

Polio and Measles Vaccination Coverage Among Afghan Immigrant and Refugee Children in Iran

Hossein Mirzaei

Kerman University of Medical Sciences

Sana Eybpoosh

Pasteur Institute of Iran

Ghulam Raza Mohammadyan

Kerman University of Medical Sciences

Saiedeh Haji-Maghsoudi

Kerman University of Medical Sciences

Zahra Tahmasebi Ashtiani

Pasteur Institute of Iran

Sakine Narouei

Kerman University of Medical Sciences

Mojtaba Norouzi

Shahrekord University of Medical Sciences

Mojtaba Keikha

Kerman University of Medical Sciences

Hamid Sharifi

University of California, San Francisco

Seyed Mohsen Zahraei

Ministry of Health and Medical Education

Fatemeh Azimian Zavareh

Ministry of Health and Medical Education

Omid Zamani

World health organization Country Office- Tehran- Iran

Naser Nasiri

Jiroft University of Medical Sciences

AliAkbar Haghdoost

ahaghdoost@gmail.com

Kerman University of Medical Sciences

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Abstract

Iran has consistently achieved vaccination coverage rates exceeding 95% for all childhood vaccines. However, the vaccination status among foreign populations, particularly immigrants and refugees, remains unclear. Given Iran's hosting of the world's largest Afghan population, this cross-sectional study focused on Afghan children under 15 years of age residing in Iran to assess their coverage with the oral polio vaccine (OPV) and the measles-mumps-rubella (MMR) vaccine. A multi-stage sampling method yielded a sample of 2992 children. Vaccination history was confirmed through vaccination cards; if unavailable, caregiver verbal reports were used. Anti-measles IgG levels were assessed in a sample of 500 children from three cities. Combining routine and campaign vaccination, self-report coverage was 69.2% for OPV (≥ 5 doses) and 71.9% for MMR (≥ 2 doses). The coverage based on the vaccine card was 45.5% for OPV and 53.0% for MMR. Serological testing showed that 76.7% of children had IgG antibodies against measles. The immunization coverage among Afghan immigrants is about 20% lower than that of Iranian children. This gap highlights the need for strengthened, targeted actions to increase vaccination coverage, especially among undocumented immigrants and refugees who face challenges related to healthcare access and visibility.

Introduction

According to the World Health Organization (WHO), immunization prevents an estimated 3.5 to 5 million deaths annually from diseases such as measles, polio, influenza, diphtheria, and tetanus [1]. Mass immunization programs are considered successful when they achieve coverage rates above the herd immunity threshold. For highly contagious diseases such as measles and polio, the WHO recommends vaccination coverage of at least 95% and 80%, respectively. Falling below these thresholds increases the likelihood of local outbreaks [2].

Iran has consistently maintained vaccination coverage rates exceeding 95% for all childhood vaccines since 1992. However, vaccination coverage among foreign populations, particularly immigrants and refugees, remains unknown.

Iran hosts the world's largest Afghan population, including approximately 2.1 million undocumented migrants, 800,000 documented residents, and 600,000 passport holders[3]. Following the Taliban's return to power in August 2021, an estimated 500,000 to 1,000,000 additional Afghan nationals fled to Iran, further increasing the demand for health, housing, and social services [3]. In response, the Iranian health system has extended routine vaccination services to all individuals, regardless of nationality [4], as well as the 2023 national vaccination campaign targeting Afghan children [5].

Estimates of vaccination coverage among Afghan children pertain to the period preceding the large influx of Afghan migrants into Iran in 2021. A study conducted in 2013 found that an incomplete immunization history was six times more probable in non-Iranian children compared to their Iranian peers, with the majority of non-Iranian participants being of Afghan nationality [6]. Another study in 2013 showed that vaccination coverage among Afghan children residing in Kerman was significantly higher

than that of children living in Afghanistan [7]. Additionally, a 2019 study reported vaccination coverage rates of 97.8% among Iranian children and 90.3% among non-Iranian children, most of whom were Afghan [8].

However, several major events have taken place since then that are likely to have a substantial impact on current vaccination coverage levels. These include the influx of a large number of Afghan children following the Taliban's return to power in 2021 (3). In response, a nationwide vaccination campaign targeting Afghan migrants was launched in January 2023, followed by a complementary phase between February and April of the same year. Furthermore, the COVID-19 pandemic disrupted healthcare services [9], negatively impacting routine immunization efforts [10]. These evolving circumstances underscore the need for updated data.

This study sought to provide updated insights into routine vaccination coverage among Afghan children under 15 years of age living in Iran and to evaluate the impact of the recent nationwide campaign implemented to improve their immunization status.

Methods

Ethical Considerations

The study protocol was reviewed and approved by the Ethics Committee of Kerman University of Medical Sciences (IR.KMU.REC.1402.028). For children under 12 years of age, written informed consent was obtained from the child's caregiver. For children aged 12–15 years, informed consent was obtained from both the caregiver and the child, using tailored informed consent forms. Verbal informed consent was obtained from the experts and the key informants. The study was conducted in accordance with the Declaration of Helsinki.

Vaccination campaign

Coordinated by 27 medical universities across 24 cities, the campaign aimed to vaccinate approximately 1,000,000 Afghan children under 15. Children with vaccination cards received a dose of measles-mumps-rubella (MMR) and oral polio vaccine (OPV), while those without documentation began a primary vaccination schedule under caregiver supervision [5].

Sampling and participants

This cross-sectional survey was conducted between Jun 5, 2023, and July 2024. The study targeted Afghan immigrants and refugees under 15 years old who were residing in Iran during the vaccination campaign. The inclusion criteria were families with at least one Afghan child under 15 years old at the time of the campaign, living in Iran as a migrant or refugee. The required sample size was calculated to be 2,800 children, based on the WHO Immunization Coverage Cluster Survey Reference Manual [11].

A multi-stage sampling method was employed. Initially, 27 cities in five provinces that participated in the vaccine campaign program were included. These provinces had the highest burden of Afghan refugees and migrants in Iran. These cities were grouped into five clusters based on immunization rates, disease reporting, birth and death records, IT infrastructure, outreach facility quality, community engagement, and stakeholder evaluation. Then, one city was randomly selected from each cluster.

Through group discussions with key informants at the city health center and community-based Afghan facilitators, we compiled a list of health centers, the Afghan populations each serves, and the geographic areas each center covers within its respective city. To ensure a representative sample, six zones encompassing both urban and rural areas were selected in each city to provide an even distribution across geographic regions. The number of samples from each zone was proportional to its Afghan population. Within each zone, community health staff and community-based Afghan facilitators identified all residential, semi-residential, commercial, agricultural, and industrial areas, as well as city slums, waste centers, brick kilns, and other relevant locations. Sampling was then conducted to ensure a random, uniform examination of all these areas.

Measurements

Data were collected using a researcher-designed questionnaire that was pre-tested for validity and reliability. Because of linguistic differences between the Afghan and Iranian populations, we evaluated the questionnaire's face validity with Afghan facilitators and conducted a pilot study among Afghan residents in Kerman. To ensure content validity, the questionnaire was reviewed and approved by experts in epidemiology, biostatistics, and infectious disease specialists. The questionnaire gathered information on the place of birth, the number of vaccine doses received, and the date and location of each vaccination. Socio-demographic characteristics of the family, household economic and residential conditions, and the date of arrival in Iran were also documented. Routine and campaign vaccination history was verified through vaccination cards (validated coverage), if unavailable, caregiver verbal reports (self-report).

For campaign vaccination, we asked parents whether their child had received the MMR or OPV vaccine during the campaign. Then, we requested their vaccination card and recorded the vaccination date along with the child's age at that time. If they did not have a vaccination card, we asked for the vaccination date and the child's age at that time.

For routine vaccinations, we asked parents whether their child had received the MMR or OPV vaccination in Iran or Afghanistan. Then, we requested their routine vaccination card. We recorded the number of doses the child received, the timing of each dose, and the child's age at vaccination. If they did not have a vaccination card, we completed questionnaires based on their responses.

Data collection was carried out by community health practitioners and facilitated by community-based Afghan facilitators. Both groups received training prior to the fieldwork and were supervised by

experienced coordinators from the city health center and the core research team.

Serological Testing for Measles IgG Antibodies

In three of the five selected cities, 5 cc of blood was collected from a subset of 500 Afghan children who participated in the study. Serum samples were analyzed for anti-measles IgG antibodies using an ELISA kit (IBL International, Germany). The assay was performed according to the manufacturer's instructions.

Data Analysis

Survey analyses were conducted to account for the sampling design. Confidence intervals (95% CI) for all estimates were calculated using the Wilson score method. Analyses were performed using R software (version 4.3.1). A p-value less than 0.05 was considered statistically significant.

Results

Participant Characteristics

A total of 2,992 Afghan children were recruited in this study. Of these, 50.3% (n = 1,475) were female, and 39.9% (n = 1,174) were in the age group of 0–4 years. Additionally, 68.1% (n = 2,012) were born in Iran (Table 1). Regarding the parents' characteristics, the mean (SD) ages were 32.4 (7.8) years for mothers and 38.0 (9.1) years for fathers. Furthermore, 53.0% of fathers and 61.7% of mothers held a diploma or higher (Table 1).

Table 1
Demographic characteristics of Afghan children residing in Iran (N = 2,992)

Variable	Frequency (%)
Sex	
Male	1458 (49.7)
Female	1475 (50.3)
Age (year)	
0–4	1174 (39.9)
5–9	1105 (37.5)
10–15	664 (22.6)
Place of birth	
Afghanistan	938 (31.8)
Iran	2012 (68.1)
Other	4 (0.1)
Father age	
Mean (SD)	38.0 (9.1)
Median [Min, Max]	37.0 [17.0, 81.0]
Mother age	
Mean (SD)	32.3 (7.2)
Median [Min, Max]	31.0 [17.0, 65.0]
Father education	
Illiterate	205 (7.2)
Primary	1135 (39.8)
Diploma or academic degrees	1513 (53.0)
Mother education	
Illiterate	286 (9.9)
Primary	816 (28.4)
Diploma or academic degrees	94 (61.7)
*The number of children per family and the number of children under 15 years old are based on the total number of children in the family. So, in some polygamous families, the maximum number of children is high.	

Variable	Frequency (%)
Family supervision	
Father	2738 (96.8)
Mother	79 (2.8)
Other	10 (0.4)
Residential location	
House	2433 (93.2)
Janitorial unit	99 (3.8)
Commercial units	10 (0.4)
Greenhouse	64 (2.5)
Brick kiln	4 (0.2)
Market	1 (0.04)
Number of children per family*	
Mean (SD)	4.6 (2.4)
Median [Min, Max]	4.0 [1.0, 16.0]
Number of children under 15 years old*	
Mean (SD)	3.6 (1.6)
Median [Min, Max]	4.0 [1.0, 14.0]
Monthly income (USD)	
Mean (SD)	197.6 (111.4)
Median [Min, Max]	190.5 (0.00–1,666.7)
*The number of children per family and the number of children under 15 years old are based on the total number of children in the family. So, in some polygamous families, the maximum number of children is high.	

Routine vaccination coverage

According to self-reported data, 83.6% of children under 5 years old had received at least 2 doses of MMR, compared with 68.6% in the 5–10 age group and 60.6% among 10–15-year-olds. The vaccination was lower: 60.3%, 48.5% (95% CI: 26.9–70.7), and 41.1%, respectively (Table 2).

Table 2

Vaccination coverage of MMR and OPV by age group through routine and campaign immunization programs

	MMR Coverage		OPV Coverage	
	Self-report	Vaccination Card	Self-report	Vaccination Card
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Routine vaccine coverage				
18 months- 5 years				
0 doses	15.8 (9.6, 24.9)	28.5 (15.1, 47.2)	17.1 (9.0, 30.0)	26.0 (13.2, 45.0)
At least 1 dose	84.2 (75.1, 90.4)	71.5 (52.8, 84.9)	82.9 (70.0, 91.0)	74.0 (55.0, 86.8)
At least 2 doses	83.6 (74.4, 89.9)	60.3 (39.7, 77.8)	82.9 (70.0, 91.0)	71.6 (51.6, 85.6)
At least 3 doses	-	-	82.4 (69.2, 90.7)	66.9 (45.0, 83.3)
At least 4 doses	-	-	81.8 (68.6, 90.3)	61.7 (39.8, 79.7)
At least 5 doses	-	-	80.8 (68.3, 89.1)	51.8 (32.6, 70.5)
5–10 years				
0 doses	28.9 (16.5, 45.5)	43.4 (22.9, 66.5)	29.2 (16.5, 46.1)	40.3 (21.7, 62.1)
At least 1 dose	71.1 (54.5, 83.5)	56.6 (33.5, 77.1)	70.8 (53.9, 83.5)	59.7 (37.9, 78.3)
At least 2 doses	68.6 (51.9, 81.6)	48.5 (26.9, 70.7)	70.1 (53.0, 83.0)	57.4 (36.0, 76.4)
At least 3 doses	-	-	69.2 (51.4, 82.7)	54.4 (33.3, 74.1)
At least 4 doses	-	-	68.6 (51.7, 81.7)	51.0 (32.5, 69.3)
At least 5 doses	-	-	64.4 (47.2, 78.6)	39.1 (20.6, 61.4)
10–15 years				
0 doses	35.8 (24.3, 49.1)	50.0 (30.5, 69.5)	35.7 (22.7, 51.1)	46.8 (28.2, 66.5)
At least 1 dose	64.2 (50.8, 75.6)	50.0 (30.5, 69.5)	64.3 (48.9, 77.3)	53.2 (33.5, 71.9)
* For vaccine dose counting, any dose administered through Afghanistan's vaccination program, Iran's routine immunization program, or Iran's vaccination campaign is included.				

	MMR Coverage		OPV Coverage	
	Self-report	Vaccination Card	Self-report	Vaccination Card
At least 2 doses	60.6 (45.8, 73.6)	41.1 (21.4, 64.1)	63.1 (47.0, 76.8)	49.4 (29.3, 69.8)
At least 3 doses	-	-	63.0 (47.1, 76.6)	48.6 (29.6, 68.0)
At least 4 doses	-	-	61.6 (46.0, 75.1)	44.8 (27.4, 63.6)
At least 5 doses	-	-	59.3 (44.2, 72.9)	35.0 (19.6, 53.9)
All age				
0 doses	27.7 (17.3, 41.2)	42.1 (23.6, 63.1)	28.1 (16.6, 43.4)	39.0 (21.8, 59.5)
At least 1 dose	72.3 (58.8, 82.6)	57.9 (36.9, 76.4)	71.9 (56.6, 83.4)	61.0 (40.5, 78.2)
At least 2 doses	70.1 (56.0, 81.1)	48.9 (28.1, 70.1)	71.1 (55.5, 82.9)	58.1 (37.2, 76.4)
At least 3 doses	-	-	70.6 (54.7, 82.7)	55.1 (34.3, 74.3)
At least 4 doses	-	-	69.8 (54.3, 81.8)	51.2 (32.0, 70.0)
At least 5 doses	-	-	67.2 (51.9, 79.5)	40.7 (23.0, 61.1)
Campaign vaccine coverage by age group				
Under 5 years	73.3 (59.8, 83.5)	40.3 (30.4, 51.1)	70.3 (56.1, 81.4)	36.6 (26.8, 47.6)
5–10 years	82.1 (66.5, 91.4)	43.4 (28.7, 59.4)	70.4 (59.1, 79.7)	38.3 (22.1, 57.6)
10–15 years	75.8 (64.2, 84.5)	46.8 (36.1, 57.7)	60.8 (49.4, 71.2)	36.6 (21.3, 55.3)
Campaign vaccine coverage by place of birth				
Afghanistan	76.0 (72.1, 79.5)	40.6 (36.4, 44.9)	65.7 (61.4, 69.8)	34.7 (30.8, 38.8)
Iran	79.3 (76.7, 81.6)	46.0 (42.5, 49.5)	71.0 (67.8, 74.0)	40.4 (37.0, 43.9)
Total	77.1 (63.6, 86.6)	43.1 (31.2, 55.7)	68.0 (57.5, 76.9)	37.2 (23.8, 53.0)
Total (Routine or Campaign) vaccine coverage*				
* For vaccine dose counting, any dose administered through Afghanistan's vaccination program, Iran's routine immunization program, or Iran's vaccination campaign is included.				

	MMR Coverage		OPV Coverage	
	Self-report	Vaccination Card	Self-report	Vaccination Card
18 months- 5 years old				
0 doses	5.8 (4.0, 8.5)	23.7 (11.9, 41.4)	5.8 (3.4, 9.8)	21.2 (10.5, 38.1)
At least 1 dose	94.2 (91.5, 96.0)	76.3 (58.5, 88.0)	94.2 (90.2, 96.6)	78.8 (61.9, 89.5)
At least 2 doses	84.1 (75.1, 90.3)	64.4 (44.7, 80.2)	82.9 (70.0, 91.03)	72.5 (53.0, 86.1)
At least 3 doses	-	-	82.94 (70.0, 91.0)	68.3 (46.9, 84.0)
At least 4 doses	-	-	82.4 (69.3, 90.7)	62.9 (40.9, 80.6)
At least 5 doses	-	-	81.7 (68.7, 90.1)	56.3 (35.7, 74.9)
5–10 years old				
0 doses	7.2 (4.7, 10.9)	31.9 (15.2, 55.2)	11.5 (6.4, 20.1)	30.8 (14.5, 53.9)
At least 1 dose	92.8 (89.1, 95.3)	68.1 (44.8, 84.8)	88.4 (79.9, 93.6)	69.2 (46.1, 85.5)
At least 2 doses	70.8 (54.7, 83.0)	52.7 (30.6, 73.8)	70.5 (53.4, 83.2)	58.2 (36.2, 77.4)
At least 3 doses	-	-	69.8 (52.4, 82.9)	55.5 (34.0, 75.2)
At least 4 doses	-	-	69.1 (51.5, 82.4)	52.5 (33.1, 71.2)
At least 5 doses	-	-	67.7 (50.9, 80.9)	44.2 (25.2, 65.1)
10–15 years old				
0 doses	8.56 (7.3, 10.1)	32.2 (17.8, 51.0)	14.5 (9.3, 21.9)	34.7 (17.9, 56.5)
At least 1 dose	91.4 (89.9, 92.7)	67.8 (49.0, 82.2)	85.5 (78.1, 90.7)	65.3 (43.5, 82.1)
At least 2 doses	63.2 (49.6, 75.0)	45.2 (25.4, 66.8)	64.0 (48.2, 77.2)	51.4 (31.4, 70.9)
At least 3 doses	-	-	63.1 (47.0, 76.7)	49.0 (29.5, 68.7)
At least 4 doses	-	-	62.5 (46.4, 76.3)	46.1 (27.8, 65.5)
At least 5 doses	-	-	60.9 (45.4, 74.4)	40.2 (22.9, 60.5)
* For vaccine dose counting, any dose administered through Afghanistan's vaccination program, Iran's routine immunization program, or Iran's vaccination campaign is included.				

	MMR Coverage		OPV Coverage	
	Self-report	Vaccination Card	Self-report	Vaccination Card
All age				
0 doses	7.4 (5.6, 9.7)	30.3 (15.5, 50.6)	11.5 (6.9, 18.7)	30.2 (15.0, 51.5)
At least 1 dose	92.6 (90.3, 94.4)	69.7 (49.4, 82.5)	88.5 (81.3, 93.1)	69.8 (48.5, 85.0)
At least 2 doses	71.9 (58.5, 82.2)	53.0 (32.1, 72.9)	71.5 (56.1, 83.2)	59.3 (38.3, 77.4)
At least 3 doses	-	-	71.0 (55.3, 82.9)	56.1 (35.0, 75.1)
At least 4 doses	-	-	70.4 (54.5, 82.5)	52.5 (32.6, 71.6)
At least 5 doses	-	-	69.2 (53.9, 81.2)	45.5 (26.5, 65.9)
Total (Routine or Campaign) vaccine coverage by place of birth				
Afghanistan	44.1 (39.8, 48.5)	31.2 (27.5, 35.2)	38.1 (34.0, 42.3)	22.3 (19.1, 25.9)
Iran	94.5 (92.5, 96.0)	70.7 (67.0, 74.1)	94.8 (92.6, 96.3)	64.5 (60.8–68.0)
* For vaccine dose counting, any dose administered through Afghanistan's vaccination program, Iran's routine immunization program, or Iran's vaccination campaign is included.				

Self-reported coverage (≥ 5 doses) of OPV was 80.8% among children under five, 64.4% among 5–10-year-olds, and 59.3% among 10–15-year-olds. Validated coverage was lower: 51.8%, 39.1%, and 35.0%, respectively (Table 2).

Campaign vaccination coverage

One-dose campaign vaccination coverage, based on self-report, was 68.0% (ranging from 34.3% to 89.8% across cities) for OPV and 77.1% (ranging from 34.0% to 89.8% across cities) for MMR. Validated coverage was 37.2% (ranging from 11.5% to 76.5% across cities) for OPV and 43.1% (ranging from 11.5% to 76.3% across cities) for MMR.

Self-reported MMR vaccination coverage was 76.0% among Afghan children born in Afghanistan and 79.3% among those born in Iran. Validated coverage was 40.6% among those born in Afghanistan and 46.0% among those born in Iran. Self-reported OPV vaccination coverage was 65.7% among those born in Afghanistan and 71.0% among those born in Iran. Validated coverage was 34.7% among those born in Afghanistan and 40.4% (37.0, 43.9) among those born in Iran.

Self-reported one-dose MMR coverage during the campaign was highest among 5–10-year-olds (82.1%), followed by 10–15-year-olds (75.8%), and under-fives (73.3%). Validated coverage was lower, ranging from 46.8 in 10–15-year-olds to 40.3 in under-fives. (Table 2).

For OPV, self-reported campaign coverage was highest among 5–10-year-olds (70.4%), followed by under-fives (70.3%) and 10–15-year-olds (60.8%). Validated coverage was lower, ranging from 38.3 in 5–10-year-olds to 36.6 in under-fives (Table 2).

Total vaccination coverage

When combining data from both routine and campaign immunization programs, self-reported coverage was 70.1% (ranging from 64.4% to 93.9% across cities) for MMR (≥ 2 doses) and 67.2% (ranging from 60.8% to 95.5% across cities) for OPV (≥ 5 doses). Validated data showed coverage of 70.1% (ranging from 39.4% to 86.1% across cities) for MMR (≥ 2 doses) and 67.2% (ranging from 32.5% to 81.8% across cities) for OPV (≥ 5 doses).

Self-reported MMR (≥ 2 doses) vaccination coverage was 44.1 among Afghan children born in Afghanistan and 94.5 among those born in Iran. Validated coverage was 31.2 among those born in Afghanistan and 70.7 among those born in Iran. Self-reported OPV (≥ 5 doses) coverage was 38.1 among those born in Afghanistan and 94.8 among those born in Iran. Validated coverage was 22.3 among those born in Afghanistan and 64.5 among those born in Iran.

Self-reported MMR coverage (≥ 2 doses) was 84.1% among children under 5, 70.8% among 5–10-year-olds, and 63.2% among 10–15-year-olds. OPV coverage for at least five doses, based on self-report, was 81.7%, 67.7%, and 60.9%, respectively (Table 2).

Validated data showed lower coverage in all groups. For MMR (≥ 2 doses), confirmed coverage was 64.4% among under-fives, 52.7% among 5–10-year-olds, and 45.2% among 10–15-year-olds. OPV coverage (≥ 5 doses) was 56.3%, 44.2%, and 40.2%, respectively (Table 2).

Serologic Evidence of Immunity

Serologic testing results showed slightly different trends. Among children under five, 71.7% were seropositive for measles antibodies, compared to 76.5% of children aged 5–10 years and 78.9% of those aged 10–15 years (Table 3).

Table 3
Proportion of Afghan children in Iran immune to measles virus based on IgG test results

MMR	Negative (CI 95%)	Positive (CI 95%)	Equivocal (CI 95%)
0–5	18.3 (10.6–29.9)	71.7 (59.2–81.5)	10.0 (4.7–20.1)
5–10	11.1 (7.1–16.9)	76.5 (69.5–82.4)	12.3 (8.1–18.3)
10–15	11.6 (7.3–17.7)	78.9 (71.6–84.7)	9.5 (5.8–15.4)

Discussion

The findings from this study offer important insights into vaccine coverage of MMR and OPV among Afghan children in Iran. Over two-thirds of Afghan children in Iran reported receiving vaccines through the vaccination campaign, though fewer than half had valid vaccination cards. Over two-thirds of Afghan children reported receiving at least five doses of OPV and at least two doses of the MMR vaccine, either through the routine immunization or campaign vaccination programs. Additionally, more than three-quarters of the children tested positive for anti-measles

Based on verbal reports, 77.1% of children stated they received the vaccine, but only 43.1% were confirmed to have received it based on vaccination cards, indicating low campaign vaccine coverage. The low vaccination coverage during this campaign may be attributed to several factors. First, the total number of the Afghan population in Iran exceeded the available vaccine doses. In this campaign, 600,000 doses of MMR vaccine were provided by UNICEF, and an additional 400,000 doses were supplied from domestic sources. In total, 954,000 individuals were vaccinated, of whom 850,000 were Afghan children, and the remainder were Iranian children living in the same regions[3]. So, the campaign aimed to cover areas with a higher concentration of newly migrated Afghan populations, rather than the entire Afghan population. Second, the target populations were primarily mobile and unstable, with frequent movements that could have led to missed vaccinations. Third, our approach for identifying children for this study differed from that of the campaign, which may have contributed to discrepancies in coverage estimates. While the campaign primarily focused on households, we also assessed semi-residential and non-residential areas in our study.

The immunization coverage among Afghan children in Iran was slightly higher than the reported coverage in Afghanistan [12]. However, the vaccination coverage among Afghan migrant children in Iran was lower than that of Iranian children, which exceeds 97% according to various reports [8, 13]. This result is in line with studies in other countries. Studies conducted among Ukrainian refugees in Norway[14], refugees in New Zealand[15], and Syrian refugees in Lebanon[16] showed that, like our study, vaccination coverage among refugees was lower than national estimates.

An analysis based on place of birth revealed a significant disparity in total vaccination coverage between Afghan children born in Iran and those born in Afghanistan. The vaccination campaign aimed to address this gap, and during the campaign, vaccination coverage among Afghan children from both locations was relatively comparable. However, the notable difference in overall vaccination coverage suggests that additional efforts are necessary to improve this situation. Findings indicate that vaccination coverage among Afghan children born in Iran is similar to that of Iranian children, primarily because those born in Iran receive a birth certificate and are registered within the Iranian health system. As a result, they have access to vaccinations just like their Iranian counterparts, whereas children born in Afghanistan who later migrated to Iran often face challenges, including being unregistered and lacking access to vaccines. This result is in line with the findings of a study on vaccination coverage for Ukrainian children in Norway[14].

A study conducted in Kerman in 2013 indicated that vaccination coverage was similar among Iranian and Afghan children in that city.[7]. Furthermore, a national survey conducted in 2014 found that 87.5% of non-Iranian children, primarily Afghan, had received vaccinations[6]. These findings suggest that vaccination coverage among Afghan refugees was higher than what we observed in our study. This could be attributed to the timing of the surveys. Following the political events in Afghanistan in August 2021, a large number of Afghan migrants entered Iran through informal routes, which may have limited their access to Iran's health system and immunization services. Other contributing factors may include the broader decline in vaccination rates globally and regionally, due to the disruptions caused by the COVID-19 pandemic[17], and a lack of awareness regarding polio and measles vaccines[18]. Another contributing factor may be related to the research methodology and sampling frame used. In Kerman's study, data were collected from health center records that received support from the Higher Commission for Refugees in Kerman, which showed high vaccine coverage. In contrast, our study conducted sampling in both semi-residential and non-residential areas.

Results of vaccination coverage by age group showed higher coverage among younger age groups. This can indicate an increasing trend in vaccination coverage over recent years. In the age groups of 5–10 and 10–15 years, as well as in the overall sample, the percentage of Afghan children who tested positive for measles IgG antibodies was higher than the reported vaccination coverage for at least two doses of the MMR vaccine. The higher proportion of immune individuals identified through serological testing may be attributed to immunity acquired from prior measles infections. This hypothesis is further supported by the observed increase in IgG seropositivity with age. In children under five years old, the percentage of IgG seropositive individuals was lower than the percentage of those who received at least two doses of the vaccine. This discrepancy may be due to some vaccinated individuals not developing immunity, as indicated by equivocal test samples, and the fact that children in this age group may not yet have been exposed to natural infection.

The proportion of measles IgG seropositive individuals is below the herd immunity threshold for measles, which requires at least 93% to 95% coverage to prevent outbreaks [19–21]. This result underscores the urgent need for a more inclusive public health strategy that removes barriers to healthcare access for all residents, regardless of their documentation status. Furthermore, it highlights the importance of leveraging community-based approaches to reach and engage these hard-to-reach populations effectively. Future efforts should focus on targeted interventions designed for undocumented immigrants and refugees, including mobile vaccination clinics, flexible scheduling, and community-led outreach programs.

This study provides valuable findings; however, it has certain limitations. First, vaccine coverage was based on parental recall, which may lead to underestimation (due to possible memory lapses) or overestimation (due to confusion with other vaccines). Second, selection bias may contribute to an overestimation of vaccination rates, as the study did not include some hard-to-reach populations with limited access to vaccinations, particularly those living in rural areas.

Conclusion

The study's findings reveal a significant gap in vaccination coverage between Afghan children living in Iran and their Iranian peers, despite the vaccination campaign. The successful immunization rate for the Afghan population is estimated to be between 70% and 75%, which is approximately 20% lower than that of Iranian children. Consequently, there is a possibility of a local outbreak occurring among Afghan migrants, which could then spread to the Iranian population. Therefore, future efforts should focus on targeted interventions designed for undocumented immigrants and refugees, including mobile vaccination clinics, flexible scheduling, and community-led outreach programs.

Declarations

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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"Sana Eybpoosh" and "AliAkbar Haghdoost" contributed equally and share Corresponding authorship. The WHO funded the research.

Author contributions

AliAkbar Haghdoost, Hamid Sharifi, Sana Eybpoosh, Hossein Mirzaei, Ghulam Raza Mohammadyan, Mojtaba Keikha, Mohsen Zahraei, Omid Zamani, and Naser Nasiri contributed to the study design. AliAkbar Haghdoost, Hamid Sharifi, Sana Eybpoosh, Hossein Mirzaei, Ghulam Raza Mohammadyan, Mojtaba Keikha, and Naser Nasiri contributed to the design of the questionnaire. Ghulam Raza Mohammadyan, AliAkbar Haghdoost, Zahra Tahmasebi Ashtiani, Sana Eybpoosh, Hossein Mirzaei, Sakine Narouei, Mojtaba Norouzi, and Fatemeh Azimian Zavareh contributed to data collection. Saiedeh Haji-Maghsoudi, Ghulam Raza Mohammadyan, AliAkbar Haghdoost, Sana Eybpoosh, Zahra Tahmasebi Ashtiani, and Hossein Mirzaei contributed to data cleaning and analysis. Hossein Mirzaei, Sana Eybpoosh, and AliAkbar Haghdoost drafted the first version of the manuscript. All authors critically reviewed and edited the manuscript and approved the final version for submission.

Competing Interest

Omid Zamani is a staff member of the WHO. The other authors declare no competing interests.

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