Original Research Article

Integration of COVID 19 vaccination into Immunization program in Belize

ABSTRACT

Aims: To describe the process for the integration of COVID 19 vaccination into routine immunization program in Belize and outcome on immunization coverage

Study design: This is a descriptive study with mix of qualitative and quantitative methods.

Methodology: The qualitative data was collected from the review of documents produced, and processes involved in the implementation of the integration of COVID 19 vaccination into routine immunization program.. The quantitative data was from retrospective review of COVID 19 vaccination and routine immunization data extracted from the Belize Health Information System.. Descriptive data is presented in graph and table and univariate analysis was done by generating frequencies of the variables and test of association was done using paired t test to compare the mean change in annual immunization coverage before (2021) and after integration (2022) and p value was set at significant level of 5%.

Results: Belize adopted the Co-delivering of COVID-19 vaccines with other routine vaccines as a service delivery approach using fixed health facility and mobile clinics and home visits as the delivery strategies for integration. The mobile team and the home visit teams also tracked and provided mop up vaccination for missed children to help with the reduction in zero-dose children.

The results showed that the annual coverage of 1st dose and 3rd dose of Pentavalent vaccine increased by 7 percent and 10 percent between 2021 and 2022 though not statistically significant (p>0.5). The coverage of population who received at least one dose of COVID 19 vaccine and those fully vaccinated increased from 54.3 percent and 51 percent to 65percent and 55.7percent respectively between 31st March 2022 and 31st March 2023.

Conclusion: The study contributes to the existing literature on integration of COVID 19 vaccination into routine immunization services which is essential to address the continued backslide in routine vaccination due to the COVID 19 pandemic and ensure sustained equitable access to improve uptake of the COVID-19 vaccine and other routine vaccines.

Keywords: COVID 19 vaccination, Integration, Immunization program

1. INTRODUCTION

Belize, like many countries around the world, was hit hard by the COVID-19 pandemic and recorded the first case on 23rd March 2020 .[1] Belize officially launched the rollout of COVID-19 vaccines on

March 1, 2021, with mass vaccination campaigns used as the main delivery approach to reach targeted populations.[1] However, this negatively affected utilization of routine services because health workers and resources were diverted from providing essential health services, including immunization, to COVID-19 vaccination efforts.[2]

As of March 31, 2022, two hundred and twelve thousand four hundred and eighty 212,480) persons which represents 53.4 percent of the total population were vaccinated with at least one dose of a COVID-19 vaccine, and 202,878 persons which represents 51 percent of the total population were fully vaccinated.[3]

In line the Strategic Advisory Group of Experts on Immunization recommendation that countries should leverage the COVID-19 vaccination roll-out as a transformative opportunity for building resilient immunization programmes and to strengthen primary health care [4] , the government of Belize with support from partners which included PAHO,UNICEF, World Bank, Inter America Development Bank and Embassy of Japan commenced the integration of COVID 19 with the routine immunization system in April 2022.

Belize has a robust immunization program and ranks favorably in the Global Health Security Index (GHSI) index regarding its immunization capacity (92.1/100 points) and has successfully introduced vaccines against 12 communicable diseases in the routine vaccination schedule.[5] Thus, integrating COVID 19 vaccination into the routine immunization was considered to be feasible with adequate planning and effective implementation strategy and support from the partners.

The study described the process for the integration of COVID 19 vaccination into routine immunization program in Belize and outcome on immunization coverage.

2. MATERIAL AND METHODS

2.1 DESIGN .

The study was a descriptive study and used mix of both qualitative and quantitative methods.

2.1 STUDY POPULATION AND SETTING.

The study was conducted in Belize, located in Central America with a population of 430,191 and six administrative districts. Belize implements decentralized health system with four health regions and each region provides secondary and primary health care services. The rural population is served at the community level through health posts and health centers. Urban based regional hospitals provide secondary care while tertiary care is provided at the country's sole public referral hospital the Karl Heusner Memorial Hospital (KHMH), located in the Central Health Region.

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2.3 DATA COLLECTION AND STATISTICAL ANALYSIS

The qualitative data was collected from the review of documents produced and processes involved in the implementation of the initiative. The quantitative data was from retrospective review of COVID 19 vaccination and routine immunization data extracted from the Belize Health Information System. Descriptive data is presented in graph and tables and univariate analysis was done by generating frequencies of the variables and test of association was done using paired t test to compare the mean change in annual immunization coverage before (2021) and after integration (2022) and p value was set at significant level of 5%

3. RESULTS AND DISCUSSION

3.1 Results:

This is organized and presented along the two major themes:

(1) The description of the process of integration of COVID 19 vaccine into routine immunization services.

(2) Program Results: the analysis of immunization coverage for COVID 19 Vaccine and routine vaccines before integration and after integration

3.1.1 The description of the process of integration of COVID 19 vaccine into routine immunization services.

The implementation was guided using the five components of the immunization system; program management and coordination; service delivery, vaccine supply and cold chain logistic, Surveillance and monitoring; and advocacy and social mobilization and communication as implementation framework

1. Program Management and coordination

In close coordination with other partners, under the leadership of the Ministry of Health and Wellness (MOHW), Partners' review meetings were held to take stock of the COVID 19 vaccination campaign and coverage of primary health care services. The outcome of the meetings showed that despite the geographic distribution of the COVID 19 vaccination campaign across the country, equitable access to vaccination sites, particularly in remote, and rural areas, remained a concern. In realization that the campaign strategy for COVID 19 vaccination cannot be sustained because of the impact on the limited health workers and resources being diverted for the campaign, it was agreed to commence integration of COVID 19 vaccination into the routine immunization program. The Ministry of Health at the national and subnational levels and health partners led the implementation, coordination and monitoring of the integration in all districts in the country.

The implementation team reviewed the benefit and potential risk and challenges of integration of COVID-19 vaccination due to the disruption of the function of the health system by the pandemic and adapted the use of the five components of the EPI operational system; program management and coordination; service delivery; vaccine supply and cold chain logistic; Surveillance and monitoring ; and advocacy and social mobilization and communication as the framework for implementation. This is to ensure equitable access to COVID-19 vaccines and routine vaccines through strengthening of the vaccine delivery system.

2. Services delivery

The service delivery approach used was co-delivering of COVID-19 vaccination with other routine vaccination using fixed health facilities and mobile clinics and home visits as the delivery strategies. The fixed health facilities offered both routine and COVID19 vaccines daily while the mobile teams were deployed based on schedule to villages that are far to reach from the fixed health center and the communities with lowest vaccination coverages prioritized for both routine and COVID19 vaccines. COVID 19 vaccine was provided to individual including children above 12 years old based on the national strategy. The mobile team and the home visit teams also tracked and provided mop up

vaccination for missed children to help in reduction of zero-dose children. The public health system in Belize is made of various types of health facilities- hospitals, polyclinics, health centers and health posts- across the four regional health administrations. All regions provide primary and secondary health care services while tertiary care is provided at the country's sole public referral hospital located in the Central Health Region. All the health facilities were used as fixed sites.

3.**Surveillance and monitoring**

The Belize Health Information System (BHIS) was updated to accommodate COVID-19 vaccines administration. The BHIS has an integrated module on immunization where data on vaccines administered including COVID 19 vaccine is entered into electronic medical records of the vaccinees. The data on COVID 19 vaccine administered are collected at every service delivery point and entered into the BHIS. The BHIS allows for real-time tracking of vaccination data. Some rural health facilities without access to the BHIS use a paper-based system to collect vaccination data which are later entered into the BHIS at the nearest health facility with access to the BHIS.

Belize has an established Adverse event following immunization (AEFI) surveillance system for the documentation and reporting of adverse events following immunization and the BHIS system updated manually to record AEFI so as to strengthen the AEFI surveillance system for both COVID 19 and other routine vaccines.

3. Vaccine supply and cold chain logistic.

COVID-19 vaccines were distributed along with the routine vaccines from the national vaccine storage facility to the district management team. At the district level, the vaccine distribution to the health facilities is based on requisitions placed via the BHIS supply chain management system and last mile delivery was facilitated using various transport means. No cold chain assessment based on WHO-UNICEF Effective Vaccine Management (EVM) assessment has been conducted 12 months prior to the introduction of the COVID 19 vaccine.

A cold chain assessment for all levels of the health care system was conducted using a supervisory checklist developed to re-assess the availability and functionality of cold chain equipment in each health facility . This was to ensure that they are properly maintained and make necessary corrections where needed. There are 44 health facilities in primary care within the public health sector. Of these, 95% (42) have cold chain equipment installed for the management of vaccines and 81.8% (36) do not have access to backup generator in case of power failure.

Additional cold chain equipment were procured and redistributed to enhance vaccine storage and cold chain capacity in all the health facilities and for mobile teams to accommodate both COVID 19 vaccines and routine vaccines.

All primary care health workers and vaccine technicians involved in the immunization activities were trained in the management of the cold chain system and vaccine management for both COVID 19 and routine vaccines and preventive and corrective maintenance plans developed.

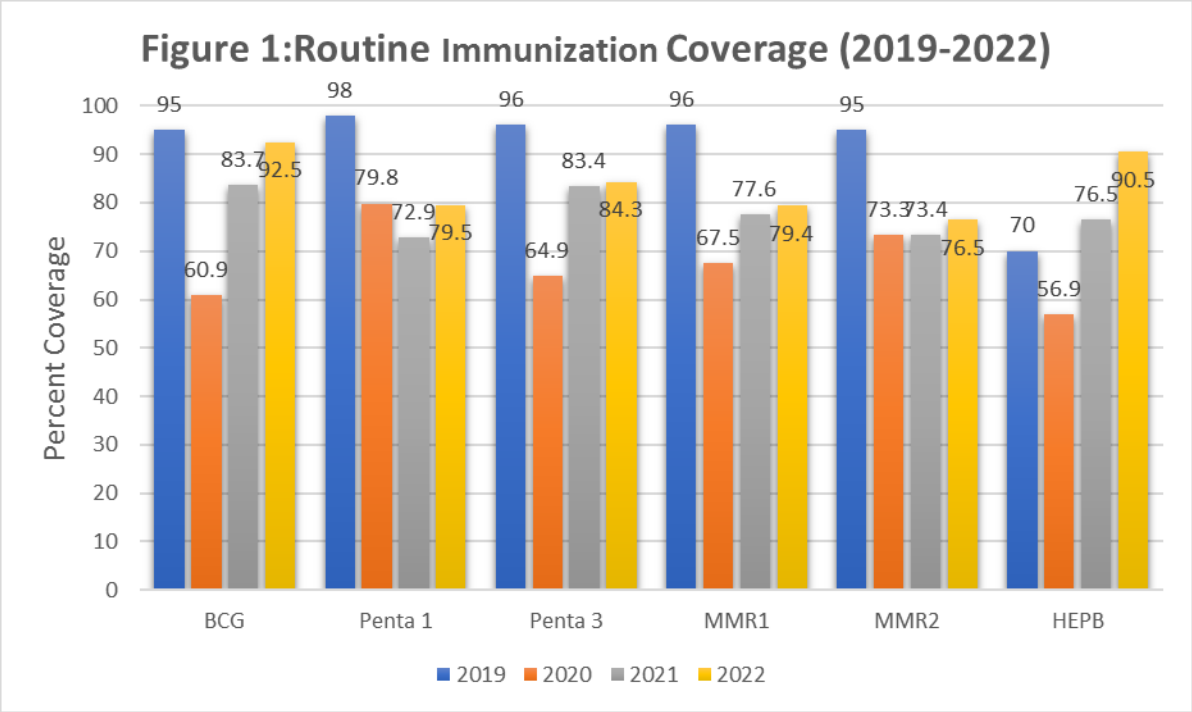
4. Advocacy and Social Mobilization and communication

To improve on demand generation and reduce vaccine hesitancy, coordination and engagement with local leaders was enhanced and community health workers who were trained on interpersonal communication conducted house-to-house health education visits 1-2 days before the vaccination exercise using culturally specific job aids. All the Social Behavioural Change Communication materials developed for COVID 19 vaccination campaign were updated to include messages on routine vaccines and other primary health care services and were disseminated through multiple media (e.g. phone, text messages, billboards, radio and television, social media etc.).

3.1.2.Programme Results:

Quantitative Analysis: The data on COVID 19 vaccines and routine vaccines administered were analysed to compare coverage of COVID 19 vaccines coverage before integration and a year after integration. The routine immunization data from 2019 to 2022 were analysed to show the coverage of the various vaccines during this period and compare the coverage a year before and after integration.

Figure 1 shows that the coverage of 1st dose of Pentavalent vaccine (Penta 1) decreased from 98% in 2019 to 72.9% in 2021 but increased slightly to 79.5% in 2022. The coverage of the 3rd dose of Pentavalent vaccine (Penta 3) decreased from 96% in 2019 to 64.9% in 2020 but increased to 83.4% in 2021 and 84.3% in 2022. This shows a 7% increase in Penta 1 and about 10% increase in Penta 3 coverage between the period of integration.



The differences are however not statistically significant as shown in Table 1 which shows the bivariate analysis using paired t -test of change in annual immunization coverage for pentavalent vaccines between 2021 and 2022. The mean number of children who received first dose of

pentavalent vaccine (Penta 1) in 2021 (mean= 816; SD= 245.94) compared to (mean= 878.; SD= 253.19) in 2022. This difference is however not statistically significant, p=0.77.

The mean number of children who received third dose of pentavalent vaccine (Penta 3) in 2021 (mean= 847; SD=246.62) compared to (mean= 938.17; SD= 294.85) in 2022. This difference is however not statistically significant, p=0.98

Variables	Mean± SD	T-test value	95%CI Lower Limit	95%CI Upper Limit	P-value
Children under one who received 1st dose of pentavalent vaccine (Penta 1) in 2021	816.83±245.94	0.2996	277.91	364.25	0.77
Children under one who received 1st dose of pentavalent vaccine (Penta 1) in 2022	878 ±253.19				
Children under one who received 3rd dose of pentavalent vaccine (Penta 3) in 2021	847 ±246.62	0.0138	347.49	351.82	0.98
Children under one who received 1st dose of pentavalent vaccine (Penta 3) in 2022	938.17±294.85				

Table 1: Bivariate analysis of change in annual Immunization coverage for pentavalent vaccines between 2021 and 2022

Source: ***Belize Health Information System, Epidemiology Unit, MoHW***

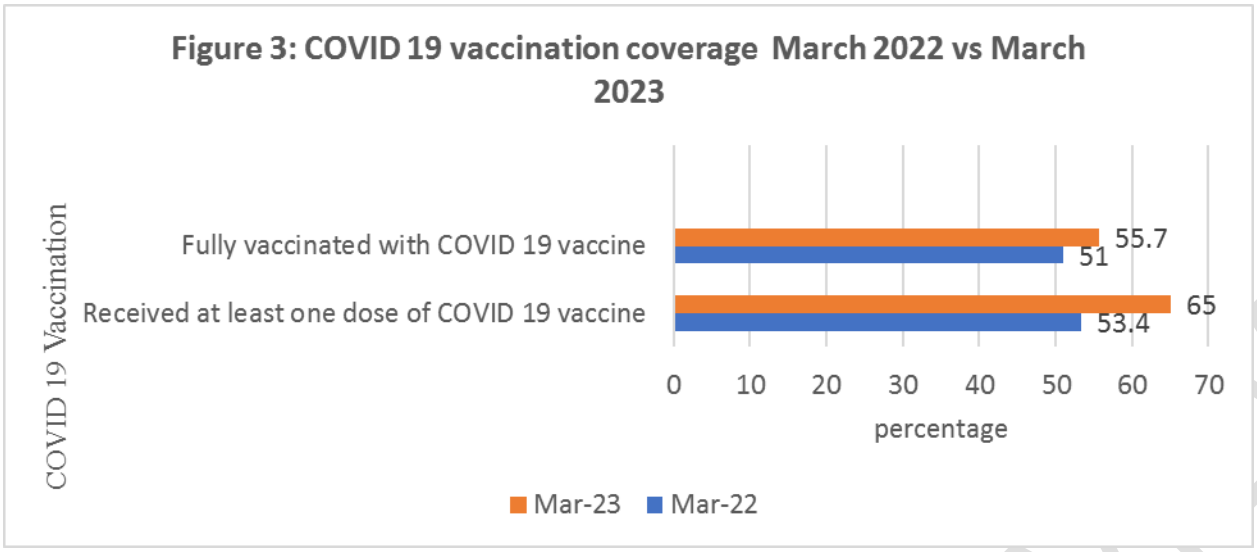
Table 2 shows the annual immunization coverage in 2021 and 2022 among the six health district highlighting geographical coverages of the key routine vaccines. The coverage of 1st dose of Pentavalent vaccine (Penta 1) in 2021 ranged from 69.4% in Toledo district to 78.2% in Cayo district with average coverage of 72.9%. The coverage of 1st dose of pentavalent vaccine (Penta 1) in 2022 ranged from 72.6% in Belize district to 87.8% in Corozal district with average coverage of 79.5%.

Table 2: Annual Immunization coverage 2021 vs 2022 by districts

District	BCG (%)		Penta 1 (%)		Penta 3(%)		MMR1(%)		MMR (%)		Hepatitis B(%)	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Corozal	88.1	105.3	70.6	87.8	92.3	89.8	79.1	75.6	75.4	79.3	76.9	92.4
Orange Walk	71	93.3	71.1	76.3	74.6	84.1	73.9	76.1	71.3	76.3	73.9	91
Belize	84.6	98.3	72.5	72.6	84	76.2	75.5	76.3	67.6	69.4	78.3	93.3
Cayo	92.7	88.6	78.2	86.2	93.5	89.4	74.6	79.9	72	74.2	81.7	98.8
Stann Creek	77.5	79.4	75.5	78.8	74.5	80.7	82.2	83.8	77.3	84.5	74.7	75
Toledo	85.4	97.9	69.4	75.3	77.9	90.2	80.3	84.7	76.8	75.3	73.5	89.6
Country	**83.7**	**92.5**	**72.9**	**79.5**	**83.4**	**84.3**	**77.6**	**79.4**	**73.4**	**76.5**	**76.5**	**90.5**

Source: *BHIS, Epidemiology Unit, MoHW/* Belize.

Figure 3 shows that as of March 31, 2022, 212,480 persons (53.4 percent of the total population) were vaccinated with at least one dose of a COVID-19 vaccine, and 202,878 persons (51 percent of total population) were fully vaccinated. By March 2023, 258,418 (65% of total population) were vaccinated with at least one dose of a COVID-19 vaccine and 221,397 persons (55.7% of total population) were fully vaccinated. This shows an increase of 12% and 5% between the period of integration on the percentage of population vaccinated with at least one dose of COVD 19 vaccine and fully vaccinated respectively.



Source: *BHIS, Epidemiology Unit, MoHW*

3.2 DISCUSSION

There is growing recognition of the potential for integration with other services as the way forward for ensuring sustainable and equitable COVID-19 vaccination.[6,7] Many countries have recently begun to integrate COVID 19 vaccination into their other services, however very limited examples have so far been documented with little evidence available on the outcome or success of such integration.[8,9,10] Integration is one of the six fundamental principles of the Global Vaccine Action Plan (GVAP) framework endorsed at the World Health Assembly (WHA) in May 2012 to achieve the Decade of Vaccines' vision of delivering universal access to immunizations.[11] Integration into the routine immunization through the primary health care system have consistently demonstrated to improve equity of access and diminishes health and is prioritised in the global Immunisation Agenda 2030 as an essential platform for providing other priority public health interventions.[12]

Belize adopted the Co-delivering COVID-19 vaccination with other routine vaccines as a service delivery approach using fixed health facility and mobile clinics as the delivery strategy for integration. All the health facilities provided immunization services for COVID19 and routine vaccines daily while the mobile clinic are based on schedules. This is similar to the practice reported in Iraq , Honduras, Sri-Lanka and Yemen.[8,9,10] However, in Panama, co-administration of COVID-19 occurred only

during immunization week through campaign with influenza vaccination house to house and in health facilities.[9]

Other service delivery approaches and strategies reported included collaboration between COVID-19 vaccination and other existing immunization delivery platforms targeting different age groups. Angola, Nigeria and Ethiopia implemented this approach using mass vaccination campaign as the delivery strategy during which COVID 19 Vaccination campaign was integrated with measles campaigns.[9] Bangladesh, India and Maldives adopted the same approach using Outreach/health facility- based delivery strategy during which the health centers (fixed/outreach) provided routine immunizations and COVID-19 vaccination on different days or same days but different times.[8,9,10]

Co-delivering COVID-19 vaccination with other health interventions (e.g., screening for NCDs, malnutrition) for the same target population was another approach adopted by other countries. In Cambodia, Djibouti, Panama and Nigeria, mass campaign delivery strategy was used to provide COVID 19 vaccines along with other health care services such as for childhood vaccination, screening and treatment of malnutrition and screening for non-communicable diseases (NCDs) while Tanzania through health facility based delivery partnered with the HIV programme to vaccinate people living with HIV/AIDS with COVID 19 vaccine and established collaborations with physicians treating chronic diseases (e.g. diabetes, hypertension) to provide COVID-19 vaccination on specialist clinic days.[9]

There has been little evidence available as to the success of these integration initiatives to compare with our findings.

In this study, Penta 1 coverage increased from 72.9% to 79.5% while Penta 3 coverage increased from 83.4% to 84.3%. This shows annual 7% increase in P1 and about 10% increase in Penta3 coverage between 2021 and 2022. This is less than the immunization coverage reported in a study in Iraq which reported coverage rates for Penta3, and Penta 1 were up by 17% and 27% respectively

when comparing between March 2021 and March 2022, reaching 98% and 99% coverage in March 2022 respectively.

In the study, the percentage of total population who received at least one dose of COVID 19 vaccine and those fully vaccinated increased from 54.3 percent and 51 percent to 65percent and 55.7percent of the total population respectively between 31st March 2022 and 31st March 2023, which shows an increase of 12% and 5% between the period of integration on the percentage of population vaccinated with at least one dose of COVD 19 vaccine and fully vaccinated respectively. This is higher than what was reported in the study in Iraq, where the percentage of fully vaccinated Iraqi people remains at 18.5% nationally in September 2022, up from 10% in September 2021.[10]

The low coverage in COVID 19 vaccine uptake following the integration in our study and Iraq could have been driven by low perception of COVID-19 risk as reported in other study.[8]

Unlike the study in Iraq which focused more on mobile outreaches than fixed health facilities, in our study, focus was more on service delivery through the fixed health facilities than mobile clinic in view of the high financial cost and logistic challenges associated with mobile outreaches which are not sustainable.[8,10]

In Yemen, unlike the finding in this study, integrating RI with COVID-19 vaccines was reported to have resulted in a reduction in RI vaccine uptake from previous years in some localities.[10]

There were concern that integrating COVID-19 vaccination with other services, particularly routine immunisation, may have the effect of tainting those services with COVID-19-specific doubts (such as lack of trust and safety concerns).[8,10] In addition, inadequate resourcing and inappropriate planning and implementation including lack of health workers with sufficient capacity were among the main barriers to effective integration cited by various studies.[8,10]

Mobile outreach through effective is particularly resource intensive and a reliance on outreach services may diminish participation in other health services provided at health facilities.[8,10]

Strategy to address the various barriers to improving on the coverage in targeted communities and health districts with low coverage of COVID 19 vaccination and routine immunization was being developed and to be rolled in consultation with all stakeholders including the community members and leaders.

4. Conclusion: The study contributed to the existing literature on integration of COVID 19 vaccination into routine immunization services which is essential to address the continued backslide in routine vaccination due to the COVID 19 pandemic and ensure sustained equitable access to improve uptake of the COVID-19 vaccine and other routine vaccines.

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