


Annual cost savings of US\$70 million with similar outcomes: vaccine procurement experience from Iraq

S M Moazzem Hossain,¹ Riyadh-Al Hilfi,² Alaa Rahi,³ Firas Jabbar,⁴ Cristina Garcia,⁵ Nadia Teleb,⁶ Ulla Kou Griffiths ¹

To cite: Hossain SMM, Hilfi R-A, Rahi A, *et al*. Annual cost savings of US\$70 million with similar outcomes: vaccine procurement experience from Iraq. *BMJ Global Health* 2022;**7**:e008005. doi:10.1136/bmjgh-2021-008005

Handling editor Seye Abimbola

Received 15 November 2021

Accepted 11 January 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Program Division, UNICEF, New York, New York, USA

²General Directorate of Public Health, Ministry of Health, Baghdad, Iraq

³Health Section, UNICEF Iraq, Baghdad, Iraq

⁴EPI Department, MOH, Baghdad, Iraq

⁵Department of International Health, Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland, USA

⁶Former Regional Advisor, World Health Organisation Regional Office for the Eastern Mediterranean, Cairo, Egypt

Correspondence to

Dr S M Moazzem Hossain; smhossain@unicef.org

INTRODUCTION

Iraq is classified as an upper-middle-income country with 2019 gross national income per capita of US\$5740.¹ The poverty rate increased from 19% to 23% between 2012 and 2014 and exceeds 70% in some Southern districts.² Iraq has had a dramatic population increase in the past decades; the population totalled seven million in 1960 and was 41 million in 2021.³

The Expanded Programme on Immunisation was launched in Iraq in 1985, aiming to protect children against tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus and measles, and their mothers against tetanus for prevention of neonatal tetanus.⁴ Measles-mumps-rubella combined (MMR) vaccine was introduced in 1988, hepatitis B vaccine in 1994, *Haemophilus influenzae* type b (Hib) and rotavirus vaccines in 2012, inactivated polio vaccine (IPV) in 2016 and 13-valent Pneumococcal Conjugate vaccine (PCV13) in 2017.⁴

In early 2019, the Ministry of Health convened a series of meetings to review the National Immunisation Programme in collaboration with WHO and Unicef.⁵ The objective was to strengthen the efficiency of the programme and improve immunisation coverage. The national vaccination schedule adopted by the Ministry was discussed and the National Immunisation Technical Advisory Group (NITAG) recommended to rationalise it to achieve cost savings. We reflect on the process and rationale for recommended changes to the vaccination schedule.

IPV INTRODUCTION

In October 2015, the WHO Strategic Advisory Group of Experts on Immunisation recommended that all countries should introduce at least one dose of IPV into their routine immunisation schedule.⁶ This was part of the Polio Eradication and Endgame Strategic Plan

Summary box

- ▶ Procurement efficiency savings are monetary savings made by improving efficiency in procurement.
- ▶ Governments have a strong desire for procurement efficiency because it is viewed as a relatively painless way to achieve cost savings.
- ▶ Public policy and political considerations may influence procurement decisions because governments tend to have wider objectives than efficiency alone.
- ▶ The Iraqi Ministry of Health succeeded in achieving vaccine procurement savings of US\$70 million per year by implementing changes to the immunisation schedule.
- ▶ The new schedule is considered just as effective in terms of disease prevention as the previous, more expensive schedule.
- ▶ Procurement efficiency savings in the public sector is possible with a transparent policy process and strong leadership.

2013–2018, which included global withdrawal of the type 2 component of oral polio vaccine (OPV).⁷ The primary purpose of the IPV dose is to induce an immunity base that can be rapidly boosted should there be an outbreak of poliovirus type 2 after the removal of type 2 virus from OPV.⁶

At that time, the Ministry of Health leadership in Iraq decided to revise the immunisation schedule to include five doses of IPV as part of combined vaccines, which all contained acellular pertussis (aP). From 2016, combined DTaP-HepB-Hib-IPV were scheduled at 2, 4 and 6 months, one dose of DTaP-Hib-IPV at 18 months, and one dose of DTaP-IPV at 4–6 years.

COST CONSIDERATIONS

Vaccine forecasting is completed annually by the Directorate of Technical Affairs in the Iraqi Ministry of Health. The State Company for Marketing Drugs and Medical Appliances

(KIMADIA) is responsible for vaccine procurement, including management of tendering processes and issuing contracts. KIMADIA has faced challenges of non-standardised prices and costs of vaccine procurement have at times exceeded the Ministry of Health budget.

Budget constraints have for decades caused intermittent drug and vaccine shortages. In 2019, a situation analysis on health in Iraq conducted by the new administration of the Ministry of Health revealed that 49% of essential drugs were not available at health facilities, 39% were partially available, and only 12% were consistently available.⁸ Difficulties in securing timely supplies have been exacerbated since 2014 due to sharp reductions in oil prices and military operations against the Islamic State of Iraq and Syria. These events severely impacted the Iraq economy.

Procurement efficiencies can be achieved in numerous ways, such as expanding bulk procurement, implementing long-term contracting frameworks and standardising processes.⁹ In Iraq, options for improving procurement efficiency were focused on rationalising the immunisation schedule as well as leveraging the Government's existing agreement with UNICEF to use its procurement services. BCG vaccine has been procured through UNICEF since 2012, while remaining vaccines were procured independently.

During 2018–2019, the Ministry of Health initiated a review of vaccine procurement list items with technical support from WHO and UNICEF. It was found that the numerous IPV doses and the acellular component of pertussis vaccine especially contributed to high vaccine procurement budget.

2019 NITAG RECOMMENDATIONS

The Iraqi NITAG was established by ministerial order #2922 in July 2004. The committee has functioned in its current form since 2012. The nine, core NITAG members are academics independent of the Ministry of Health. Non-core members serve to provide information and have no right to vote. The Director General of Public Health in the Ministry of Health is the convener of NITAG meetings, with the Expanded Programme of Immunisation serving as the secretariat. The NITAG Chair reports to the Minister of Health.

The Minister of Health called for a NITAG meeting on 'Cost efficiency in procurement of vaccines and quality coverage data of vaccination' on 14 January 2019–15 January 2019.¹⁰ The meeting focused especially on the rationale for several doses of IPV in the schedule and on the acellular component of pertussis vaccine. The NITAG considered the WHO pertussis and polio position papers.^{6 11}

The 2015 WHO pertussis position paper concluded that while the licensed aP and whole-cell pertussis (wP) vaccines have equivalent initial effectiveness in preventing disease in the first year of life, there is more rapid waning of immunity, and possibly a reduced

impact on transmission, with aP relative to wP vaccines.¹¹ Hence, the use of aP vaccines may result in a resurgence of pertussis after several years, which could lead to an increased risk of death in those too young to be vaccinated.¹¹ For polio-endemic countries and in countries at high risk for importation and subsequent spread of poliovirus, the WHO recommends a bivalent OPV birth dose followed by a primary series of three bivalent OPV doses and at least one IPV dose.⁷

During the meeting, the NITAG made the following recommendations for changing the immunisation schedule¹⁰:

1. Replace DTaP-HepB-Hib-IPV vaccine at 2, 4 and 6 months with DTwP-HepB-Hib at 2, 4 and 6 months and IPV vaccine at 4 and 6 months.
2. Replace DTaP-Hib-IPV at 18 months and DTaP-IPV at 4–6 years with DTwP vaccine.
3. Change the MMR vaccine schedule so that the first dose is given at 12 months instead of at 15 months and the second dose at 18 months instead of at 4–6 years.

Iraq had experienced several measles and mumps outbreaks. Since children are more likely to be taken for health services while they are young, the NITAG recommended to move the MMR schedule forward with the aim of increasing vaccination coverage.

COST SAVINGS DUE TO THE NITAG RECOMMENDATIONS

Both the new and the old schedule contain ten different antigens and a total of 23 vaccine doses per child (table 1). Due to preferential vaccine prices, the Ministry of Health decided that DTwP, DTwP-HepB-Hib and IPV vaccines should be procured through UNICEF after the switch. This was facilitated by using the UNICEF procurement services agreement previously established for BCG.

The price per dose ranged from US\$0.17 for the DTwP vaccine in the new schedule to US\$20.65 for the DTaP-IPV-HepB-Hib vaccine in the old schedule (table 1). Vaccine wastage rates vary according to vial size and age of delivery, ranging from 50% for BCG vaccine given at birth to 5% for vaccines in single dose vials.

Annual costs of the two schedules were calculated using the 2018 birth cohort of 1117512 infants and district level vaccination coverage estimates¹² (table 2). The old schedule amounted to around US\$129 million per year, equivalent to US\$116 per child in the birth cohort and US\$137 per fully vaccinated child (the latter approximated by the number of children that received the third dose of DTP-containing vaccine). The DTaP-IPV-HepB-Hib vaccine comprised 49.7% of the total costs.

Annual costs of the new schedule totalled approximately US\$59.7 million, with PCV13 comprising 49% of total costs. Cost per child in the birth cohort and per fully vaccinated child amounted to US\$53 and US\$64, respectively. Changing the schedule resulted in annual procurement cost savings of approximately US\$69.6 million, which is a 54% reduction.

Table 1 Recommended old and new childhood vaccination schedule in Iraq

Age	Vaccine	Old schedule	New schedule	No of doses	Price per dose (US\$)	Vaccine wastage (%)
At birth	BCG	X	X	1	0.19	50
	Hepatitis B	X	X	1	0.55	25
	OPV	X	X	1	0.22	25
<1 year	DTaP-IPV-HepB-Hib	X		3	20.65	5
	DTwP-HepB-Hib		X	3	0.69	13
	PCV13	X	X	3	18.77	5
	OPV	X	X	3	0.22	25
	IPV		X	2	2.95	13
	Rotavirus	X	X	2	6.65	5
	Measles	X	X	1	0.70	40
1–6 years	OPV	X	X	2	0.22	25
	DTaP-Hib-IPV	X		1	14.89	5
	MMR	X	X	2	3.18	40
	DTaP-IPV	X		1	10.58	5
	DTwP		X	2	0.17	20

aP, acellular pertussis; HiB, haemophilus influenzae type b; IPV, inactivated polio vaccine; MMR, measles-mumps-rubella; OPV, Oral Polio Vaccine; PCV13, 13-valent Pneumococcal Conjugate vaccine; wP, whole-cell pertussis.

CONCLUSION

Iraq was able to half its annual vaccine procurement budget by modifying the childhood vaccination schedule and increasing the number of vaccines procured through UNICEF. Cost savings of US\$70 million per year would be considerable in any setting, but is especially important

in a country like Iraq where budget fluctuations have frequently led to vaccine stock-outs.

Improved procurement efficiency was achieved by calling a meeting for all concerned stakeholders where NITAG members presented the rationale for the change in schedule along with technical advice from WHO

Table 2 Cost of vaccines and injection supplies for the 2018 birth cohort with old and new vaccination schedule

Vaccine	Doses administered			Total cost (US\$)	
	Old schedule	New schedule	Cost per dose (US\$)*	Old schedule	New schedule
BCG	1 061 636	1 061 636	0.48	510 014	510 014
Hepatitis B child	938 710	938 710	0.82	768 107	768 107
OPV	4 173 163	4 173 163	0.29	1 212 373	1 212 373
DTaP-IPV-HepB-Hib	2 941 386	–	21.83	64 212 844	–
DTwP-HepB-Hib	–	2 941 386	0.94	–	2 777 010
PCV13	1 465 226	1 465 226	19.80	29 005 124	29 005 124
IPV	–	1 913 541	3.64	–	6 956 958
Rotavirus	1 312 142	1 312 142	6.98	9 165 198	9 165 198
Measles	929 434	929 434	1.27	1 184 315	1 184 315
DTaP-Hib-IPV	721 678	–	15.76	11 373 820	–
MMR	1 421 488	1 421 488	5.40	7 692 924	7 692 924
DTaP-IPV	371 774	–	11.23	4 173 774	–
DTwP	–	1 421 488	0.33	–	466 733
Total				129 300 493	59 738 756

*Cost per dose includes vaccine wastage, safe injection supplies and freight. For vaccines procured through UNICEF (BCG, DTwP, DTwP-HepB-Hib and IPV), it also includes UNICEF handling fees.

aP, acellular pertussis; HiB, haemophilus influenzae type b; IPV, inactivated polio vaccine; MMR, measles-mumps-rubella ; OPV, Oral Polio Vaccine; PCV13, 13-valent Pneumococcal Conjugate Vaccine; wP, whole-cell pertussis.

and UNICEF. The NITAG contended that the potential cost savings should be reprogrammed to improve the quality of vaccine delivery and other primary health-care services. Although NITAG's decision was evidence based and transparently communicated, there was resistance from some stakeholders who had been involved in introducing hexavalent vaccine only 3 years earlier. Reluctance towards changing procurement procedures was expressed and it was argued that training of health workers would be complex.

Importantly, the changed schedule delivers similar overall disease protection to Iraqi children. The wP vaccine is at least as effective as the acellular component. While the old schedule included nine polio doses, this was reduced to seven doses in the new schedule. Seven polio vaccine doses are more than sufficient for ensuring lifelong protection. The MMR schedule was brought forward with the aim of increasing coverage of mumps and measles protection especially. Due to confounders caused by the COVID-19 pandemic, it is however not yet possible to conclude whether the schedule change had the intended impact.

Contributors SMMH conceptualised and lead organisation of the paper. R-AH, AR, FJ and NT was part of the policy process being described and contributed content. UG and CG estimated the efficiency cost savings. UG edited the paper.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study does not involve human participants.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data related to the study can be made available upon request to UNICEF Iraq.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Ulla Kou Griffiths <http://orcid.org/0000-0001-6822-6493>

REFERENCES

- 1 World Bank GNI per capita, Atlas method (current US\$). Available: https://data.worldbank.org/indicator/NY.GNP.CAP.CD?most_recent_year_desc=true
- 2 Iraqi Central Statistical Office and World Bank - Poverty Reduction Strategy 2018-2022. Available: <https://mop.gov.iq/en/static/uploads/1/pdf/15192838546d2344468c97dc099300d987509ebf27-Summary.pdf>
- 3 Iraq central statistical organization. Available: <http://cosit.gov.iq/ar/2013-01-31-08-43-38>
- 4 Ministry of Health. *Iraq national comprehensive Multi-Year plan for immunization 2020-2024*, 2019.
- 5 Ministry of Health & Environment. Improving Routine Immunization in Iraq. Workshop - Working Groups Findings, 2019. Available: <http://moh.gov.iq/upload/upfile/ar/996.pdf>
- 6 Polio vaccines: who position paper – March, 2016. *Wkly Epidemiol Rec* 2016;91:145–68.
- 7 WHO. Polio eradication and endgame strategic plan 2013–2018, global polio eradication initiative, 2013. Available: https://polioeradication.org/wp-content/uploads/2016/07/PEESP_EN_A4.pdf
- 8 Alwan A. The Health Situation in Iraq: Challenges and Priorities for Action, Ministry of Health & Environment, 2019. Available: <https://moh.gov.iq/upload/upfile/ar/1027.pdf>
- 9 World Health Organization. Procurement of vaccine for public-sector programmes: a reference manual, 2003, WHO/V&B/03.16. Available: <https://apps.who.int/iris/handle/10665/69675>
- 10 Ministry of Health, WHO and UNICEF. *High level meeting on cost efficiency in procurement of vaccines and quality data coverage of vaccination in Iraq. meeting minutes*, 2019.
- 11 Pertussis vaccines: WHO position paper - September 2015. *Wkly Epidemiol Rec* 2015;90:433–58.
- 12 Garcia C, Hossain SMM, Lami F. Costs of childhood vaccine delivery in Iraq. *BMJ Open* 2021.