

**Use of the two-dose oral cholera vaccine
in the context of a major natural disaster**

**Report of a mass vaccination campaign
in Aceh Province, Indonesia, 2005**



**World Health
Organization**

**Use of the two-dose oral cholera vaccine
in the context of a major natural disaster**

**Report of a mass vaccination campaign
in Aceh Province, Indonesia, 2005**



**World Health
Organization**

This report was prepared by the Global Task Force on Cholera Control

© World Health Organization 2006

All rights reserved.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either express or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use.

The named authors alone are responsible for the views expressed in this publication.

Contents

Acknowledgements	ii
Abbreviations	iii
Summary	v
1. Introduction and project background.....	1
2. Objective	2
3. Methodology	2
3.1 Type of vaccine.....	2
3.2 Target population	3
3.3 Planning and time frame	4
3.4 Human resources.....	4
3.4.1 Training.....	5
3.5 Logistics.....	5
3.5.1 Transport and storage.....	5
3.5.2 Waste management	6
3.5.3 Materials.....	6
4. Unfolding of the project.....	6
4.1 Phase I.....	6
4.2 Phase II	7
4.3 Phase III	8
5. Findings and recommendations.....	9
5.1 Evaluation of Phase I.....	9
5.2 Target population and timing.....	9
5.3 Human resources.....	9
5.3.1 Training	10
5.4 Social mobilization, health education and prevention activities	10
5.5 Logistics.....	11
5.5.1 Transport and storage.....	11
5.5.2 Waste management	12
5.6 Expenditure and funding.....	12
6. Discussion and concluding remarks	13
7. References.....	15
Annex 1: Maps.....	16
Annex 2: Summary tables.....	17
Annex 3: Time frame	22
Annex 4: Joint WHO/UNICEF statement for cholera vaccine use in tsunami-affected areas.....	23

Acknowledgements

The Global Task Force on Cholera Control thanks the following for their support and dedication throughout this project:

- All the staff involved in the field in preparation and implementation, the vaccination and management teams from the Expanded Programme on Immunization of the Indonesian Ministry of Health, the WHO field offices and the nongovernmental organizations and United Nations agencies that helped us when needed.
- The Government of Indonesia, which provided the necessary support for the project.
- WHO country and regional offices, as well as numerous departments at WHO headquarters.
- The Government of Sweden, for having made the vaccines available.

Without the commitment of all partners, this mass vaccination campaign would not have been carried out.

Abbreviations

AEFI	adverse event following immunization
CDC	Communicable Diseases Centre (Ministry of Health of Indonesia)
DHO	district health office
EPI	Expanded Programme on Immunization (Ministry of Health of Indonesia)
FRC	French Red Cross
IDP	internally displaced person
MoH	Ministry of Health
MSF	Médecins Sans Frontières
NGO	nongovernmental organization
OCV	oral cholera vaccine
PHC	primary health centre
PHO	provincial health office
SIDA	Swedish International Development Agency
UN	United Nations

Summary

On 26 December 2004, a major earthquake triggered a devastating tsunami that destroyed the coasts of numerous countries in south Asia. A total of 231 452 people were reported dead or missing, and more than one million were displaced. In Indonesia, about 131 934 inhabitants of Aceh Province were killed, 37 066 were reported missing and about 400 000 were displaced.

The destruction of basic infrastructures caused difficulties in accessing adequate health care and sufficient water and sanitation. The Government of Indonesia, perceiving the risk of a cholera outbreak, decided to implement a mass vaccination campaign among the displaced people using the two-dose whole-cell killed oral cholera vaccine (WC/rBS) made available to WHO by the Swedish Government. Although a WHO assessment showed a limited risk of cholera (a disease not endemic in the areas affected by the tsunami), it agreed to support the official request of assistance made by the Ministry of Health of Indonesia (MoH) by providing the vaccine and deploying logistic and technical experts for the duration of the campaign.

Between April and August 2005, a total of 54 627 internally displaced persons (IDPs) out of 78 870 identified as being at risk of cholera received two doses of the oral cholera vaccine (OCV) necessary to ensure protective efficacy, resulting in an overall vaccination coverage of approximately 69.3%. Challenges in coordination and planning coupled with heavy logistics and frequent aftershocks greatly complicated and delayed implementation of the campaign. Furthermore, difficulties in maintaining the cold chain caused vaccine losses of 11.7%. The important logistic constraints and high vaccine wastage increased the direct costs of the campaign, which reached US\$ 958 649 (equivalent to US\$ 17.55 per fully immunized person).

The evidence gained from this mass vaccination campaign highlighted the limitations of using a two-dose vaccine in a crisis situation and will help WHO to issue recommendations on the use of OCVs in complex emergencies settings. These recommendations will be made public in 2006, following a meeting held in Cairo in December 2005 at which humanitarian partners, scientific institutions and representatives of cholera-prone countries participated.

1. Introduction and project background

On Sunday 26 December 2004 at 07:58, a major earthquake, reaching 9.0 on the Richter scale, struck the north-western part of Sumatra Island. With its epicentre located in the deep sea, the seismic tremor triggered a tsunami of gigantic dimensions. Within a few hours, the coasts of India, Indonesia, the Maldives, Myanmar, Seychelles, Sri Lanka, Thailand and even Somalia were hit, causing death and destruction: at least 5 million people were affected. A total of 231 452¹ people were reported dead or missing and more than one million had to flee their homes. Cities and villages were destroyed and infrastructures were ruined.

In Indonesia, Aceh and the western part of Sumatra province, situated in the north-west of Sumatra Island, were the areas most affected.² About 131 934 individuals were killed and 37 066 reported missing. Following the destruction of their dwellings, about 400 000 people were displaced; some joined family members' households, others had to be sheltered in temporary camps, under tents or in barracks. In some areas, water supplies were contaminated, making clean water difficult to obtain. Sanitation facilities and sewage treatment plants were damaged and health-service facilities severely disrupted. Inadequate living conditions, as well as insufficient food and lack of basic hygiene, rendered the displaced population vulnerable to potential outbreaks of waterborne diseases such as cholera, shigellosis and typhoid fever.

Within a few days, a massive international effort was deployed on site; national and international nongovernmental organizations (NGOs), United Nations (UN) agencies as well as various humanitarian actors brought relief to victims. Non-humanitarian actors, among them armed forces from different countries, also participated in the relief effort. WHO, in cooperation with the Indonesian MoH and other partners, rapidly set up an epidemic-prone disease surveillance system for IDPs in order to detect and ensure an early warning of potential epidemics. Although cases of diarrhoea were reported, none was confirmed as cholera. Nonetheless, given the poor hygiene conditions, the risk of waterborne diseases could not be completely ruled out.

In February 2005, the MoH conducted a cholera outbreak risk assessment in Aceh Province³ and reached the following conclusions:

- No cholera case had been reported in Aceh within the past three years. Nonetheless, other areas of Sumatra were prone to regular cholera outbreaks. The risk of importing the disease to Aceh was therefore perceived through the movements of aid workers. Furthermore, as the population in Aceh had not been exposed to cholera for a long time, their natural immunity was low or non-existent.
- The living conditions faced by IDPs – lack of clean water, minimal environmental management and uncontrolled food safety – were fertile grounds for cholera epidemics should *Vibrio cholerae* be introduced into the area.
- No proper cholera surveillance system was available in Indonesia. Consequently, there was no accurate information or baseline data on the occurrence of the disease.
- The health-care facilities were severely damaged by the tsunami and the system would be unable to respond to an outbreak (including ensuring proper case management or setting up efficient control measures).

¹ Figures published by the Office of the Special Envoy for Tsunami Recovery, July 2005 (*J*).

² See Annex 1.

³ Report addressed to the Communicable Diseases Centre, Ministry of Health of Indonesia, on 28 February 2005 by Professor Dr R.H.H. Nelwan, Team Leader, Risk Assessment Mission (2).

The MoH therefore decided to implement a cholera mass vaccination campaign in IDP settlements and surrounding areas as a pre-emptive measure, in addition to the usual cholera control measures, including the improvement of water and sanitation facilities as well as provision of health education.

A WHO risk assessment concluded that the risk of a cholera outbreak appeared to be limited, for the following reasons:

- numerous humanitarian agencies were active in improving the water and sanitation situation;
- most IDPs were accommodated in host families not affected by the tsunami, and only a few camps remained inhabited;
- the last cholera outbreak in the tsunami-affected areas took place in 1996: the area was therefore not known to be endemic for cholera.

Nonetheless, the MoH risk perception led the Indonesian Government to officially call for WHO technical and logistic assistance to carry out a mass vaccination campaign. WHO decided to support this request, by providing the two-dose killed OCV donated by the Government of Sweden for the tsunami-affected areas and by deploying a technical support team comprising public health experts and logisticians.

This campaign contributed to gaining evidence on the use of OCVs after a natural disaster, and will ultimately allow guidelines and recommendations for future similar events to be developed.

2. Objective

The objective of the project was to prevent a cholera outbreak among the vulnerable IDP population in Aceh Province by vaccinating all people aged over 2 years living in areas defined by the MoH as the most at risk. The use of OCV was considered as an additional public health tool but was not intended to replace the usually recommended prevention activities.

The project was led by the Indonesian MoH and implemented through its regional and local counterparts. Staff members of the Expanded Programme on Immunization (EPI)¹ played a crucial role in the planning, preparation and implementation of the mass vaccination campaign. WHO support involved providing the vaccines, ensuring the logistics and deploying technical support.

The MoH opted for a three-phased approach: Phase I, which aimed at vaccinating the most vulnerable populations, was to have taken place in Aceh Jaya (Calang, Teunom), phase II in Aceh Barat (Meulaboh) and phase III in Banda Aceh.²

3. Methodology

3.1 Type of vaccine

The two-dose killed whole-cell B subunit cholera vaccine (WC/rBS) OCV was used in Indonesia. Each dose consists of 1 mg of recombinant cholera-toxin B subunit and approximately 1×10^{11} inactivated whole cells of the classic and El Tor biotypes of *V.*

¹ Communicable Diseases Centre, Ministry of Health, Indonesia.

² See Annex 1.

cholerae O1, serotypes Inaba and Ogawa. The vaccine is supplied in 3 ml one-dose vials, each with a sachet of sodium bicarbonate buffer. The vaccine is administered in two doses, 10–14 days apart.¹ The two-dose vaccine was easily available² and its use in this particular mass vaccination campaign complied with WHO recommendations.³

Protective efficacy is reached 10 days after the second dose and lasts for approximately two years in adults. Each dose of the vaccine needs to be administered in 150 ml of water (75 ml for children aged from 2 to 6 years) mixed with the buffer solution. Vaccinees should be informed of the necessity to fast for 2 hours before and one hour after ingesting a dose.

3.2 Target population

The IDPs living in camps, barracks or with host families were considered by the MoH as the high-risk group for cholera. The following criteria were used in selecting IDPs for mass vaccination:

- lack of access to clean water, poor hygiene (map of hygiene and sanitation with last evaluation of water quality in 2002 was used for decision-making);
- poor sanitation;
- poor nutrition;
- camps in remote areas with reduced access to health posts;
- lack of an epidemic surveillance system.

Initially, the MoH considered vaccinating all IDPs living in high-risk areas, and the number of people perceived as vulnerable reached 160 000. Further analysis helped it to scale down the targeted population. Moreover, the three-phased approach proposed by the MoH allowed time to conduct an evaluation after phase I; it also enabled an adjustment of the procedures for phases II and III. By the end of February 2005, a total of 102 082 people had been identified to receive the vaccine:

- Phase I: Aceh Jaya (Calang, Teunom): 40 382 people
- Phase II: Aceh Barat (Meulaboh): 20 869 people
- Phase III: Banda Aceh: 40 831 people.

Given the volatile security situation,⁴ this planning schedule had to be modified. Phase I finally took place in Aceh Barat, phase II in Banda Aceh/Aceh Besar and phase III in Aceh Jaya.

WHO provided technical and logistic support to phase I, after which a joint MoH/WHO evaluation took place to adjust phases II and III according to the findings. Definition of the targeted population was thus modified after phase I and refocused only on IDPs living in temporary camps, as IDPs living with family members were considered as not being at greater risk than their hosts.

In addition, assessments showed that numerous IDPs had moved from Banda Aceh town to Aceh Besar district, in the outskirts of the city; phase II was thus extended to IDPs living in camps located in Aceh Besar. Whereas phase II target population numbers slightly exceeded the estimates made by the MoH in February as a result of the extension of the vaccination campaign to Aceh Barat, the target population figures for phase III (Aceh Jaya) was greatly scaled down. This is linked to logistic constraints and to the relocation of numerous IDPs

¹ See Annex 4: *Joint WHO/UNICEF statement for cholera vaccine use in tsunami affected areas.*

² In early January 2005, the Government of Sweden made a donation to WHO for purchase of OCVs.

³ *Potential use of oral cholera vaccines in emergency situations. Report of a WHO meeting. Geneva, Switzerland, 12–13 May, 1999.* Geneva, World Health Organization, 1999 (WHO/CDS/CSR/EDC/99.4) (3).

⁴ Aceh has been torn by an internal armed conflict for three decades.

within host families' households. As of July 2005, the final target population figures accounted for a total of 78 870 people, divided into the following three phases:

- Phase I: Aceh Barat (Meulaboh): 20 869 people
- Phase II: Banda Aceh 45 540 people (10 392 in Banda Aceh town and 35 148 in Aceh Besar);
- Phase III: Aceh Jaya (Calang, Teunom): 12 461 people.

3.3 Planning and time frame

Given the necessity for the two doses of OCV to be administered at least 10 days apart, three weeks were anticipated for this task in each of the three phases. In addition, one or two days' training for the vaccination teams and for community social mobilization was arranged. These activities were scheduled to take place one week before administration of the first dose.

According to a first rather optimistic planning schedule, the project would be completed by the end of March 2005. Unfortunately, an immunization campaign of such scale, and in a difficult environment in terms of logistics and security, could not be carried out so quickly. The preparation phase, including logistics, micro-planning, identification of human resources, training and social mobilization, needed to be carefully undertaken before implementation could begin. The entire operation was therefore delayed. Moreover, the human resources needed for vaccination were not readily available because EPI staff had first to complete a measles vaccination campaign. The official time frame, communicated by the MoH in February, set the start of the cholera vaccination campaign (phase I in Aceh Jaya) at the beginning of April. Social mobilization and training activities were to take place in the last week of March. However, because of a sudden change in the Aceh Jaya security environment and the need to take into account other public health priority activities, WHO and the MoH decided to revise planning and start the campaign in Aceh Barat (Meulaboh), where the situation appeared safer. The project was redefined and the vaccination campaign took place on the following dates:

- Phase I: Aceh Barat (Meulaboh): 11–29 April 2005
- Phase II: Banda Aceh/Aceh Barat: 31 May – 16 June 2005
- Phase III: Aceh Jaya (Calang, Teunom): 19 July – 4 August 2005

3.4 Human resources

The human resources involved in the preparation, planning, implementation and follow-up of the mass vaccination campaign came from three different sources:

1. The Indonesian MoH was particularly involved in the initial assessment and made the decision to undertake a vaccination campaign. It was responsible for overall planning and implementation.
2. EPI is routinely involved in all immunization campaigns carried out in Indonesia and therefore provided the human resources for the vaccination teams. Each vaccination team comprised four people, including at least one professional health worker. EPI staff were greatly committed and played a crucial role in the implementation of the mass vaccination campaign.
3. WHO dispatched, to support the MoH teams, two public health experts and two logisticians for the preparation, planning and implementation of phase I; another public health expert took part in phase II, whereas a logistician participated in phases II and III. In addition, a consultant participated in phase I evaluation, resulting in recommendations for improved implementation of phases II and III.

The main tasks of the WHO public health experts, as agreed by the MoH and WHO, were to provide support (i) for training on cholera mass vaccination to health professionals at provincial, district and sub-district levels, (ii) to the elaboration and revision of written technical information and (iii) to Indonesian health officers in micro-planning, including data collection. The logistic support provided by WHO was critical given the complexity of the infrastructure to be set up. In addition to the staff deployed to the field, the WHO Indonesia Country Office and the coordinator of the Global Task Force on Cholera Control, based at WHO headquarters in Geneva, Switzerland, greatly contributed to facilitating project implementation through the different partners involved.

3.4.1 Training

Generic guidelines and training material produced by the MoH were provided to staff. The Provincial Health Office (PHO), with WHO support, trained the trainers – heads of the primary health centres (PHCs)¹ and immunization coordinators. The training was also used to perform micro-planning for each PHC, leaflets and banners for social mobilization were distributed and the target population definition was fine-tuned.

WHO logisticians provided training and supervision for the procurement of required supplies in appropriate quantities and developed forms for the logistic follow-up of the vaccines and other supplies to be used by the vaccination teams. They also advised the District Health Office (DHO) on storage issues and supervised the transport of supplies from the DHO to the PHCs. In addition, they carried out on-site evaluations of the vaccination teams.

3.5 Logistics

3.5.1 Transport and storage

The vaccines and disposable cups were shipped from Sweden to Indonesia. Given the limited availability of cold chain facilities in the field, the shipment was organized in two parts: 80 396 vials were received on 21 March and 57 000 on 4 June (a total of 137 396 vials). The vaccines arrived in Medan, and not Jakarta as first thought, which led to last-minute repacking.

The management of the cold chain and the important volume of the OCV vials were the two main logistic challenges. The OCV is packed in single 3 ml doses conserved in a 38.4 ml vial, almost 30 times the volume of other vaccines used in mass vaccination campaigns.² This important volume complicated both the storage in cold chain facilities, which were scarcely available, and the transport of the vaccines from the provincial centre to the cities and thereafter to the vaccination sites.

The OCV Dukoral® is prequalified to be stored between +2 °C and +8 °C, even if, according to the manufacturer, safety and stability data would allow the vaccine to be kept for four weeks at ambient temperature (37 °C ± 2 °C). Given the volume of the vaccines, the usual cold-chain facilities were not sufficient and a temporary cold-chain system had to be set up. As a cold chain was not available at district level, it was planned, once the vaccines were shipped to the districts, to store them in insulated boxes and to change ice packs daily. A proper cold-room was not available in Aceh region. Medan (where cold room facilities do exist) was therefore selected to receive the vaccine shipment from Sweden. However, the Medan PHO cold room facilities had insufficient capacity to store the cholera vaccines and they were therefore stored in a cold-room/refrigerated 20-foot container lent by Médecins Sans Frontières (MSF) Belgium. The vaccines were later transferred to other ad hoc refrigerated facilities.

¹ Designed as Puskesmas in Bahasa Indonesian.

² For instance: measles, 500 children, 750 doses (with waste and reserve) = 1.5 litre volume; OCV Dukoral®: 500 people, 1000 doses = 39 litres volume.

Because there were limited cold rooms available at district level, and because the boxes were not insulated, the vaccine had to be shipped from Medan only shortly before use, according to needs. Unfortunately, a strong earthquake on 28 April 2005 destroyed the Medan–Meulaboh road, and air transportation capacities were requisitioned for the new emergency (Nias and Simelu islands suffered severe destruction). A French Red Cross (FRC) aeroplane transported the boxes on 4 April, but this new complication meant that the vaccines for the first and second doses were sent simultaneously in order not to delay administration of the second dose in case of transportation difficulties.

3.5.2 Waste management

Waste related to the preparation and the use of the vaccine (cups, vials, boxes, etc.) should be collected and destroyed. Instructions were given to the teams and PHCs to collect all the waste and return it to the districts. Vaccine vials are made out of thick glass, and a high-temperature incinerator is needed to destroy them. As none was reliable in Meulaboh or Banda Aceh, all vials were sent to Medan, where a glass factory accepting glass waste for recycling was identified. Plastic (cups and bottled water) and paper (buffer sachets) items were discarded in city waste disposal units.

3.5.3 Materials

The materials required for the mass vaccination campaign were agreed upon and provided as follows:

- WHO: vaccines, including buffer sachets, and plastic cups;
- MoH: specific material (bottled water, water containers, vaccine carriers and backpacks);
- DHO: miscellaneous material (forms, soap, pens, etc.)

4. Unfolding of the project

4.1 Phase I

Phase I took place in Aceh Barat¹ and targeted 20 869 IDPs. The vaccination campaign was carried out from 11 to 30 April 2005 (first dose: 11–16 April; second dose: 25–30 April). Local EPI staff ensured field implementation, with close follow-up and support from WHO.

A week before beginning the vaccination campaign, the DHO held a “training of trainers” course with two senior staff from each of the 10 PHCs involved in phase I. This course was held by WHO with the active participation of two staff from the PHO and two representatives from the MoH central office. The participants then trained the vaccination teams. Social mobilization activities were also carried out, and transport of supplies to the sub-districts was ensured.

In some PHCs, shortage of staff was an issue because a number of health workers had been killed or injured by the tsunami. In addition, the disaster triggered several public health priorities that needed to be addressed. Conflicting priorities could have jeopardized the smooth implementation of the different public health projects and resulted in a lack of health-care capacity to undertake the cholera vaccination.

Despite numerous hindrances unavoidable in such a setting, including logistics and transport limitations, the vaccination campaign went well as a result of the commitment and dedication of all parties involved. Vaccine coverage after administration of the two doses reached an

¹ See Annex 1.

estimated 71.3% of the 20 869 people selected for immunization. A total of 15 727 people received the first dose and 14 885 both doses.¹

Whereas the loss of vaccine during implementation was low (0.1%), 12 290 doses had to be discarded at the end of phase I because they had been kept outside the cold chain for four weeks. The overall loss of vaccine therefore reached 28.4%.

4.2 Phase II

Phase II took place in Banda Aceh/Aceh Besar² and targeted 45 540 IDPs. The vaccination campaign was carried out from 31 May to 26 June 2005.

Following the evaluation conducted after phase I,³ it was decided that phase II would target only IDPs living in camps (tents or barracks) in Banda Aceh town and Aceh Besar district. Given the high mobility of the population and the lack of updated census, identification of the target population was difficult. After several assessments, the following figures were decided upon: 10 392 IDPs for Banda Aceh town and 35 148 IDPs in Aceh Besar.

A two-day training of trainers was carried out at district level on 19–20 May attended by 89 senior health workers (heads of puskesmas, immunization coordinators and supervisors). Trainers were representatives from the MoH, PHO, DHO and WHO. The course participants then trained the vaccination teams at the sub-district level. Guidelines on how to handle OCVs, revised after phase I, were widely distributed among the teams. Leaflets and banners were handed out to communities as part of social mobilization activities. The experience gained during phase I was used by the trainers, who included in their presentations illustrations and pictures.

In Banda Aceh, a one-day training was organized, where community and religious leaders were invited to give their input in order to enhance social mobilization activities. Community leaders organized sessions one week before the campaign, as well as between the first and second round. The aim was to inform their people of the importance of taking the second dose to be fully immunized and to explain the necessity to fast for two hours before and one hour after ingesting the vaccine. Furthermore, the leaders were successful in inciting community members to help during the vaccination campaign. They also took this opportunity to transmit health education messages regarding personal hygiene, food and water safety and the actions to be taken in case of diarrhoea. In Aceh Besar, one member from the IDP community was part of each vaccination team, contributing to improve the contact with IDPs.

In Banda Aceh town, the vaccination campaign was conducted by 28 teams between 31 May and 17 June. In Aceh Besar district, it was conducted by 47 teams between 6 June and 26 June. Recommendations made after phase I were highly useful and enabled the teams to improve their performance.

In Banda Aceh, vaccination coverage after the two doses reached 89.5% of the 10 392 IDPs selected for immunization; 9608 received the first dose and 9298 both doses. This high coverage indicates that the vaccination campaign was very well planned and organized and well accepted by the IDPs. The fact that the campaign took place in an urban setting, where all the people intended to be vaccinated are located in a small area, facilitated its implementation. However, in Aceh Besar, a wide rural area, vaccination coverage after the two doses reached only 58% of the 35 148 IDPs targeted. A total of 26 754 people took the first dose but only 20 418 the second dose. The significantly lower coverage can be explained as follows:

¹ See Annex 2 for the detailed figures.

² See Annex 1.

³ See 5.1 below.

- high mobility of the IDPs, which explains the “loss” of 6000 people between dose 1 and 2;
- poor social mobilization, compared with other places, and lower implication of the community leaders despite the presence of IDPs in the vaccination teams;
- lower acceptance: the vaccination teams reported difficulties caused by misunderstandings and unadapted educational messages. Moreover, people refused to have the second dose because they complained about the effect and/or the taste of the vaccines;
- miscalculation of the per diem: the vaccination teams were paid for only four days instead of six, resulting in demotivation;
- limited follow-up by the senior management group, which had to attend other duties.

The logistic issues were easier to deal with during phase II than phase I, and the vaccines could be kept in the cold chain in Banda Aceh and delivered to the vaccination sites according to needs. A small cold room was available in the DHO, where the vaccines could be kept at between 2 °C and 8 °C. A total of 66 557 vials were used (loss during implementation: 0.3%). Because the cold chain was maintained, the remaining 25 273 vaccines could be used for phase III. Nonetheless, the limited expiry dates¹ of the vaccines had to be taken into account in planning their use.

4.3 Phase III

By July 2005, the security situation had improved sufficiently in Aceh Jaya for implementation of phase III. The target population was limited to IDPs living in camps, all situated along the coastline road. The remaining vaccines could therefore be used before their expiry dates. A total of 12 461 IDPs were identified for the campaign, which was carried out from 17 July to 4 August 2005. WHO support was limited to logistics only, as the MoH and DHO had acquired the necessary experience during phases I and II. The recommendations made after phase I, plus the few comments made after phase II, were implemented. Vaccination coverage after the two doses reached 80.4%, with 10 416 people out of the 12 461 IDPs identified taking the first dose and 10 026 taking two doses.

As indicated by the above figures, the coverage rate was the highest of the three phases, excluding Banda Aceh town only, despite a difficult environment. Several elements can explain this result:

- all the IDP settlements were located along the 120 km coastal area and were easily accessible from the road;
- the vaccination teams were, by then, well trained and had gained valuable experience during phases I and II;
- the target population figures were not high, which enabled a better census and follow-up;
- given the remoteness and destruction of the main roads, the population had very little mobility and could not leave the area.

Vaccine loss during implementation reached 0.1%; with the implementation of phase III, the available vaccine stock was emptied.

¹ Expiry dates: 13 843 vials, August 2005; 11 430 vials, February 2006; 20 160 buffer sachets, September 2007.

5. Findings and recommendations

5.1 Evaluation of Phase I

A joint MoH–WHO evaluation of phase I was undertaken in Aceh Barat on 24–30 April 2005. The evaluation team performed a detailed qualitative/quantitative assessment of the planning, preparation, implementation and outcome of the first phase of the OCV campaign. It aimed at redirecting and fine-tuning the successive phases according to the findings in order to maximize the impact of the campaign. Among improvements made in phases II and III, the following was noted:

- more flexible timing of the vaccination teams in the different sites, depending on IDP activities (work, school, etc.);
- greater involvement of community and religious leaders in social mobilization and health education;
- redefinition of the target population to vaccinate only IDPs living in camps;
- better communication with the population to identify the target population;
- modification of the reporting forms to enhance clarity and precision;
- introduction of cholera data surveillance into the routine MoH surveillance system.

5.2 Target population and timing

The target population was difficult to identify because of the high mobility of the IDPs, already moving to different relocation sites or returning to their domicile to start rebuilding their homes. Numerous IDPs no longer living in the camps left their tents or barracks in order to keep receiving assistance. Another challenge was to differentiate IDPs from non-IDPs, when families not affected by the tsunami were hosting IDPs. During phase I, the vaccination teams administered the vaccine indiscriminately to both groups of population, resulting in an artificially higher vaccination rate, as non-IDPs were not included in the target population figures. For phases II and III, only IDPs living in tents and barracks were considered for immunization. Those living with host families were considered at lower risk for contracting waterborne diseases, as were the host family members.

A critical element was to establish the availability of the target population: after a natural disaster, people try to return to their daily lives as soon as possible. This implies finding a job or resuming work, rebuilding dwellings and participating in the reconstruction collective effort. In Aceh Barat, up to 50% of adults living in IDP camps were absent during the day, usually from 09:00 to 17:00, except on Friday afternoons and Sundays (usual holidays). Numerous IDPs were present in the camps on food distribution days only.

Taking these elements into consideration when planning a vaccination campaign is essential in order to ensure high vaccination coverage. Community representatives should be included in the establishment of the schedule, as should the humanitarian agencies in charge of food distribution. Coordinating vaccination with food distribution¹ may well be a solution.

5.3 Human resources

In view of the large number of the targeted population, and of the limited access to some remote IDPs settlements – especially during the rainy seasons – the number of vaccination teams was rather low. An increase in the number of vaccinators, coupled with adequate logistic support, could contribute to quicker implementation. Human resources dedicated to health education and social mobilization appeared not to be sufficiently trained and were therefore not optimally used. Some vaccination teams showed a certain lack of reactivity,

¹ The OCV is administrated in two doses, 10–14 days apart. Food distribution should therefore follow the same pattern.

sometimes waiting for hours at their site without any “clients” before finally performing door-to-door sweeping¹ just before they had to leave the camp. A quicker reaction would have enabled better vaccination coverage.

An effective way to increase vaccination team numbers and to allow facilitated access to the communities would be to recruit members of the community. Hiring – and training – people from the community also give greater impact to the campaign through continued health education and increased awareness at community level. At management level, lack of a clear driving force was noted. Senior management had numerous other health priorities to follow up and could not be dedicated 100% to the campaign. WHO technical and logistic support was highly useful because experts were fully dedicated to the vaccination campaign from beginning to end, ensuring continuity throughout the project.

5.3.1 Training

The performance of the vaccination teams varied between sites and influenced the quality of the work delivered. A certain lack of understanding about the use of the vaccine was sometimes observed, as well as confusion about the target population (non-IDPs vaccinated, or people receiving the second dose only). These elements showed that the training sessions were too short and that interactive activities and simulation exercises should be systematic. Furthermore, the training material appeared not to be fully adapted to local needs and was received only on the training days. If logistically possible, distributing materials in advance would help trainees to familiarize themselves with the subject before training begins. Finally, the material should be revised in accordance with the possible shortfalls identified during the vaccination campaign: the importance of taking two doses as well as identification and follow-up of adverse events following immunization (AEFI) should be stressed. A refresher course between administration of the two doses would be indicated.

5.4 Social mobilization, health education and prevention activities

Field staff regularly reported that IDPs were insufficiently motivated to receive vaccination and thus did not present at the vaccination sites. Women remained busy with their household work and needed to be actively reminded about the presence of the vaccination team in the camps. Social mobilization activities were insufficient, limited and started too late. Leaflets and banners were available but funding for payment of staff and transport was late and delayed implementation of social mobilization. Leaflets used during the administration of the first dose were scarcely seen during administration of the second dose. Health education was rarely provided during social mobilization. In many camps, people were poorly informed about the role and procedure of the vaccination campaign.

Health education about cholera, its transmission and the importance of personal hygiene and good sanitation needs to be strengthened. By carefully selecting partners and intermediaries inside the community the message will be better received. Community and religious leaders, NGOs as well as other associations should be closely linked to social mobilization and health education efforts in order to avoid cultural misunderstandings and increased public acceptance of the vaccine. Furthermore, women should not be forgotten, as they play a key role in cholera health education: they are the ones cleaning the house, buying/producing the food, preparing the meals and taking care of the children.

Posters, banners and leaflets are a good way of transmitting messages. To maximize their impact, they should be produced in local languages and be visually attractive; the illiteracy rate should be taken into account. Education and social mobilization messages should be repeated after administration of the first dose. The importance of taking the two doses to be protected against cholera and the necessity to fast for two hours before one hour after ingesting the vaccine after should be stressed.

¹ Efficient but time-consuming.

Some people refused the vaccine or did not take it entirely, mentioning religious beliefs and/or bad taste of the vaccine. Cultural awareness is therefore highly recommended during the preparation phase of the campaign, which should be conducted in close collaboration with religious leaders and community representatives. It is essential to get a clearer idea of the issues that may arise and to design a health education and social mobilization programme accordingly. Reactions to the taste of the vaccine were reported: the OCV currently produced has a strawberry taste, widely appreciated in Western Europe but usually unknown in developing countries. If the taste is considered unacceptable by a significant percentage of the vaccinated population, only partial vaccination and overall lower campaign impact may result.

One of the main factors to be taken into account for cholera prevention is environmental safety: improvement in the water and sanitation status is a key issue. In the places chosen for the implementation of the vaccination campaign, numerous humanitarian actors were involved in water and sanitation projects. Efforts were made to have a consistent approach, but a clear lack of coordination appeared among the different agencies. The level of access to clean water and good environmental hygiene therefore differed greatly from one area to another. Furthermore, there was no coordination between the cholera vaccination campaign and water and sanitation activities.

5.5 Logistics

5.5.1 Transport and storage

Good logistic infrastructure is essential for a successful mass vaccination campaign. In Aceh Province, logistics were complicated by external constraints such as a volatile security environment, a difficult geographical setting and ongoing aftershocks. The type of vaccine involved, its weight, volume and the necessity for two doses to be administered to the same person 10–15 days apart, are factors that contribute to the need for a well organized and efficient logistic setup.

The first challenge faced was the need to maintain a cold chain through adapted facilities and proper packaging. The manufacturer confirmed OCV stability at ambient temperature for four weeks, but as it is not pre-qualified as such, all possible efforts should be made to maintain a functioning cold chain. Already during the international transport from Sweden to Medan, this condition was not respected: non-insulated boxes were used, and vaccines were scattered inside the shipment boxes. Important discrepancies were also noted regarding the expiry dates of the buffer sachets.¹

The packaging issue was likely a consequence of last-minute repacking by the manufacturer because the delivery destination changed from Jakarta to Medan.² Nonetheless, a few recommendations can be made to the manufacturer before shipment to avoid such complications: the internationally recommended Class A packaging, designed to ensure that the temperature of the vaccine does not exceed +8 °C for a minimum exposure of 48 hours at an ambient temperature of 43 °C, should be used. Packing the vaccine vials in small vaccine insulated boxes (class A) with a maximum weight of 40 kg/box enables manual handling and can serve as a cool box in the field or during local transportation. Loose packaging should be avoided and small packaging used for the other materials (buffer solution and cups). All three components (vaccines vials, buffer solution and cups) should be packed in the same batch and in small quantities (maximum of 100 each) to avoid unpacking and repacking of goods before field distribution. Furthermore, batches of vaccines and buffers sent together should have the same expiry date and a shelf-life of at least one year after the shipment. Hindrances and

¹ The expiry date written on the buffer sachets was January 2005, whereas on the boxes it stated June 2005. Seemingly, the buffers were tested for stability and their shelf-life extended to June 2005. WHO nonetheless requested the necessary proof of stability data.

² Transportation between Singapore and Kuala Lumpur to Medan is ensured by Boeing 737, an aeroplane with limited cargo capacity.

unforeseen events are not rare in complex emergency environments, and the management team should be able to rely on enough flexibility should operations need to be postponed.

The PHC supplied each vaccination team with 100–250 doses on a daily basis. The vaccines were transported in 18-litre cold boxes¹ charged on the vaccinators' motorcycles until their final destination. At sub-district level, the vaccines were stored at room temperature (20–32 °C) in Styrofoam boxes. At the end of Phase I, 28% of the vaccine doses had to be destroyed because they had been outside the cold chain for four weeks. In addition, because of their important volume, the vaccines and related material had to be scattered in all possible places (pharmacies, DHO hall and designated offices), making follow up of material movement particularly difficult.

To minimize these problems, an assessment of cold chain facilities at all levels should take place before ordering the vaccines. A temporary cold chain system should be set up when common cold-chain facilities are insufficient to store the OCV. Temperature controls and monitoring should be carried out daily. Where shortages of electricity are foreseen, the use of auxiliary generators should be considered, taking into account the additional costs and logistic burden this may cause. Road and air transportation difficulties should be assessed when planning the campaign. At each level, the packing lists and contents should be cross-checked and irregularities/damages reported in a uniform way.

5.5.2 Waste management

Vaccine waste always occurs during vaccination campaigns, but the wastage in this campaign was substantial² and caused mainly by the lack of cold-chain facilities and the short shelf-life of the vaccines, as well as the rescheduling and change in the targeted population figures. During implementation, however, only minimal losses occurred because the vaccine was contained in thick glass vials. Waste management is essential and should be planned before implementation. Strict guidelines should be given to field teams, and waste management costs included in the overall budget. Specific attention should be paid to the destruction of the vaccine and recycling of vials, as infrastructures corresponding to WHO standards are frequently unavailable.

5.6 Expenditure and funding

Although a WHO certified financial statement has not yet been issued, an initial analysis of expenditure indicates the following breakdown:

Item	Cost (US\$)	Remarks
Vaccines with buffer + cups	644 535	Cost per dose: US\$ 4.7 per vaccinated person: US\$ 9.4
International shipment	20 712	From Sweden to Medan
Other equipment	315	Markers, etc.
computers	4423	
WHO experts	124 230	2 logisticians, 4 public health specialists, 1 coordinator
Cold room facilities Medan	4389	
Shipment Medan - Banda Aceh	770	By air cargo
MoH expenditures	159 275	Per diems, transport of staff, training, material
Total	958 649	Overall cost per fully immunized person: US\$ 17.55

¹ Capacity: about 250 vials with two ice packs.

² An average loss of 11.7%, or 20 000 doses. The percentage loss reaches 28% for phase I.

These figures are an estimate of expenditure and do not include other costs including salaries (WHO experts and field officers) and other resources (human and material) generously provided by other humanitarian agencies, mainly the FRC (which transported the vaccines from Medan to Meulaboh) and the UN (which provided helicopter transport from Medan to Calang). Warehousing facilities on some occasions were provided free of charge. The calculation of US\$ 17.55¹ for each person fully immunized can therefore be considered a slight underestimate.

Because the two-dose OCV is still not widely used, its cost remains high; volume and weight increases the logistic costs linked to storage and transport. Moreover, because the vaccine is administered in two doses 10 days apart doubles the expenses of logistics, human resources and training. Additionally, the difficult geographical setting tends to increase costs (delays, transport difficulties, shipment to be ensured by air rather than by road, etc.).

The mass cholera vaccination campaign in Aceh Province was funded mostly by the Swedish Government through its international cooperation agency, SIDA. Additional expenses were paid by different donors² from unearmarked funds for the tsunami-affected areas.

6. Discussion and concluding remarks

Implementation of the mass vaccination campaign extended over several months, much longer than first planned. Between April and August 2005, a total of 54 627 IDPs out of the 78 870 people identified received two doses of OCV necessary to ensure protective efficacy, resulting in an overall vaccination coverage of approximately 69.3%. Vaccination coverage differed between areas, with a maximum in Banda Aceh town (89.5%) and a minimum in Aceh Besar district (58%). These results show that community involvement, population movement, geographical setting and the number of vaccine recipients identified significantly influenced the results of the campaign.

Aceh Besar had the highest target population, the most scattered around a wide area and the most subject to movements. Furthermore, the involvement of community leaders was noticeably lower than in other places. In general, given the difficulties in identifying the target population and the instances when a person who should not have received a dose was partially or fully vaccinated, the results need to be interpreted with caution. Furthermore, the absence of previous baseline data on cholera in Aceh area and the scarcity of cases during the past years will make it extremely difficult to evaluate and quantify the real impact of the campaign on communities if no cholera outbreak occurs in the next two years.

The logistics linked to the use of OCV were heavy because of the volume of the vaccine, the need to maintain a cold chain and for clean water and the necessity of being able to reach the same population twice within a short time. This experience showed as well that the expiry dates of both the vaccine and the buffer solution should be carefully checked to avoid discrepancies. Several constraints can hinder planning: weather conditions, security deterioration and, above all, population movements. Careful assessment and planning preceding the implementation phase are therefore critical in order to facilitate logistic operations and to obtain good vaccination coverage and low vaccine wastage.

This vaccination campaign further highlighted the need for a coherent approach towards preparation and implementation, and on a larger scale the need for preventive measures for a

¹ Of which US\$ 12.18 covered only the cost of the vaccine and its transport from the manufacturer's country (Sweden) to Medan. The cost of one dose of vaccine was US\$ 4.7.

² Japan, Netherlands.

cholera outbreak. Parallel or incoherent initiatives should be avoided. Rather, emphasis should be placed on coordinating all the actions related to cholera control: vaccination campaigns, health education activities, and water and sanitation improvement projects.

The campaign underscored the need for a thorough assessment before embarking on a mass vaccination campaign. A two-step approach in the decision-making process is recommended: first, the risk of an outbreak should be assessed; second the feasibility of mass vaccination in a particular context should be evaluated.

In order to undertake a thorough risk assessment, key indicators should be developed that would help in deciding when to use the vaccine. Indeed, the perception of risk is difficult to assess and not always based on objective data. When dealing with cholera, several psychosocial, political or cultural aspects influence risk perception. At a second stage, all aspects of field implementation, including logistics, timing and commitment of the population, should be examined in detail. External constraints and public health priorities are key issues: during the campaign, it became clear that following a large-scale natural disaster, many basic health services are destroyed or severely disrupted. These services should be reliable before capacities are withdrawn for other additional activities. Furthermore, health workers tend to be overwhelmed by numerous activities, all of which are considered urgent, leading to incomplete coverage of tasks. Priorities should therefore be set at central level and followed up accordingly.

At the planning level, a three-phased approach proved to be a good option, allowing time to conduct an evaluation after phase I and for adjustments to be made in subsequent phases. According to the DHO, this campaign contributed to building capacities among MoH staff and has been perceived as a booster to undertake routine immunization activities after the tsunami. WHO support for technical assistance, logistics, monitoring and evaluation was required and appreciated.

The sociocultural aspects of the campaign underscored the need for communities to be fully involved and committed to the project from the preparatory phase. An understanding of cultural and religious behaviours is essential, and these aspects should be considered in advance to avoid jeopardizing mass vaccination coverage.

A few technical elements require clarification, for example an evaluation of the effectiveness of the vaccine for children aged between 2 and 6 years when smaller amounts of buffer solution are ingested. The amount currently recommended (75 ml) is often too great for small children to drink. Furthermore, a two-dose vaccine is difficult to administer in emergency settings. A single-dose vaccine would enable implementation through eased logistic constraints, reduced costs and improved management of moving populations. The benefits of use of the two-dose OCV in a natural disaster setting, given its cost and numerous constraints, should therefore be thoroughly examined.

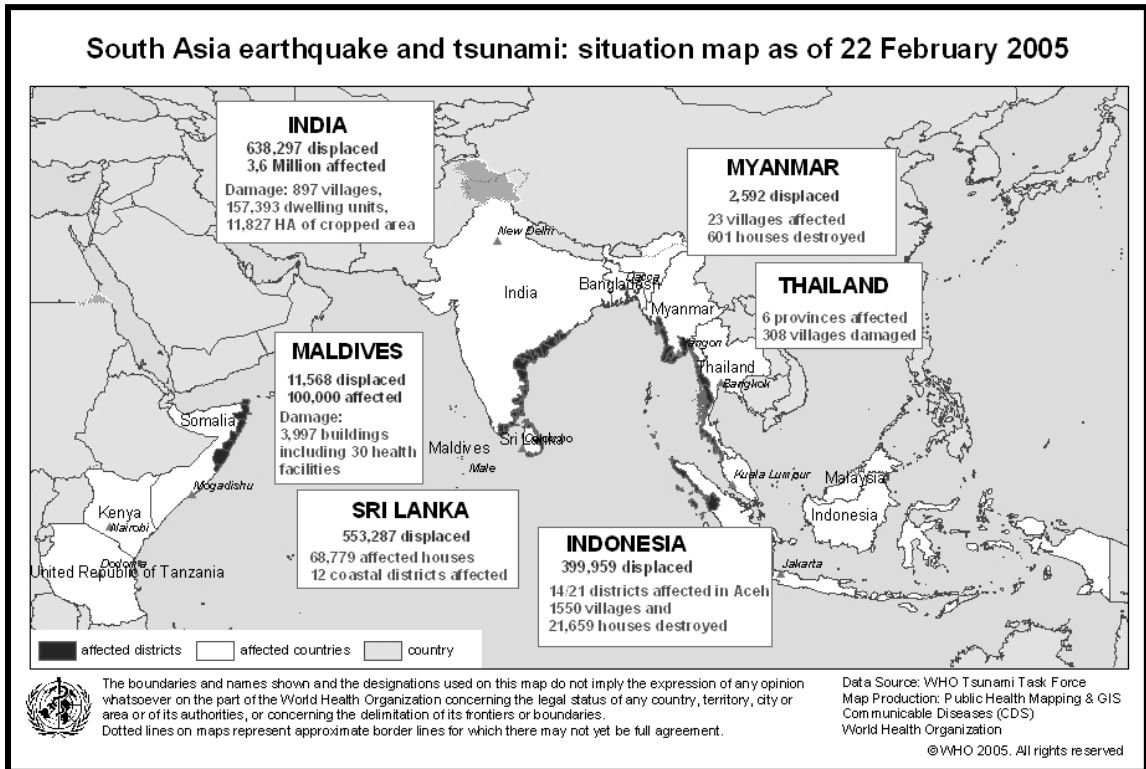
In conclusion, the lessons learnt from this mass vaccination campaign will help WHO to issue clear recommendations and guidelines on the use of OCVs in complex emergencies and natural disasters. The evidence gained was thoroughly examined during a meeting held in Cairo in December 2005 at which humanitarian partners, scientific institutions and representatives of epidemic-prone countries participated.

7. References

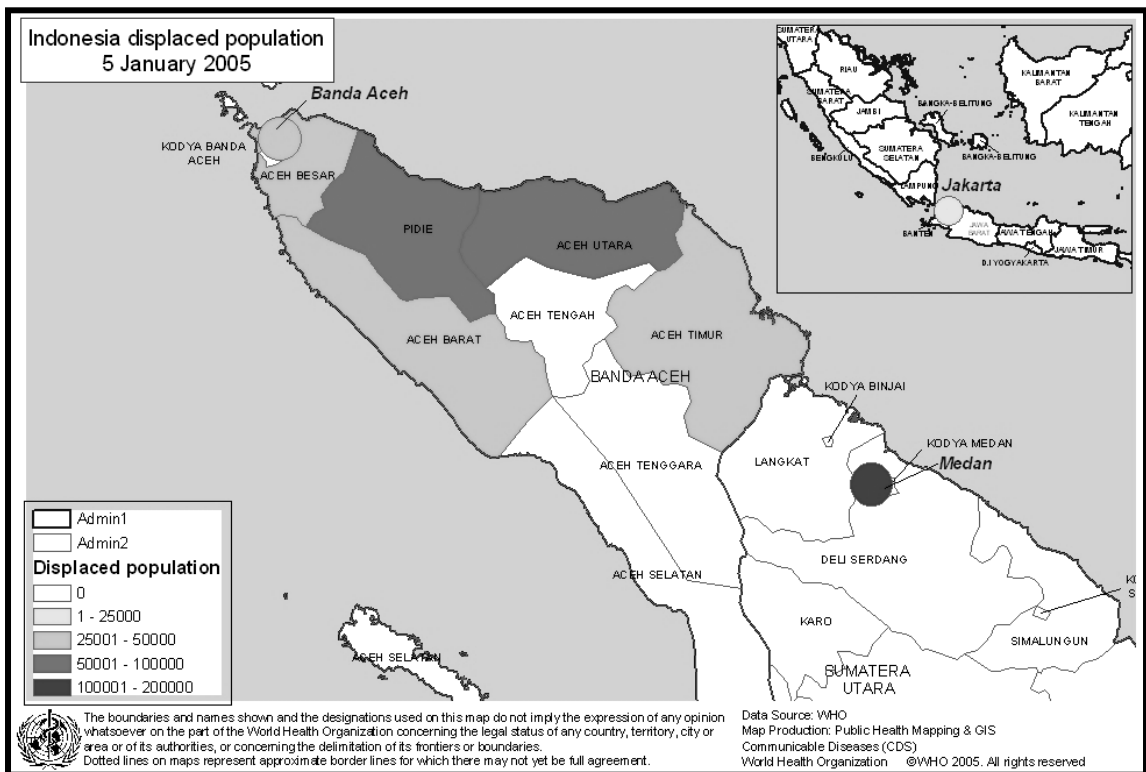
1. *Report of the Office of the Special Envoy for Tsunami Recovery*, July 2005.
2. Nelwan RHH. *Report to the Communicable Diseases Centre, Ministry of Health*, 28 February 2005.
3. *Potential use of oral cholera vaccines in emergency situations. Report of a WHO meeting. Geneva, Switzerland, 12–13 May 1999*. Geneva, World Health Organization, 1999 (WHO/CDS/CSR/EDC/99.4).

Annex 1: Maps

Impact of the tsunami



Sumatra and Aceh provinces



Annex 2: Summary tables

Phase I: Data, Aceh Barat

Province : Nanggroe Aceh Darussalam

Doses received: 53 918 vials

District: Aceh Besar

Doses remaining: 6 267 vials

<ul style="list-style-type: none"> • Vaccination posts • Sub-districts • Districts • _____ 	Target population	Vaccination rate					Logistics					
	Total	Dose 1	Coverage dose 1	Dose 2	Coverage dose 2	Vaccine coverage after dose 2	Vaccine doses used & wasted	Wastage rate	Vaccine doses used & wasted	Wastage rate	Vaccine doses used & wasted	Wastage rate
	No.	No.	%	No.	%	%	Dose 1	%	Dose 2	%	Total	%
	Name	A	B	$B/A \times 100 = C$	D	$D/B \times 100 = E$	$D/A \times 100 = F$	G	$(G/B \times 100) - 100 = H$	I	$(I/D \times 100) - 100 = J$	$K = G + I$
Kota Jantho	2 605	1 579	60.6	1 504	95.2	57.7	1 588	0.57	1 508	0.27	3 096	0.42
Saree	137	150	109.5	147	98.0	107.3	150	0.00	151	2.72	301	1.35
Seulimum	1 205	387	32.1	346	89.4	28.7	396	2.33	350	1.16	746	1.77
Kuta Malaka	538	358	66.5	341	95.2	63.4	360	0.56	346	1.47	706	1.00
Sukamakmur	1 990	1 342	67.4	1 208	90.0	60.7	1 340	-0.15	1 211	0.25	2 551	0.04
Montasik	520	470	90.4	470	100.0	90.4	475	1.06	474	0.85	949	0.96
Ingin Jaya	2 960	2 103	71.0	1 464	69.6	49.5	2 115	0.57	1 466	0.14	3 581	0.39
Kr.BARONA JAYA	469	363	77.4	291	80.1	62.0	370	1.93	295	1.37	665	1.68
Darussalam	632	506	80.1	496	98.0	78.5	513	1.38	500	0.81	1 013	1.10
Kajhu	6 338	3 993	63.0	2 650	66.3	41.8	4 020	0.68	2 655	0.19	6 675	0.48
Kuta Baro	1 213	934	77.0	601	64.4	49.5	945	1.18	603	0.33	1 548	0.85
Mesjid Raya	3 671	3 011	82.0	2 211	73.4	60.2	3 212	6.68	2 220	0.41	5 432	4.02
Darul Imarah	5 097	4 632	90.9	3 832	82.7	75.2	4 690	1.25	3 835	0.08	8 525	0.72
Peukan Bada	3 511	2 733	77.8	1 911	69.9	54.4	2 751	0.66	1 917	0.31	4 668	0.52
Pulo Aceh	854	785	91.9	468	59.6	54.8	800	1.91	471	0.64	1 271	1.44
Lhonga	1 740	1 709	98.2	1 080	63.1	62.1	1 728	1.11	1 085	0.46	2 813	0.86
Leupeung	748	750	100.3	750	100.0	100.3	760	1.33	756	0.80	1 516	1.07
Lhoong	920	940	102.2	648	68.9	70.4	945	0.53	650	0.31	1 595	0.44
TOTAL	35 148	26 745	76.1	20 418	76.34	58.1	27 158	1.54	20 493	0.37	47 651	1.03

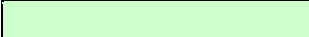
Phase II: Data – first dose, Aceh Besar

Sub-district/primary health centre	Number of people vaccinated												Total number of people vaccinated	
	Age (2–6 years)				Age (>6 years)				Male		Female			
	Male		Female		Male		Female							
	A	%	B	%	C	%	D	%	A + C	%	B + D	%		A + B + C + D
Johan Palawan	134	5.8	140	6.1	1 072	46.7	948	41.3	1 206	52.6	1 088	47.4	2 294	
Meureubo	119	6.3	111	5.8	770	40.5	899	47.3	889	46.8	1 010	53.2	1 899	
Kawai Xvi	73	5.5	74	5.6	598	45.1	580	43.8	671	50.6	654	49.4	1 325	
P. Cereumen	33	4.9	40	5.9	242	35.9	359	53.3	275	40.8	399	59.2	674	
Samatiga	97	3.3	88	3.0	1 349	46.3	1 381	47.4	1 446	49.6	1 469	50.4	2 915	
P. Layung	85	7.1	83	6.9	461	38.4	571	47.6	546	45.5	654	54.5	1 200	
Woyla Kuala Bhee	190	12.0	188	11.9	467	29.5	738	46.6	657	41.5	926	58.5	1 583	
Woyla Timur	16	4.6	22	6.3	162	46.3	150	42.9	178	50.9	172	49.1	350	
Woyla Barat	82	5.1	87	5.4	714	44.6	717	44.8	796	49.8	804	50.3	1 600	
Arogan	122	6.5	97	5.1	923	48.9	745	39.5	1 045	55.4	842	44.6	1 887	
TOTAL	951	6.0	930	5.9	6 758	43.0	7 088	45.1	7 709	49.0	8 018	51.0	15 727	

Phase II: Data – second dose, Aceh Besar

Sub-district/primary health centre	Number of people vaccinated												Total number of people vaccinated	
	Age (2–6 years)				Age (>6 years)				Male		Female			no data
	Male		Female		Male		Female							
	A	%	B	%	C	%	D	%	A + C	%	B + D	%		E
Johan Palawan	152	7.0	156	7.2	839	38.8	1 013	46.9	991	45.9	1 169	54.1	–	2 160
Meureubo	78	4.7	100	6.1	532	32.4	641	39.0	610	37.1	741	45.1	293	1 644
Kawai Xvi	65	5.3	74	6.0	578	46.7	520	42.0	643	52.0	594	48.0	–	1 237
P. Cereumen	30	4.6	61	9.3	169	25.7	277	42.2	199	30.3	338	51.4	120	657
Samatiga	85	3.1	80	2.9	1 260	45.6	1 341	48.5	1 345	48.6	1 421	51.4	–	2 766
P. Layung	79	7.2	77	7.0	415	37.6	532	48.2	494	44.8	609	55.2	–	1 103
Woyla Kuala Bhee	181	11.9	172	11.3	455	30.0	711	46.8	636	41.9	883	58.1	–	1 519
Woyla Timur	15	4.8	19	6.1	142	45.5	136	43.6	157	50.3	155	49.7	–	312
Woyla Barat	64	4.0	79	4.9	496	31.0	501	31.3	560	35.0	580	36.3	460	1 600
Arogan	38	2.0	26	1.4	356	18.9	341	18.1	394	20.9	367	19.4	1 126	1 887
TOTAL	787	5.3	844	5.7	5 242	35.2	6 013	40.4	6 029	40.5	6 857	46.1	1 586	14 885

 Figures higher than for first dose.

 Data incomplete: some data on vaccination days were not recorded.

Phase II: Data, Banda Aceh town

<ul style="list-style-type: none"> • Vaccination posts • Sub-districts • Districts • _____ 	Target population	Vaccination rate					Logistics					
	Total	Dose 1	Coverage dose 1	Dose 2	Coverage dose 2	Coverage after dose 2	Vaccine doses used & wasted	Wastage rate	Vaccine doses used & wasted	Wastage rate	Vaccine doses used & wasted	Wastage rate
	No.	No.	%	No.	%	%	Dose 1	%	Dose 2	%	Total	%
Name	A	B	$B/A \times 100 = C$	D	$D/B \times 100 = E$	$D/A \times 100 = F$	G	$(G/B \times 100) - 100 = H$	I	$(I/D \times 100) - 100 = J$	K = G + I	$(K - (B + D)) \times 100 = L$
Kuta Alam	3 810	3 646	96	3 626	99.45	95.17	3 646	0	3 626	0	7 272	0
Mibo	2 274	1 790	79	1 570	87.71	69.04	1 790	0	1 570	0	3 360	0
Ulee Kareng	1 128	1 128	100	1 116	98.94	98.94	1 128	0	1 116	0	2 244	0
Batoh	361	207	57	207	100.00	57.34	210	1.44	207	0	417	0.72
Kopelma Darussalam	2 819	2 834	101	2 779	98.06	98.58	2 834	0	2 779	0	5 613	0
TOTAL	10 392	9 605	92	9 298	96.8	89.47	9 608	0.03	9 301	0	18 909	0.01

Phase III: Data, Aceh Jaya

District: Aceh Jaya
Province: Nad
Doses received: 24 581

Date: 19 July – 2 August 2005
Target population: 12 461
Doses remaining: 4 131

<ul style="list-style-type: none"> • Vaccination posts • Sub-districts • Districts • _____ 	Target population	Vaccination rate				Logistics					
	Total	Dose 1	Coverage dose 1	Dose 2	Coverage dose 2	Vaccine doses used & wasted	Wastage rate	Vaccine doses used & wasted	Wastage rate	Vaccine doses used & wasted	Wastage rate
	No.	No.	%	No.	%	Dose 1	%	Dose 2	%	Total	%
Name	A	B	$B/A \times 100 = C$	D	$D/A \times 100 = E$	G	$(G/B \times 100) - 100 = H$	I	$(I/D \times 100) - 100 = J$	K = G + I	$(K/(B+D)) \times 100 = L$
Lamno	3 042	2 528	83.1	2 445	80.4	2 530	0.1	2 445	0	4 975	0.1
Lhok Kruet	989	920	93.0	871	88.1	920	0.1	874	0.3	1 794	0.1
Patek	861	750	87.1	743	86.3	751	0.2	745	0.3	1 496	0.1
Lageun	1 469	1 253	85.3	1 217	82.8	1 256	0	1 217	0.1	2 473	0.1
Calang	1 255	1 011	80.6	987	78.6	1 011	0	988	0	1 999	0.1
Panga	1 977	1 609	81.4	1 456	73.6	1 609	0	1 456	0	3 065	0
Krueng Sabbe	1 382	1 136	82.2	1 126	81.5	1 139	0.1	1 129	0.1	2 268	0.1
Teunom	1 486	1 208	81.3	1 181	79.5	1 208	0	1 181	0	2 389	0
TOTAL	12 461	10 415	83.6	10 026	80.5	10 424	0.1	10 035	0.1	20 459	0.1

Annex 3: Time frame

	Dec.	January					February				March					April				May				June				July			Aug		
Week	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Tsunami	26																																
Swedish donation			4																														
MoH decision to use OCV						2 5																											
WHO assessment						27.01– 02.02																											
MoH requests WHO support							1																										
MoH assessment										20.02– 23.02																							
Preparation and planning											Preparation																						
OCV shipment 1													2 1																				
Earthquake in Meulaboh area													2 8																				
Implementation phase I															11.04–29.04																		
Evaluation MoH/WHO																			24.04– 30.04														
Preparation phase II																			Preparation														
OCV shipment 2																							0 4										
Implementation phase II																							31.05–26.06										
Preparation phase III																												Preparation					
Implementation phase III																																19.07–04.08	

Annex 4: Joint WHO/UNICEF statement for cholera vaccine use in tsunami-affected areas

Background

- Traditional parenteral whole-cell (WC) cholera vaccine has never been recommended by the World Health Organization (WHO) because of its low protective efficacy and its high reactogenicity.
- Currently available oral cholera vaccines (OCVs) are safe and offer good protection (over 70%) for an acceptable period of time (at least one year).
- The use of OCV is considered as an additional public health tool to usually recommended cholera control measures such as provision of safe water and adequate sanitation.
- OCV use is recommended for populations to limit the risk of:
 - occurrence of cholera outbreaks in displaced populations in endemic areas,
 - spread and incidence of cholera during an outbreak.

Currently commercially available OCVs

- a. Live attenuated single-dose cholera vaccine CVD 103-HgR, Orochol-E®, contains a live attenuated strain derived from reference strain 569B (classical, O1, Inaba) presented in a single dose.
 - Protective efficacy was reached 8 days after administration of the vaccine in a volunteer's challenge study.
 - **Therefore, use of the single dose OCV may be possible once an outbreak has started.**
- b. Killed WC B subunit cholera vaccine (WC/rBS), Dukoral®, derived from mixtures of WC killed strains. They are given in two doses, 10–14 days apart.
 - Protective efficacy is reached 10 days after the second dose.
 - **The two-dose OCV is currently not indicated for use once an outbreak has started.**

Neither of the two vaccines protects against *Vibrio cholerae* O139.

Issues to be considered for vaccine use

Population at risk

- Displaced population living in settlements/camps
- With limited access to safe water and proper sanitation
- Location endemic for cholera or past cholera outbreaks
- Outbreak risk according to seasonality of past data
- With limited health infrastructure
- Community leaders ensuring involvement of community
- Access to the population at risk possible (individuals >2 years of age)
- Access to same population possible over 3–4 weeks (for the two-dose vaccine)

Surveillance

- Data on occurrence of cholera over time
- Predominant strain *V. cholerae* O1

Vaccine

- Choice of vaccine will depend on the occurrence of cholera¹
- Timing of vaccination either pre-emptive (environmental management in the population not satisfactory and outbreak expected in the near future) or reactive (at the early stages of an outbreak to limit its spread).
- Sufficient doses available for total population at risk in given area
- Vaccine prequalified by WHO (in case no adequate prequalified vaccine is available or supply is insufficient, special case-by-case decision will be taken)

Logistics

- Cold chain facility and storage capacity available
- Safe water and cups for vaccine distribution available

Human resources

- Health care staff (e.g. Ministry of Health, nongovernmental organization)
- Expanded Programme on Immunization (EPI)/polio vaccination teams
- Community

Prevention

- Capacity to implement health education during campaign
- Environmental management activities should continue

Political commitment

- Agreement to import/license vaccine from manufacturing country
- Support and commitment from national/regional and local levels
- Support and commitment from community leaders and other groups

Decision-making process for OCV use/deployment

- Request for OCV use should be initiated by the Ministry of Health of the country.
- The decision for deployment of OCV should be taken by an Advisory Panel which will base its decision upon analysis of a set of prerequisites. Terms of reference of the Advisory Panel are similar to the ones of the ICG.² The Advisory Panel consists of:
- WHO Headquarters: Department of Immunization, Vaccines and Biologicals; Global Task Force on cholera control; Communicable Disease Surveillance and Response (CSR)/Alert and Response Operations (ARO)/Epidemic Readiness and Interventions (ERI)
- WHO Regional Office for South-East Asia and the WHO Representative
- UNICEF Headquarters and UNICEF Regional Office
- Advice and guidance for implementation of the mass vaccination campaign using OCV will be provided through the WHO Global Task Force on Cholera Control.

Systems to be put in place

- Disease surveillance/Early Warning and Response Network (EWARN) to be strengthened if already existent
- Monitoring and evaluation system
- Adverse events following immunization (AEFI) surveillance
- Safe waste-disposal system

Characteristics of currently available cholera vaccines

	Killed WC/rBS OCV	Live attenuated CVD 103 Hg-R OCV	Parenteral WC vaccine
Commercial name	Dukoral®	Orochol E®	NA
Number of doses required for full immunization	Two, 10–14 days apart (3 doses recommended by manufacturer for children; however, recent studies indicate that 2 doses are sufficient to induce protection)	One	Two, 1–4 weeks apart
Administration	oral	oral	parenteral
Earliest onset of protection after full immunization	10 days ^a	8 days ^b	NA
Protective efficacy	50—86%	60—90%	NA
Use in pregnancy	possible	not recommended	NA
Simultaneous administration with other vaccines	Possible except for orally administered vaccines	Possible also with oral polio and yellow fever vaccines; not possible with live typhoid vaccine (Vivotif®).	NA
Exclusion criteria	Children aged under 2 years	Children aged under 2 years; immune deficiency; concomitant treatment with immunosuppressive or antimetabolic drugs	NA
Side-effects	Rare gastrointestinal symptoms	Rare gastrointestinal symptoms	At injection site; general malaise; low-grade fever, headache
Precautions	Postpone vaccination in case of acute illness	Do not use during acute febrile illness, acute gastrointestinal infection, during and up to 7 days after antibiotic or sulfonamid treatment	NA
Presentation	Vial with oral suspension (vaccine) plus sachet with effervescent granules (buffer)	1 double chamber sachet, each chamber containing either vaccine or buffer	Vial (need syringe and needle)
Storage volume/50 000 doses	? but minimum 7m ³	7 m ³	NA
Storage	Cold chain (2–8 °C)	Cold chain (2–8 °C)	NA

	Killed WC/rBS OCV	Live attenuated CVD 103 Hg-R OCV	Parenteral WC vaccine
Need for cold chain at immunization point	relative at ambient temperature (20–25 °C) if the vaccine is used within 24 hours	Relative at ambient temperature (20–25 °C) if the vaccine is used within 24 hours	NA
Amount of drinkable-water needed/dose	150 ml for adults ; 0.75 dl for children aged 2–6 years	100 ml	none
Manufacturer	SBL Powderject, Stockholm, Sweden	Berna Biotech, Bern, Switzerland	NA
WHO prequalification for purchase by UN	yes	no	Was never recommended for use by WHO
Availability	yes	currently not available; manufacturer stopped production	

NA = information not available; OCV = oral cholera vaccine; WC = whole-cell

^aJertborn M, Svennerholm AM, Holmgren J. Evaluation of different immunization schedules for oral cholera B subunit-whole cell vaccine in Swedish volunteers. *Vaccine*, 1993, 11:1007–1012.

^bTackett Co et al. Onset and duration of protective immunity in challenged volunteers after vaccination with live oral cholera vaccine CVD 103-HgR. *Journal of Infectious Diseases*, 1992, 166(4):837–841.