i>		77.78%	22.22%	0.16	78.77%	21.23%	0.11
<i>Social media</i>		67.93%	32.07%	0.41	67.80%	32.20%	0.12
<i>Organizations</i>		83.11%	16.89%	< 0.001	80.50%	19.50%	0.042
Trusted source of information	904						
<i>Health care providers</i>		71.96%	28.04%	< 0.001	70.49%	29.51%	0.006
<i>Community health care workers</i>		69.03%	30.97%	0.42	66.66%	33.34%	0.82
<i>Local leaders</i>		83.33%	16.67%	0.39	98.54%	1.46%	0.012
<i>Religious leaders</i>		54.55%	45.45%	0.39	48.67%	51.33%	0.53
<i>Family members</i>		47.62%	52.38%	0.007	53.47%	46.53%	0.039
<i>Neighbors, friends, colleagues</i>		43.75%	56.25%	< 0.001	40.78%	59.22%	0.065
<i>Organizations</i>		80.27%	19.73%	< 0.001	79.91%	20.09%	0.007
<i>Media</i>		53.04%	46.96%	< 0.001	56.90%	43.10%	0.035
<i>Radio</i>		64.00%	36.00%	0.76	40.82%	59.18%	0.010
<i>Television</i>		61.63%	38.37%	0.28	57.24%	42.76%	0.43
<i>Other</i>		54.39%	45.61%	0.040	54.77%	45.23%	0.058
Trust health providers and CHWS to provide with accurate information about the COVID-19 vaccine	901			< 0.001			0.005
<i>No or Don't know</i>		45.38%	54.62%		44.80%	55.20%	
<i>Yes</i>		77.86%	22.14%		77.87%	22.13%	
<i>Somewhat</i>		55.47%	44.53%		56.82%	43.18%	
Follow social media platforms to get info about vaccine	904			0.35			0.16

	N	Vaccine hesitant (Unweighted)		Vaccine hesitant (Weighted)			
<i>No or Don't know</i>		64.25%	35.75%		61.44%	38.56%	
<i>Yes</i>		67.64%	32.36%		67.03%	32.97%	
Social media platforms used to get info about vaccine:	683						
<i>Facebook</i>		67.31%	32.69%	0.19	66.75%	33.25%	0.015
<i>Twitter</i>		69.92%	30.08%	0.55	76.21%	23.79%	0.19
<i>Instagram</i>		67.05%	32.95%	0.79	65.91%	34.09%	0.63
<i>YouTube</i>		64.20%	35.80%	0.28	67.31%	32.69%	0.93
Shares information related to vaccine on social media network	861	78.61%	21.39%	< 0.001	83.85%	16.15%	0.014
How do you know info about vaccine from social media is true	904			< 0.001			0.006
<i>I do not verify</i>		47.92%	52.08%		45.71%	54.29%	
<i>Other</i>		60.45%	39.55%		65.37%	34.63%	
<i>Verify from reputable website or health care provider</i>		76.98%	23.02%		77.04%	22.96%	
Do leaders (religious, political, teachers, health care workers) in your community support the COVID-19 vaccines?	525			0.009			0.24
<i>No or Don't know</i>		60.14%	39.86%		63.92%	36.08%	
<i>Yes</i>		72.09%	27.91%		71.03%	28.97%	
Most people you know interested in getting the COVID-19 vaccine	904			< 0.001			0.017
<i>No or Don't know</i>		47.88%	52.12%		47.70%	52.30%	
<i>Yes</i>		85.62%	14.38%		85.61%	14.39%	
<i>Somewhat</i>		64.31%	35.69%		61.11%	38.89%	

	N	Vaccine hesitant (Unweighted)		Vaccine hesitant (Weighted)	
How many people in your community are concerned about COVID-19 in the community	689			0.024	0.35
<i>Few or some people, less than half</i>		55.94%	44.06%	60.32%	39.68%
<i>Most people</i>		66.07%	33.93%	61.78%	38.22%
<i>Some people – more than half</i>		68.94%	31.06%	69.98%	30.02%
COVID-19 vaccines will or are being rolled out equitably in community	900			0.023	0.27
<i>No or Don't know</i>		59.66%	40.34%	62.59%	37.41%
<i>Yes</i>		68.65%	31.35%	67.19%	32.81%
Knows somebody that had a serious negative reaction to a vaccine that makes them reluctant to get COVID-19 vaccine	903			< 0.001	0.17
<i>Yes</i>		57.49%	42.51%	57.53%	42.47%
<i>Somewhat</i>		60.87%	39.13%	59.00%	41.00%
<i>No or Don't know</i>		73.45%	26.55%	74.52%	25.48%
Consider COVID-19 vaccines safe	903			< 0.001	0.007
<i>No or Don't know</i>		43.00%	57.00%	41.46%	58.54%
<i>Yes</i>		95.17%	4.83%	96.19%	3.81%
<i>Somewhat</i>		79.39%	20.61%	78.03%	21.97%
Concerned about risks or side effects with COVID-19 vaccines	904			< 0.001	0.003
<i>No or Don't know</i>		89.05%	10.95%	90.53%	9.47%
<i>Yes</i>		52.83%	47.17%	49.04%	50.96%
<i>Somewhat</i>		83.54%	16.46%	82.41%	17.59%
Risks or side effects concerned about	692				

	N	Vaccine hesitant (Unweighted)			Vaccine hesitant (Weighted)		
<i>Fever</i>		61.66%	38.34%	0.37	55.57%	44.43%	0.76
<i>Body aches</i>		60.42%	39.58%	0.83	55.62%	44.38%	0.49
<i>Infertility</i>		49.40%	50.60%	0.001	43.48%	56.52%	0.014
<i>Physical disability</i>		46.82%	53.18%	< 0.001	40.03%	59.97%	0.009
<i>Death</i>		47.69%	52.31%	< 0.001	44.25%	55.75%	0.073
<i>Other</i>		54.29%	45.71%	0.19	53.52%	46.48%	0.39
Type of COVID vaccine preferred	903			< 0.001			0.004
<i>Other</i>		100.00%	0.00%		100.00%	0.00%	
<i>No preference</i>		37.92%	62.08%		38.22%	61.78%	
<i>Pfizer</i>		79.02%	20.98%		76.28%	23.72%	
<i>Sputnik</i>		83.77%	16.23%		85.30%	14.70%	
<i>Moderna</i>		85.71%	14.29%		86.09%	13.91%	
<i>Unsure</i>		41.38%	58.62%		37.28%	62.72%	
<i>Sinopharm</i>		72.73%	27.27%		87.09%	12.91%	
Believe there are other (better) ways to prevent COVID-19 instead of vaccine	904			< 0.001			0.016
<i>No or Don't know</i>		84.35%	15.65%		85.35%	14.65%	
<i>Yes</i>		52.13%	47.87%		50.59%	49.41%	
<i>Somewhat</i>		74.31%	25.69%		68.15%	31.85%	
Better ways to prevent COVID-19 instead of vaccine	447						
<i>Social distance</i>		53.19%	46.81%	0.30	51.68%	48.32%	0.25
<i>Handwashing</i>		53.18%	46.82%	0.41	49.45%	50.55%	0.35
<i>Infection prevention and control</i>		49.25%	50.75%	0.28	47.70%	52.30%	0.27
<i>Ventilation</i>		50.96%	49.04%	0.65	45.96%	54.04%	0.29

	N	Vaccine hesitant (Unweighted)			Vaccine hesitant (Weighted)		
<i>Wearing face masks</i>		53.71%	46.29%	0.20	50.57%	49.43%	0.99
Know any person with a serious disease / disability that happened because they were NOT vaccinated	903			0.008			0.22
<i>Yes</i>		76.64%	23.36%		79.21%	20.79%	
<i>No or Don't know</i>		65.01%	34.99%		63.09%	36.91%	
Think it is better to get COVID-19 and develop natural immunity than to get the vaccine	903			< 0.001			0.005
<i>No</i>		85.46%	14.54%		85.55%	14.45%	
<i>Don't know</i>		57.35%	42.65%		55.39%	44.61%	
<i>Yes</i>		45.22%	54.78%		46.42%	53.58%	
<i>Somewhat</i>		67.44%	32.56%		64.41%	35.59%	
Remember past events that would discourage them from getting COVID-19 vaccine	449	30.43%	69.57%	0.36	31.16%	68.84%	0.52
Think you are at risk to get COVID-19	903			0.11			0.30
<i>No</i>		65.17%	34.83%		63.04%	36.96%	
<i>Don't know</i>		55.71%	44.29%		55.03%	44.97%	
<i>Yes</i>		68.01%	31.99%		67.39%	32.61%	
Think you can get seriously ill, hospitalized or die if you get COVID-19	904			0.014			0.072
<i>No</i>		69.57%	30.43%		64.97%	35.03%	
<i>Don't know</i>		60.00%	40.00%		60.70%	39.30%	
<i>Yes</i>		70.31%	29.69%		72.77%	27.23%	
Barriers for receiving COVID-19 vaccine	448						
<i>Availability</i>		28.57%	71.43%	0.72	48.21%	51.79%	0.15
<i>Distance to vaccination point</i>		34.62%	65.38%	0.86	42.59%	57.41%	0.30

	N	Vaccine hesitant (Unweighted)		Vaccine hesitant (Weighted)			
<i>Cost</i>		NA%	NA%		NA%	NA%	
<i>Not a priority group</i>		31.03%	68.97%	0.81	13.55%	86.45%	0.23
<i>Lack of information about how / where to get it</i>		31.63%	68.37%	0.74	35.19%	64.81%	0.57
<i>Too stressful</i>		31.71%	68.29%	0.65	30.33%	69.67%	0.10
<i>Staff attitude</i>		33.33%	66.67%	0.98	34.61%	65.39%	0.92
<i>Not socially acceptable</i>		13.49%	86.51%	< 0.001	15.07%	84.93%	0.063
<i>None</i>		32.65%	67.35%	0.95	38.87%	61.13%	0.37
Would get / have gotten the vaccine if employer recommended	449			< 0.001			0.089
<i>No</i>		18.24%	81.76%		21.09%	78.91%	
<i>Unsure</i>		14.71%	85.29%		9.32%	90.68%	
<i>Yes</i>		49.55%	50.45%		48.71%	51.29%	
		1%					
² chi-squared test with Rao & Scott's second-order correction							

Common sources of vaccine information among the hesitant population were social media (58.18%); HCWs (53.29%); friends, neighbors and colleagues (52.52%); and family (41.55%). Notably, those classified as hesitant were more likely to report family (OR: 1.68, 95% CI 1.29–2.17); friends, neighbors and colleagues (OR: 1.83, 95% CI: 1.19–2.83); radio (OR: 1.48, 95% CI: 1.07–2.04); and mass events (OR 2.28, 95% CI: 1.12–4.62) as important sources of information, and less likely to mention HCWs (OR: 0.64, 95% CI: 0.47–0.86); religious leaders (OR: 0.51: 0.28–0.92); and civil society organization (OR: 0.41, 0.24–0.69). They were also more likely to trust family (OR: 1.75, 1.28–2.40); neighbors, friends and colleagues (OR: 3.04, 1.37–6.74); and the media (OR: 1.56, 1.23–1.98) for information on COVID-19 vaccines. They were less likely to trust HCWs (OR: 0.55, 0.46–0.65) and local leaders (OR: 0.03, 0.00–0.22) for accurate vaccine information.

Perceptions of vaccine safety and effectiveness also appear to impact vaccine hesitancy. Those classified as hesitant were far less likely to consider the vaccines safe (2.33% vs 30.34%, OR: 0.03 [95% CI: 0.01–0.16]). Around 80% of both hesitant and non-hesitant groups believed they were at risk of getting COVID-19 ; however the hesitant were less likely to consider themselves at risk of severe disease or

hospitalization if they contract COVID-19 (OR: 0.69, 95% CI: 0.50–0.97). Limited percentages of both groups perceived risk of serious outcome.

In focus group discussions, some community members voiced skepticism of the efficacy of the vaccines, linking their roll-out to financial opportunism; however there was no consensus as others referenced the vaccine being free of charge.

“From my point of view, I see that it is financial and trade between countries... the world and people have become a field of experiments. [The] Israeli Yedioth Ahraonoth newspaper published two days ago that vaccination is not effective at all.” – Female FGD participant, Persons with Disabilities (PWD) Association, Gaza Governorate

“I believe that [the vaccine is not related to] trade because if it were a trade, we would have had the vaccination on our behalf. If it were a trade, we would have paid money to take it.” – Female FGD participant, PWD Association, Gaza Governorate

In multivariable regression, the adjusted models showed demographic factors as well as certain information sources and risk perceptions are independently associated with vaccine hesitancy (Table 7b). The vaccine hesitant were less likely to be male (aOR: 0.58, 95% CI: 0.40–0.84), older compared to younger adults (aOR: 0.47, 95% CI: 0.28–0.80), and university educated compared to primary or no education (aOR: 0.32, 95% CI: 0.25–0.42). The vaccine hesitant were more likely to mention family as a common source of information on the vaccines (aOR: 1.29, 95% CI: 1.00–1.67), and less likely to trust HCWs for vaccine information (aOR: 0.58, 95% CI: 0.49–0.68). Perception of vaccine safety and serious personal risk from COVID-19 are also independently related to vaccine hesitancy. Those who consider the vaccine safe had 97% lower odds of being hesitant (aOR: 0.03, 95% CI: 0.01–0.15), while those who believed in the possibility of serious illness from COVID-19 were had 38% lower odds of being hesitant (aOR: 0.62, 95% CI: 0.37–1.04).

Table 7
b. Odds ratios of vaccine hesitancy (Adjusted)

Characteristic	OR (95% CI) ¹	p-value
Sex		0.004
<i>Female</i>	—	
<i>Male</i>	0.58 (0.40 to 0.84)	
Age		0.005
<i>18–39</i>	—	
<i>40+</i>	0.47 (0.28 to 0.80)	
Highest education level		< 0.001
<i>Primary or None</i>	—	
<i>Secondary or College / Vocational</i>	0.45 (0.22 to 0.93)	
<i>University</i>	0.32 (0.25 to 0.42)	
Have enough information about COVID-19 vaccine		0.11
<i>Yes</i>	—	
<i>No or Don't know</i>	1.39 (0.93 to 2.07)	
Common source of information about health and vaccines		
<i>Health care providers (ref: no)</i>	1.01 (0.74 to 1.39)	0.93
<i>Family (ref: no)</i>	1.29 (1.00 to 1.67)	0.051
<i>Social media (ref: no)</i>	0.81 (0.60 to 1.10)	0.18
Trusted source of information: Health care providers	0.58 (0.49 to 0.68)	< 0.001
Think you can get seriously ill, hospitalized or die if you get COVID-19		0.005
<i>No</i>	—	
<i>Don't know</i>	1.08 (0.76 to 1.53)	
<i>Yes</i>	0.62 (0.37 to 1.04)	
Consider COVID-19 vaccines safe		< 0.001
<i>No or Don't know</i>	—	
<i>Yes</i>	0.03 (0.01 to 0.15)	
<i>Somewhat</i>	0.21 (0.18 to 0.25)	

Characteristic	OR (95% CI) ¹	p-value
¹ OR = Odds Ratio, CI = Confidence Interval		

Vaccine hesitancy among the non-vaccinated

In sub-analysis, risk factors for vaccine hesitancy were considered for the population of unvaccinated individuals (Table 8). Vaccination outreach efforts will need to specifically target the currently unvaccinated population who are hesitant (~ 67% of this sub-group). In this population, there was not enough evidence that sex, age, or educational background were associated with hesitancy (p-value > 0.05). There was little variation in the information requested and information sources accessed among hesitant and non-hesitant individuals. The most common sources of information among those classified as hesitant were social media (58.32%), HCWs (53.21%), neighbors, friends and colleagues (52.29%), and family (43.28%).

Table 8
Factors associated with vaccine hesitancy, non-vaccinated community members only

Characteristic	N	Vaccine hesitant (Unweighted)		p-value ²	Vaccine hesitant (Weighted)		p-value ²
		no, N = 149 ¹	yes, N = 300 ¹		no ¹	yes ¹	
Age	449			0.88			0.41
<i>18–39</i>		63.09%	62.33%		56.69%	62.58%	
<i>40+</i>		36.91%	37.67%		43.31%	37.42%	
Sex	449			0.033			0.68
<i>Female</i>		59.73%	49.00%		48.40%	49.89%	
<i>Male</i>		40.27%	51.00%		51.60%	50.11%	
Highest education level	449			0.018			0.41
<i>Primary or None</i>		5.37%	13.33%		5.98%	14.97%	
<i>Secondary or College / Vocational</i>		49.66%	40.00%		44.79%	41.85%	
<i>University</i>		44.97%	46.67%		49.24%	43.18%	
Have enough information about COVID-19 vaccine	449			0.58			0.30
<i>Yes</i>		30.87%	28.33%		37.74%	28.76%	
<i>No or Don't know</i>		69.13%	71.67%		62.26%	71.24%	
Information needed	449						
<i>Eligibility criteria</i>		33.56%	37.00%	0.47	46.59%	53.75%	0.58
<i>Timeline for vaccine roll-out</i>		8.05%	7.67%	0.89	17.02%	12.82%	0.35
<i>When it's my turn to get the vaccine</i>		9.40%	8.33%	0.71	14.14%	12.06%	0.59
<i>Doses needed</i>		19.46%	23.00%	0.39	25.10%	30.53%	0.50
<i>Risks and side effects</i>		90.60%	88.33%	0.47	94.12%	89.80%	0.12
<i>Effectiveness of the vaccines</i>		76.51%	74.33%	0.62	84.62%	81.19%	0.27
<i>How to register for the vaccine</i>		10.74%	12.00%	0.69	11.05%	12.47%	0.75
Common source of information about health and vaccines	448						
<i>Health care providers</i>		59.73%	57.53%	0.66	62.75%	53.21%	0.16

	N	Vaccine hesitant (Unweighted)			Vaccine hesitant (Weighted)		
<i>Community health care workers</i>		20.81%	20.74%	0.99	12.33%	13.66%	0.54
<i>Radio</i>		10.07%	16.39%	0.073	8.61%	16.61%	0.067
<i>Television</i>		28.19%	33.11%	0.29	27.28%	35.24%	0.43
<i>Newspapers</i>		0.67%	3.01%	0.12	0.05%	1.71%	0.018
<i>Mass events</i>		10.07%	9.36%	0.81	9.16%	9.03%	0.97
<i>Family</i>		26.17%	29.10%	0.52	29.06%	43.28%	0.15
<i>Neighbors, friends, colleagues</i>		34.90%	43.48%	0.083	44.04%	52.29%	0.51
<i>Local leaders</i>		2.68%	1.67%	0.47	3.36%	1.38%	0.51
<i>Religious leaders</i>		2.68%	2.68%	> 0.99	4.55%	3.41%	0.63
<i>Social media</i>		68.46%	56.52%	0.015	66.73%	58.32%	0.058
<i>Organizations</i>		14.09%	8.36%	0.061	15.36%	10.30%	0.17
Trusted source of information	449						
<i>Health care providers</i>		71.14%	58.33%	0.009	73.03%	58.60%	0.14
<i>Community health care workers</i>		23.49%	23.33%	0.97	22.87%	26.79%	0.69
<i>Local leaders</i>		2.01%	0.33%	0.075	1.12%	0.02%	0.012
<i>Religious leaders</i>		0.00%	1.67%	0.11	0.00%	1.20%	0.35
<i>Family members</i>		2.01%	7.33%	0.021	4.05%	9.51%	0.075
<i>Neighbors, friends, colleagues</i>		3.36%	9.00%	0.029	4.72%	10.81%	0.082
<i>Organizations</i>		14.77%	9.67%	0.11	14.47%	9.17%	0.45
<i>Media</i>		14.77%	18.00%	0.39	13.40%	15.69%	0.40
<i>Radio</i>		1.34%	3.00%	0.29	0.82%	4.70%	0.012
<i>Television</i>		9.40%	11.00%	0.60	9.12%	12.88%	0.58
<i>Other</i>		4.70%	8.67%	0.13	2.81%	7.78%	0.069
Trust health providers and CHWS to provide with accurate information about the COVID-19 vaccine	448			< 0.001			0.001
<i>No or Don't know</i>		5.37%	23.75%		6.66%	25.71%	
<i>Yes</i>		71.14%	38.13%		67.87%	33.96%	

	N	Vaccine hesitant (Unweighted)		Vaccine hesitant (Weighted)		
<i>Somewhat</i>		23.49%	38.13%	25.48%	40.33%	
Follow social media platforms to get info about vaccine	449			0.20		0.15
<i>No or Don't know</i>		20.81%	26.33%	15.69%	22.34%	
<i>Yes</i>		79.19%	73.67%	84.31%	77.66%	
Social media platforms used to get info about vaccine	339					
<i>Facebook</i>		99.15%	99.10%	0.96	99.67%	99.93%
<i>Twitter</i>		13.56%	16.74%	0.44	15.49%	12.84%
<i>Instagram</i>		41.53%	38.91%	0.64	44.09%	47.97%
<i>YouTube</i>		16.10%	26.24%	0.034	18.32%	21.91%
Shares information related to vaccine on social media network	421	17.86%	13.17%	0.20	16.82%	6.94%
How do you know info about vaccine from social media is true	449			< 0.001		0.16
<i>I do not verify</i>		20.13%	41.67%		24.76%	46.56%
<i>Other</i>		14.09%	17.67%		13.72%	15.54%
<i>Verify from reputable website or health care provider</i>		65.77%	40.67%		61.52%	37.90%
Do leaders (religious, political, teachers, health care workers) in your community support the COVID-19 vaccines?	257			0.082		0.45
<i>No or Don't know</i>		23.40%	33.74%		24.83%	32.43%
<i>Yes</i>		76.60%	66.26%		75.17%	67.57%
Most people you know interested in getting the COVID-19 vaccine	449			< 0.001		0.036
<i>No or Don't know</i>		22.82%	45.00%		27.78%	43.95%
<i>Yes</i>		38.93%	14.67%		39.38%	14.48%
<i>Somewhat</i>		38.26%	40.33%		32.83%	41.57%

	N	Vaccine hesitant (Unweighted)		Vaccine hesitant (Weighted)			
How many people in your community are concerned about COVID-19 in the community	356			0.003		0.17	
<i>Few or some people, less than half</i>		11.97%	26.36%	15.20%	31.45%		
<i>Most people</i>		46.15%	31.80%	40.77%	26.16%		
<i>Some people – more than half</i>		41.88%	41.84%	44.03%	42.39%		
COVID-19 vaccines will or are being rolled out equitably in community	447			0.23		0.63	
<i>No or Don't know</i>		18.79%	23.83%	23.28%	26.78%		
<i>Yes</i>		81.21%	76.17%	76.72%	73.22%		
Knows somebody that had a serious negative reaction to a vaccine that makes them reluctant to get COVID-19 vaccine	449			0.056		0.26	
<i>Yes</i>		31.54%	40.67%	34.84%	42.93%		
<i>Somewhat</i>		12.08%	15.00%	14.85%	21.93%		
<i>No or Don't know</i>		56.38%	44.33%	50.31%	35.14%		
Consider COVID-19 vaccines safe	448			< 0.001		0.074	
<i>No or Don't know</i>		42.95%	76.25%	49.16%	74.25%		
<i>Yes</i>		17.45%	3.34%	17.38%	2.08%		
<i>Somewhat</i>		39.60%	20.40%	33.46%	23.67%		
Concerned about risks or side effects with COVID-19 vaccines	449			0.009		0.14	
<i>No or Don't know</i>		15.44%	7.67%	19.21%	7.48%		
<i>Yes</i>		71.14%	83.33%	69.81%	83.79%		
<i>Somewhat</i>		13.42%	9.00%	10.97%	8.73%		
Types of risks or side effects concerned about	402						
<i>Fever</i>		57.94%	51.81%	0.25	58.26%	58.56%	0.95

	N	Vaccine hesitant (Unweighted)			Vaccine hesitant (Weighted)		
<i>Body aches</i>		66.67%	61.23%	0.30	73.25%	66.99%	0.17
<i>Infertility</i>		19.05%	30.43%	0.017	16.85%	36.95%	0.068
<i>Physical disability</i>		23.02%	33.33%	0.037	23.34%	31.23%	0.090
<i>Death</i>		49.21%	65.58%	0.002	47.90%	64.35%	0.17
<i>Other</i>		15.08%	17.39%	0.56	23.16%	21.99%	0.74
Type of COVID vaccine preferred	448						
<i>Other</i>		0.00%	0.00%		0.00%	0.00%	
<i>No preference</i>		12.75%	49.83%		17.25%	53.89%	
<i>Pfizer</i>		49.66%	25.75%		47.01%	27.47%	
<i>Sputnik</i>		28.19%	10.37%		27.00%	9.54%	
<i>Moderna</i>		0.00%	1.67%		0.00%	1.73%	
<i>Unsure</i>		6.71%	11.37%		5.48%	6.75%	
<i>Sinopharm</i>		2.68%	1.00%		3.26%	0.63%	
Believe there are other (better) ways to prevent COVID-19 instead of vaccine	449			< 0.001			0.039
<i>No or Don't know</i>		30.20%	16.33%		28.51%	15.14%	
<i>Yes</i>		53.69%	71.33%		51.93%	67.67%	
<i>Somewhat</i>		16.11%	12.33%		19.56%	17.19%	
Better ways to prevent COVID-19 instead of vaccine	294						
<i>Social distance</i>		85.00%	82.24%	0.58	86.75%	84.33%	0.67
<i>Handwashing</i>		78.75%	75.70%	0.58	75.60%	81.53%	0.45
<i>Infection prevention and control</i>		41.25%	47.20%	0.36	57.90%	55.56%	0.83
<i>Ventilation</i>		47.50%	47.66%	0.98	52.95%	59.28%	0.60
<i>Wearing face masks</i>		78.75%	75.70%	0.58	73.25%	79.59%	0.25

	N	Vaccine hesitant (Unweighted)		Vaccine hesitant (Weighted)			
Trust health providers and CHWS to provide with accurate information about the COVID-19 vaccine	448			< 0.001		0.001	
<i>No or Don't know</i>		5.37%	23.75%	6.66%	25.71%		
<i>Yes</i>		71.14%	38.13%	67.87%	33.96%		
<i>Somewhat</i>		23.49%	38.13%	25.48%	40.33%		
Know any person with a serious disease / disability that happened because they were NOT vaccinated	449			0.006		0.13	
<i>Yes</i>		20.13%	10.67%	26.73%	10.22%		
<i>No or Don't know</i>		79.87%	89.33%	73.27%	89.78%		
Think it is better to get COVID-19 and develop natural immunity than to get the vaccine	448			< 0.001		0.18	
<i>No</i>		39.19%	19.00%	39.21%	17.81%		
<i>Don't know</i>		7.43%	9.67%	2.94%	7.63%		
<i>Yes</i>		39.19%	57.33%	43.45%	57.73%		
<i>Somewhat</i>		14.19%	14.00%	14.39%	16.83%		
Remember past events that would discourage them from getting COVID-19 vaccine	449	32.89%	37.33%	0.36	35.22%	40.21%	0.47
Think you are at risk to get COVID-19	449			0.001		0.22	
<i>No</i>		4.70%	10.33%	7.73%	9.80%		
<i>Don't know</i>		2.68%	10.33%	0.89%	11.49%		
<i>Yes</i>		92.62%	79.33%	91.38%	78.72%		
Think you can get seriously ill, hospitalized or die if you get COVID-19	449			0.004		0.010	
<i>No</i>		34.90%	37.33%	34.33%	41.62%		
<i>Don't know</i>		25.50%	37.33%	23.76%	35.17%		
<i>Yes</i>		39.60%	25.33%	41.90%	23.20%		

	N	Vaccine hesitant (Unweighted)			Vaccine hesitant (Weighted)		
Barriers for receiving COVID-19 vaccine	448						
<i>Availability</i>		2.70%	3.33%	0.72	3.39%	1.75%	0.11
<i>Distance to vaccination point</i>		6.08%	5.67%	0.86	2.88%	1.62%	0.21
<i>Cost</i>		0.00%	0.00%		0.00%	0.00%	
<i>Not a priority group</i>		6.08%	6.67%	0.81	2.52%	7.11%	0.27
<i>Lack of information about how / where to get it</i>		20.95%	22.33%	0.74	19.50%	19.06%	0.90
<i>Too stressful</i>		35.14%	37.33%	0.65	43.82%	50.20%	0.091
<i>Staff attitude</i>		3.38%	3.33%	0.98	3.55%	3.39%	0.95
<i>Not socially acceptable</i>		11.49%	36.33%	< 0.001	11.07%	30.41%	0.078
<i>None</i>		10.81%	11.00%	0.95	19.09%	14.42%	0.39
Would get / have gotten the vaccine if employer recommended	449			< 0.001			0.092
<i>No</i>		19.46%	43.33%		22.43%	40.43%	
<i>Unsure</i>		6.71%	19.33%		4.12%	21.32%	
<i>Yes</i>		73.83%	37.33%		73.44%	38.25%	
		1%					
² chi-squared test with Rao & Scott's second-order correction							

Table 8
a. Odds ratios of vaccine hesitancy (Unadjusted)

Characteristic	OR (95% CI) ¹	p-value
Sex		< 0.001
<i>Female</i>	–	
<i>Male</i>	0.66 (0.59 to 0.75)	
Age		0.12
<i>18–39</i>	–	
<i>40+</i>	0.75 (0.52 to 1.08)	
Highest education level		< 0.001
<i>Primary or None</i>	–	
<i>Secondary or College / Vocational</i>	0.51 (0.17 to 1.54)	
<i>University</i>	0.35 (0.21 to 0.59)	
Have enough information about COVID-19 vaccine		< 0.001
<i>Yes</i>	–	
<i>No or Don't know</i>	2.53 (1.48 to 4.32)	
Information needed		
<i>Eligibility criteria</i>	1.10 (0.43 to 2.85)	0.84
<i>Timeline for vaccine roll-out</i>	1.01 (0.73 to 1.40)	0.95
<i>Knowing when it's my turn to get the vaccine</i>	1.61 (1.25 to 2.09)	< 0.001
<i>Doses needed</i>	1.47 (1.08 to 2.01)	0.016
<i>Risks and side effects</i>	1.15 (0.48 to 2.75)	0.75
<i>Effectiveness of the vaccines</i>	0.88 (0.71 to 1.08)	0.21
<i>How to register for the vaccine</i>	1.56 (1.18 to 2.07)	0.002
Common source of information about health and vaccines		
<i>Health care providers</i>	0.64 (0.47 to 0.86)	0.004
<i>Community health care workers</i>	0.87 (0.65 to 1.18)	0.37
<i>Radio</i>	1.48 (1.07 to 2.03)	0.017
<i>Television</i>	1.41 (0.68 to 2.93)	0.35

Characteristic	OR (95% CI)¹	p-value
<i>Newspapers</i>	1.17 (0.82 to 1.67)	0.39
<i>Mass events</i>	2.28 (1.12 to 4.62)	0.023
<i>Family</i>	1.68 (1.29 to 2.17)	< 0.001
<i>Neighbors, friends, colleagues</i>	1.83 (1.19 to 2.82)	0.006
<i>Local leaders</i>	0.38 (0.04 to 3.19)	0.37
<i>Religious leaders</i>	0.51 (0.28 to 0.92)	0.025
<i>Social media</i>	0.81 (0.67 to 0.98)	0.031
<i>Organizations</i>	0.41 (0.24 to 0.69)	< 0.001
Trusted source of information		
<i>Health care providers</i>	0.54 (0.46 to 0.65)	< 0.001
<i>Community health care workers</i>	0.95 (0.67 to 1.35)	0.79
<i>Local leaders</i>	2.87 (1.99 to 4.14)	< 0.001
<i>Religious leaders</i>	1.52 (0.61 to 3.76)	0.37
<i>Family members</i>	1.75 (1.28 to 2.40)	< 0.001
<i>Neighbors, friends, colleagues</i>	3.05 (1.37 to 6.77)	0.006
<i>Organizations</i>	0.02 (0.00 to 0.18)	< 0.001
<i>Media</i>	2.05 (0.26 to 16.0)	0.49
<i>Radio</i>	1.56 (1.23 to 1.99)	< 0.001
<i>Television</i>	0.43 (0.34 to 0.56)	< 0.001
<i>Other</i>	1.65 (1.19 to 2.29)	0.003
Follow social media platforms to get info about vaccine		0.063
<i>No or Don't know</i>	—	
<i>Yes</i>	0.78 (0.61 to 1.01)	
Social media platforms used to get info about vaccine		
<i>Facebook (ref: no)</i>	18.8 (3.81 to 92.8)	< 0.001
<i>Twitter (ref: no)</i>	0.58 (0.30 to 1.11)	0.10
<i>Instagram (ref: no)</i>	1.10 (0.78 to 1.55)	0.60
<i>YouTube (ref: no)</i>	0.98 (0.69 to 1.40)	0.93

Characteristic	OR (95% CI) ¹	p-value
Shares information related to vaccine on social media network		< 0.001
<i>no</i>	—	
<i>yes</i>	0.32 (0.21 to 0.50)	
How do you know info about vaccine from social media is true		< 0.001
<i>I do not verify</i>	—	
<i>Other</i>	0.45 (0.34 to 0.58)	
<i>Verify from reputable website or health care provider</i>	0.25 (0.19 to 0.34)	
Think you can get seriously ill, hospitalized or die if you get COVID-19		< 0.001
<i>No</i>	—	
<i>Don't know</i>	1.20 (0.87 to 1.67)	
<i>Yes</i>	0.69 (0.50 to 0.97)	
Consider COVID-19 vaccines safe		< 0.001
<i>No or Don't know</i>	—	
<i>Yes</i>	0.03 (0.01 to 0.16)	
<i>Somewhat</i>	0.20 (0.17 to 0.23)	
¹ OR = Odds Ratio, CI = Confidence Interval		

Non-vaccinated, vaccine hesitant individuals were more likely to believe there are better ways to prevent COVID-19 (67.67% vs 51.93% of non-hesitant individuals). In the focus group discussions people expressing hesitancy about the vaccines questioned their benefit. One participant doubted the vaccines would be effective against COVID-19 in the long-term due to regular need for boosters.

"I do not think that the vaccine is safe because I see the already vaccinated people could be infected, and we have to be vaccinated every six months. We were immunized when we were young, which was once or twice, not every six months like Corona." - Male FGD participant, PWD Association, Gaza Governorate

While the study was not powered to investigate risk factors for the unvaccinated sub-group, perceptions of vaccine safety and concerns about risks of side effects were marginally not significant in the weighted analysis, unlike in the combined population of vaccinated and unvaccinated individual. However perception of individual risk varied, with 23.20% of hesitant individuals vs 41.90% of non-hesitant individuals believing they were at risk of serious disease or hospitalization if they contracted COVID-19 (p = 0.010).

Vaccination and vaccine hesitancy among healthcare workers

In further sub-analysis we examined vaccine uptake and risk factors for hesitancy among HCWs. 89% (n = 151) of the HCWs surveyed were vaccinated (Table 9). Among the non-vaccinated HCWs only 5% (n = 9) were vaccine hesitant. Given the small number of vaccine hesitant among HCWs, few inferences can be made. However the explanations for hesitancy appear to mirror that of the population. HCWs who were hesitant were less likely to consider the vaccines safe (89% did not consider them safe compared to 11% of non-hesitant HCWs) and more likely to express concerns about side effects (89% compared to 26% of non-hesitant HCWs).

Table 9
Factors associated with vaccine hesitancy, HCWs only

Variable	N	Vaccine Hesitant		p-value ²
		no, N = 160 ¹	yes, N = 9 ¹	
Have enough information about COVID-19 vaccine, n (%)	169			0.73
Yes		101 (95)	5 (4.7)	
No or Don't know		59 (94)	4 (6.3)	
Information needed, n (%)	169			
Eligibility criteria		35 (92)	3 (7.9)	0.42
Timeline for vaccine roll-out		12 (92)	1 (7.7)	0.52
When it's my turn to get the vaccine		13 (93)	1 (7.1)	0.55
Doses needed		31 (94)	2 (6.1)	0.69
Risks and side effects, n (%)		106 (92)	9 (7.8)	0.059
Effectiveness of the vaccines, n (%)		106 (94)	7 (6.2)	0.72
How to register for the vaccine, n (%)		7 (88)	1 (12)	0.36
Common source of information about health and vaccines, n (%)	169			
Health care providers		132 (96)	6 (4.3)	0.37
Community health care workers		45 (94)	3 (6.2)	0.71
Radio		2 (100)	0 (0)	> 0.99
Television		14 (93)	1 (6.7)	0.58
Newspapers		2 (67)	1 (33)	0.15

	N	Vaccine Hesitant		
<i>Mass events</i>	1 (100)	0 (0)		> 0.99
<i>Family</i>	3 (100)	0 (0)		> 0.99
<i>Neighbors, friends, colleagues</i>	4 (80)	1 (20)		0.24
<i>Local leaders</i>	1 (100)	0 (0)		> 0.99
<i>Religious leaders</i>	2 (100)	0 (0)		> 0.99
<i>Social media</i>	51 (91)	5 (8.9)		0.16
<i>Organizations</i>	59 (97)	2 (3.3)		0.49
Trusted source of information, n (%)	169			
<i>Health care providers</i>	118 (96)	5 (4.1)		0.26
<i>Community health care workers</i>	30 (94)	2 (6.2)		0.68
<i>Local leaders</i>	0 (NA)	0 (NA)		
<i>Religious leaders</i>	0 (NA)	0 (NA)		
<i>Family members</i>	0 (0)	1 (100)		0.053
<i>Neighbors, friends, colleagues</i>	2 (67)	1 (33)		0.15
<i>Organizations</i>	55 (98)	1 (1.8)		0.27
<i>Media</i>	10 (83)	2 (17)		0.13
<i>Radio</i>	2 (100)	0 (0)		> 0.99
<i>Television</i>	5 (100)	0 (0)		> 0.99
<i>Other</i>	15 (94)	1 (6.2)		0.60

	N	Vaccine Hesitant		
Trust health providers and CHWS to provide with accurate information about the COVID-19 vaccine, n (%)	169			< 0.001
<i>No or Don't know</i>		9 (64)	5 (36)	
<i>Yes</i>		106 (99)	1 (0.9)	
<i>Somewhat</i>		45 (94)	3 (6.2)	
Follow social media platforms to get info about vaccine, n (%)	169			> 0.99
<i>No or Don't know</i>		42 (95)	2 (4.5)	
<i>Yes</i>		118 (94)	7 (5.6)	
Social media platforms used to get info about vaccine, n (%)	125			
<i>Facebook</i>		114 (94)	7 (5.8)	> 0.99
<i>Twitter</i>		18 (95)	1 (5.3)	> 0.99
<i>Instagram</i>		38 (95)	2 (5.0)	> 0.99
<i>YouTube</i>		29 (91)	3 (9.4)	0.37
Shares information related to vaccine on social media network, n (%)	166	53 (98)	1 (1.9)	0.27
How do you know info about vaccine from social media is true, n (%)	168			0.034
<i>I do not verify</i>		17 (81)	4 (19)	
<i>Other</i>		11 (100)	0 (0)	
<i>Verify from reputable website or health care provider</i>		131 (96)	5 (3.7)	
Do leaders (religious, political, teachers, health care workers) in your community support the COVID-19 vaccines?, n (%)	107			> 0.99
<i>No or Don't know</i>		20 (100)	0 (0)	

	N	Vaccine Hesitant		
<i>Yes</i>		84 (97)	3 (3.4)	
Most people you know interested in getting the COVID-19 vaccine, n (%)	169			0.072
<i>No or Don't know</i>		35 (88)	5 (12)	
<i>Yes</i>		87 (97)	3 (3.3)	
<i>Somewhat</i>		38 (97)	1 (2.6)	
How many people in your community are concerned about COVID-19 in the community, n (%)	135			0.80
<i>Few or some people, less than half</i>		50 (96)	2 (3.8)	
<i>Most people</i>		37 (92)	3 (7.5)	
<i>Some people – more than half</i>		41 (95)	2 (4.7)	
COVID-19 vaccines will or are being rolled out equitably in community, n (%)	169			0.058
<i>No or Don't know</i>		40 (89)	5 (11)	
<i>Yes</i>		120 (97)	4 (3.2)	
Knows somebody that had a serious negative reaction to a vaccine that makes them reluctant to get COVID-19 vaccine, n (%)	167			0.049
<i>Yes</i>		24 (86)	4 (14)	
<i>Somewhat</i>		20 (95)	1 (4.8)	
<i>No or Don't know</i>		114 (97)	4 (3.4)	
Consider COVID-19 vaccines safe, n (%)	169			< 0.001
<i>No or Don't know</i>		18 (69)	8 (31)	

	N	Vaccine Hesitant		
<i>Yes</i>		74 (100)	0 (0)	
<i>Somewhat</i>		68 (99)	1 (1.4)	
Concerned about risks or side effects with COVID-19 vaccines, n (%)	169			< 0.001
<i>No or Don't know</i>		75 (99)	1 (1.3)	
<i>Yes</i>		42 (84)	8 (16)	
<i>Somewhat</i>		43 (100)	0 (0)	
Types of risks or side effects concerned about, n (%)	92			
<i>Fever</i>		44 (92)	4 (8.3)	> 0.99
<i>Body aches</i>		55 (93)	4 (6.8)	0.45
<i>Infertility</i>		16 (84)	3 (16)	0.35
<i>Physical disability</i>		10 (83)	2 (17)	0.28
<i>Death</i>		10 (62)	6 (38)	< 0.001
<i>Other</i>		18 (82)	4 (18)	0.090
Type of COVID vaccine preferred, n (%)	169			0.35
<i>Other</i>		0 (NA)	0 (NA)	
<i>No preference</i>		16 (89)	2 (11)	
<i>Pfizer</i>		93 (97)	3 (3.1)	
<i>Sputnik</i>		40 (91)	4 (9.1)	
<i>Moderna</i>		8 (100)	0 (0)	

	N	Vaccine Hesitant		
<i>Unsure</i>		3 (100)	0 (0)	
<i>Sinopharm</i>		0 (NA)	0 (NA)	
Believe there are other (better) ways to prevent COVID-19 instead of vaccine, n (%)	169			0.48
<i>No or Don't know</i>		79 (96)	3 (3.7)	
<i>Yes</i>		52 (91)	5 (8.8)	
<i>Somewhat</i>		29 (97)	1 (3.3)	
Better ways to prevent COVID-19 instead of vaccine	57			
<i>Social distance</i>		45 (94)	3 (6.2)	0.17
<i>Handwashing</i>		45 (92)	4 (8.2)	0.54
<i>Infection prevention and control</i>		22 (88)	3 (12)	0.64
<i>Ventilation</i>		18 (90)	2 (10)	> 0.99
<i>Wearing face masks</i>		42 (91)	4 (8.7)	> 0.99
Know any person with a serious disease / disability that happened because they were NOT vaccinated, n (%)	167			0.27
<i>Yes</i>		52 (98)	1 (1.9)	
<i>No or Don't know</i>		106 (93)	8 (7.0)	
Think it is better to get COVID-19 and develop natural immunity than to get the vaccine, n (%)	169			0.12
<i>No</i>		87 (98)	2 (2.2)	
<i>Don't know</i>		22 (96)	1 (4.3)	
<i>Yes</i>		38 (88)	5 (12)	

	N	Vaccine Hesitant		
<i>Somewhat</i>		13 (93)	1 (7.1)	
Remember past events that would discourage them from getting COVID-19 vaccine, n (%)	18	1 (25)	3 (75)	0.58
Think you are at risk to get COVID-19, n (%)	168			0.63
<i>No</i>		5 (100)	0 (0)	
<i>Don't know</i>		11 (92)	1 (8.3)	
<i>Yes</i>		143 (95)	8 (5.3)	
Think you can get seriously ill, hospitalized or die if you get COVID-19, n (%)	169			> 0.99
<i>No</i>		67 (94)	4 (5.6)	
<i>Don't know</i>		53 (95)	3 (5.4)	
<i>Yes</i>		40 (95)	2 (4.8)	
Barriers for receiving COVID-19 vaccine, n (%)	18			
<i>Availability</i>		0 (NA)	0 (NA)	
<i>Distance to vaccination point</i>		1 (50)	1 (50)	> 0.99
<i>Cost</i>		0 (NA)	0 (NA)	
<i>Not a priority group</i>		0 (0)	1 (100)	> 0.99
<i>Lack of information about how / where to get it</i>		1 (33)	2 (67)	> 0.99
<i>Too stressful</i>		1 (100)	0 (0)	> 0.99
<i>Staff attitude</i>		0 (NA)	0 (NA)	
<i>Not socially acceptable</i>		0 (0)	1 (100)	> 0.99

	N	Vaccine Hesitant		
<i>None</i>		1 (100)	0 (0)	> 0.99
Would get / have gotten the vaccine if employer recommended, n (%)	18			0.35
<i>No</i>		3 (38)	5 (62)	
<i>Unsure</i>		0 (0)	1 (100)	
<i>Yes</i>		6 (67)	3 (33)	
		¹ Frequency (%)		
		² Fisher's exact test		

³Respondents who answered “No” or “Not sure” to the question, “If you could get the COVID-19 vaccine this week, would you get it? were classified “hesitant”. Those answering “Yes” as well as currently vaccinated people were classified “non-hesitant.”

⁴Currently unvaccinated respondents who answered “No” or “Not sure” to the question, “If you could get the COVID-19 vaccine this week, would you get it? “ were classified “hesitant”, while those answering “Yes” were classified “non-hesitant.” Currently vaccinated individuals were excluded.

Discussion

This study provides one of the first in-depth investigations of COVID-19 vaccine coverage and hesitancy from a conflict-affected setting. We estimated vaccine coverage to be 49.09% (95% CI: 43.10-55.08) among the general population. The study’s large sample size also enables reasonable sub-group estimates of vaccination coverage that reveal disparities in access to vaccination. We found the populations less likely to be vaccinated were females (41.45% of females vs 58.55% of males) and those less educated (37.30% of those with primary or no education vs 55.75% of those with university education). While global data is lacking on vaccine distribution among traditionally marginalized populations, our study’s findings suggest the worldwide systemic inequities regularly observed in public health may be taking place with COVID-19 vaccination as well [17].

We estimated the vaccine hesitant consist of 34.08% (95% CI: 28.14–40.56) of the adult population of Gaza, which is similar to the estimate from the web-based survey (37%) carried out in October 2020 [9]. Temporal data from VHS studies have generally found levels of hesitancy decreasing within countries

over time corresponding to the roll-out of vaccines [3]. The apparent lack of change in COVID-19 vaccine confidence in Gaza during 2021 raises concern about the coverage and effectiveness of early vaccine promotion efforts.

Among the non-vaccinated, 67.24%, were classified vaccine hesitant, suggesting they will be difficult to reach through supply availability alone. Characteristics of the vaccine hesitant in Gaza mirror global findings, with less education as well as lower perception of serious risk from COVID-19 linked to vaccine hesitancy [18, 19]. Among the non-vaccinated group, those classified as hesitant were less likely to consider the vaccine safe and less likely to believe they were at risk of severe disease – suggesting their perceived risk of vaccination outweighed perceived risk of infection. They are also more likely to rely on family and friends information – a finding that mirrors the global scoping review conducted by Biwas et al [3]. Conversely, perception of personal benefit and effectiveness of the vaccines, as well as lower concern about side effects, appears to positively influence vaccination. In community focus group discussions, participants with chronic diseases widely expressed support for vaccination suggesting a successful integration of messaging on comorbidity risks among this this group.

Research remains conflicting on relative levels of vaccine hesitancy among different demographic groups. Recent studies from the Middle East have reported females more likely to be vaccine hesitant, which our study similarly found [5, 19, 20]. However, among the non-vaccinated population of our study, sex was not associated with vaccine hesitancy, suggesting there may different barriers to accessing vaccines among unvaccinated women. Age was also not associated with vaccine hesitancy among the non-vaccinated in Gaza, whereas other studies have found younger groups as more vaccine hesitant or less motivated to pursue vaccination [18]. Our study was not powered to investigate risk factors among the unvaccinated population, though, and it is possible that a larger survey of this group would identify further variation.

We found high COVID-19 vaccination coverage (89%) among HCWs, similar to global reports [21, 22]. Despite the smaller number of HCWs interviewed for our study and use of purposive sampling, the high level of uptake is likely a valid representation given the vaccine mandates for this group. From June 2021, the de facto government of Gaza Strip required staff of the MoH and other agencies to be vaccinated against COVID-19. Therefore among this group, vaccination is not necessarily a valid measure of vaccine hesitancy; a non-negligible proportion of HCWs expressed doubts about certain aspects of the vaccine. More than 15% of HCWs stated they do not consider the vaccine safe or do not know, while one-quarter of HCW respondents reported concern about side effects. Among non-vaccinated HCWs, perception of insufficient vaccine safety and efficacy appear to be major determinants of hesitancy. Our qualitative interviews also suggest there may be more skepticism of vaccines among clinicians than is readily apparent in the survey data. Recent articles by El Kibbi et al. and Heyerdahl et al. raised concerns on “unspoken vaccine hesitancy” among HCWs in the Middle East, which our own study’s findings modestly support as a subject worth monitoring [23, 24].

A major strength of our study is its broad scope which covers vaccine coverage estimates, vaccine hesitancy, comparisons among sub-groups of the populations, and risk factors associated with both vaccination and vaccine hesitancy. The findings can be used to develop more persuasive and effective information campaigns, and to proactively address the concerns of vaccine hesitant sub-groups through the information channels they most commonly use and trust. Subsequent research in Gaza could examine changes in vaccine hesitancy over time and evaluate the effectiveness of outreach campaigns and social messaging based on evidence of drivers of vaccine hesitancy.

Limitations

Limitations of the study center on the use of a standard global tool for assessment of vaccine hesitancy and confidence. As such, not all reasons for hesitancy were factored into the survey and questions were not customized to the context of the Gaza Strip. We did not inquire about previous SARS-CoV-2 infection and history of COVID-19 disease, comorbidities, movement restrictions in Gaza, the recent conflict, and other individual and local factors that could influence to vaccine hesitancy. The reliance on convenience sampling of primary survey respondents within households rather than purely random sampling of adult household members may have affected the prevalence values obtained if the characteristics of available household members or self-selected household members differ from the general population.

Similarly, we collected hesitancy information from healthcare workers to investigate coverage and hesitancy among this at-risk group of frontline responders. The respondents were selected from a purposive sample of health facility clinical staff, so the findings cannot be extrapolated to the population of HCWs although we believe the findings reflect well their perspectives based on on-the-ground experience. The standard tool was not customized for the interviews with healthcare workers, so certain factors more relevant to this population – such as clinical and epidemiological knowledge, patient care experience, and employer mandates - that correlate with vaccine acceptance were not assessed here

Conclusion

The recurrent and rapid emergence of COVID-19 variants reinforces the urgency to accelerate vaccination efforts in under-resourced and conflict-prone settings like the Gaza Strip. Scientists have linked recent variants such as Delta and Omicron to low and inequitable vaccination coverage globally, indicating the need for both supply- and demand-oriented strategies to combat the pandemic [25, 26]. Our study complements previous research on the latter through an investigation of vaccination coverage and vaccine hesitancy in the difficult public health setting of the Gaza Strip. It is one of the first population-representative studies of these topics in the Middle East and is also the first to be carried out in Gaza since the vaccine roll-out.

Just half of adults in Gaza had received at least one dose of a vaccine by October 2021. Disparities in vaccination coverage were apparent across the territory's social and demographic groups; vaccination campaigns should subsequently target those who are less likely to be vaccinated including women and

those with lesser socio-economic status. HCWs are a widely trusted information channel on COVID-19 vaccines among the vaccinated and unvaccinated, although less trusted among those who are hesitant. The latter accessed information from family, friends, neighbors, and colleagues at higher levels than the vaccinated and non-hesitant. This suggests the importance of disseminating accurate messages through community-based channels to permeate social networks of the unvaccinated and to address misinformation from these sources. Community engagement to promote vaccines should emphasize messaging on vaccine effectiveness and minimal risk of serious side effects, both of which were major concerns voiced by the unvaccinated and vaccine hesitant.

List Of Abbreviations

CHW Community Health Worker

FGD Focus Group Discussion

HCW Healthcare Workers

KI Key Informant

KII Key Informant Interview

OR Odds Ratio

PCBS Palestinian Central Bureau of Statistics

PWD Persons with Disabilities

Declarations

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author's institution on reasonable request.

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Contributions

JM participated in the conception, data analysis, interpretation and drafted the manuscript; JHE was the lead consultant overseeing ethical review, data acquisition, and preliminary analysis; NM participated in data acquisition and supervision and was the primary contact for obtaining population data from the PCBS used in analysis; NK participated in statistical analysis, interpreting the results, and substantial editing of the manuscript.

Ethics declarations

Ethics Approval and Consent to Participate

The study was conducted in accordance with relevant research guidelines and regulations. All participants in household surveys, key informant interviews, and focus group discussions provided oral informed consent. The study protocol was reviewed and approved by the Helsinki Committee of the Palestinian Health Research Council (Number: PHRC/HC/998/21).

Consent for publication

Not applicable.

Competing interests

All authors declare that they have no competing interests.

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