Vaccine xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

What vaccine product attributes do immunization program stakeholders value? Results from interviews in six low- and middle-income countries

Debra D. Kristensen *, Kate Bartholomew, Shirley Villadiego, Kristina Lorenson [1]

PATH, PO Box 900922, Seattle, WA 98121, USA

ARTICLE INFO

Article history:
Received 10 August 2016
Received in revised form 11 October 2016
Accepted 25 October 2016
Available online xxxx

Keywords:
Vaccine product presentation
Immunization program
Low- and middle-income country
Supply chain
Multidose
Preservative

ABSTRACT

This study attempts to capture the opinions of stakeholders working in immunization programs in low- and middle-income countries to understand how vaccine products could be improved to better meet their needs and to obtain feedback on specific vaccine product attributes including the number of doses per container and ease of preparing a dose for administration. We also reviewed how procurement decisions are made within immunization programs. Semi-structured interviews were undertaken with 158 immunization stakeholders in Brazil, China, India, Peru, the Philippines, and Tanzania. Interviewees included national decision-makers and advisors involved in vaccine-purchasing decisions (n = 30), national Expanded Programme on Immunization managers (n = 6), and health and logistics personnel at national, subnational, and health-facility levels (n = 122).

Immunization stakeholders at all levels of the supply chain valued vaccine product attributes that prevent heat damage, decrease vaccine wastage, and simplify delivery. Minimizing the time required to prepare a dose is especially valued by those closest to the work of actually administering vaccines. Respondents appreciated the benefits of lower-multidose presentations on reducing wastage but seemed to prefer single-dose vials even more. They also expressed concern about the need for training and the potential for confusion and vial contamination if opened vials of liquid preservative-free vaccines are not handled properly. Procurement decision-making processes varied widely between countries, though most relied heavily on international agencies and vaccine manufacturers for information.

1. Introduction

The logistical and infrastructure challenges faced by national immunization programs in low- and middle-income countries are well documented [1–5]. Certain vaccine product attributes can help to mitigate these challenges, yet limited data exist on the attributes of greatest interest to immunization program stakeholders and the decision process used for weighing the trade-offs when selecting particular vaccine products for procurement. Such attributes include the number of doses per vial, use of preservatives, thermostability, packaging volume, and time required to prepare a dose.

Despite best efforts to design vaccine products that will meet the needs of end users, industry may lack insight into how product presentation attributes will affect immunization programs in low- and middle-income countries [6]. Likewise, procurement agencies and national decision-makers may be unaware of the priorities and on-the-ground realities of stakeholders at lower levels of immunization programs. National decision-makers, especially in countries transitioning off of support from Gavi, the Vaccine Alliance, must weigh the pros and cons of specific product attributes along with budget constraints when making choices about which vaccines to purchase and introduce.

One aim of this study was to illuminate which vaccine attributes are most important to stakeholders at different levels of country vaccine supply chains, as well as where priorities diverge. We also describe how vaccine procurement decisions are made in six countries, who is involved in those decisions, and where the countries are turning for information. These findings may help to

Abbreviations: EPI, Expanded Programme on Immunization; LIC, low-income country; LMIC, lower-middle-income country; MOH, ministry of health; NITAG, National Immunization Technical Advisory Group; PAHO, Pan American Health Organization; UMIC, upper-middle-income country; UNICEF, United Nations Children's Fund; VVM, vaccine vial monitor; WHO, World Health Organization.

* Corresponding author.

E-mail addresses: dkristensen@path.org (D.D. Kristensen), kbartholomew@path.org (K. Bartholomew), villadiego.shirley@gmail.com (S. Villadiego), Tina.Lorenson@gatesfoundation.org (K. Lorenson).

[1] Present address: Bill & Melinda Gates Foundation, PO Box 23350, Seattle, WA 98102 USA.

http://dx.doi.org/10.1016/j.vaccine.2016.10.057
0264-410X/

influence attributes of future vaccine products and inform decision-making around product selection.

2. Methods

This was a qualitative research study. The opinions of 158 immunization stakeholders in Brazil, China, India, Peru, the Philippines, and Tanzania (both mainland and Zanzibar) were sought via semi-structured, one-on-one interviews between October 2011 and March 2012. Countries were selected to represent demographic, geographic, and economic diversity. Interview sites and participants were chosen in collaboration with the Expanded Programme on Immunization (EPI) manager (or equivalent) in each country using a purposive sampling methodology inclusive of all levels of the supply chain and of low and high rates of third dose of diphtheria-tetanus-pertussis combination vaccine coverage. A summary of study participants is presented in Table 1.

Three different semi-structured questionnaires were used for the interviews, tailored to the roles of the interviewees as follows: (1) national decision-makers and advisors involved in vaccine-purchasing decisions, (2) national EPI managers, and (3) health and logistics personnel, including subnational EPI managers, logisticians, physicians, and nurses. The questionnaires were developed in English, translated into the local language where necessary, and pilot tested. A local immunization expert and a translator, if needed, were present at the time of the interviews to ensure questions and responses were clearly articulated and accurately transcribed into the questionnaire forms.

The survey questions reported in this article focus on desired vaccine product attributes and the processes by which the countries made vaccine procurement decisions.[2] Survey responses were translated (if needed), aggregated, and analyzed using Microsoft Excel.

3. Results

3.1. Vaccine product presentations

3.1.1. Desired product attributes

All survey participants were asked to name ways that vaccine products could be improved to better meet their immunization program's needs. Participants offered the responses presented in Table 2. The most frequent response was better heat stability (n = 56/155 respondents). There was also a strong interest in prefilled, single-dose, and easy-to-use products (n = 99/155 mentioned one or more of these attributes).

However, these results varied by country. For example, 70% of participants in the Philippines stated that prefilled syringes would be the biggest improvement for meeting their country's needs. Meanwhile, the top request in Tanzania was for single-dose presentations (45%). In Peru, heat stability was equally as popular as single-dose presentations (both 44%). Heat stability was also the top attribute in Brazil, where it was desired by 47% of respondents.

In general, these responses did not vary significantly by individual level of responsibility or a country's economic classification. One exception was the desire for prefilled syringes; 49% of facility-level participants mentioned this attribute, compared to just 22% at the national level and 21% at the regional/provincial level. Likewise, single-dose presentation was suggested by only 15% of national-level participants, whereas it was more popular (36–38%) at all other levels. When comparing Gavi-eligible to non-eligible countries in our sample, the non-eligible countries (Brazil, China, Peru, and the Philippines) had a much greater preference for prefilled syringes (45%) than Gavi-eligible countries, where only 7% of participants mentioned this preference. Some participants gave reasons such as reduced vaccine wastage, less chance of human error during dilution and administration, and ease of use.

3.1.2. Doses per vial and the multidose vial policy[3]

All participants were asked if their country has a policy to keep open vials of multidose liquid vaccines with preservative when all doses are not used in one immunization session (for example, keep the open vial for up to 28 days in a refrigerator) [7]. To this question of keeping open vials, 88% (n = 139/158) responded yes, 6% (n = 9) responded no, and 6% (n = 10) said they did not know.

National immunization program respondents in India stated that the practice of keeping multidose vials of liquid vaccines with preservative for more than one session was not currently in effect but was under consideration for the introduction of pentavalent vaccine. That said, half of the health workers and logisticians in India reported that they did keep opened multidose vials of liquid vaccines with preservative. Several participants from the Philippines and one from China also mentioned that multidose vials of liquid vaccine with preservative were not kept for more than one day after opening. In the Philippines, the majority of participants (n = 38/45) said that their country does have such a policy, though some reported discarding these vaccines after one session. This was also the case in Brazil, where several respondents stated that they follow instructions on the product insert. In Peru, the WHO multidose vial policy was well understood; nearly all participants stated that opened reconstituted multidose vaccines can be kept for only 6 h, and liquid multidose vaccines for up to 4 weeks. Similarly, in both Tanzania and Zanzibar, all respondents said they follow such a policy, and nearly all understood appropriate handling of specific types of vaccines.

To further understand how multidose vials were actually managed at facilities, we also asked these follow-up questions: "How long do you typically keep reconstituted multidose vaccines?" and "How long do you typically keep liquid multidose vaccines after opening?" Individuals were aware of the need to dispose of lyophilized vaccines within 4–6 h after reconstitution; some reported discarding within 30 min of opening. Health workers also reported keeping liquid vaccines with preservative for up to 1 month after opening; however, several participants mentioned that opened liquid vaccines remaining after an outreach setting were discarded; only open vials used in the facility setting, with frequent immunization sessions and reliable cold chain, were kept for up to 4 weeks.

Since improper vaccine management (e.g., incorrect reconstitution or handling of vaccines after opening) can be a factor in adverse events, all participants were also asked if adverse events had been reported in their immunization program that may be related to improper vaccine management, and if so to describe those events. Thirty percent of participants (n = 47/158) reported adverse events had been linked to vaccination; 63% reported no adverse events (n = 99) and 8% (n = 12) did not know. Of those reporting that adverse events had occurred, 60% reported rashes, fever, or swelling at the injection site or other less acute reactions to immunization. The remaining 23% of participants, all of which

[2] This article concerns a subset of the survey questions. Other results are reported in: Kristensen D, Lorenson T, Bartholomew K, Villadiego S. Can thermostable vaccines help address cold-chain challenges? Results from stakeholder interviews in six low- and middle-income countries. *Vaccine* 2015;34(7):899–904.

[3] A WHO policy specifying that all opened WHO-prequalified multidose vials of vaccines should be discarded at the end of the immunization session, or within six hours of opening, whichever comes first, unless the vaccine meets four specific criteria (prequalification by WHO, approval for use up to 28 days after opening the vial, not expired, and stored at appropriate temperatures) in which case the opened vial can be kept and used for up to 28 days after opening.

Please cite this article in press as: Kristensen DD et al. What vaccine product attributes do immunization program stakeholders value? Results from interviews in six low- and middle-income countries. Vaccine (2016), http://dx.doi.org/10.1016/j.vaccine.2016.10.057