

Vaccination in Humanitarian Emergencies: Literature review and case studies

Part I: Literature review

1. Introduction

Humanitarian crises and emergencies are ubiquitous and frequently unpredictable in time and location. However, with increasing awareness of populations and regions at risk, responses to such events are becoming more and more systematic and better organized. Apart from attending to the immediate need for emergency medical care, food, shelter and access to water and sanitation¹, preventive public health measures are looked upon as critical issues for consideration as response to a humanitarian emergency. One such measure is the potential use of vaccines against vaccine preventable diseases. A systematic review of literature was carried out to collate existing guidelines, analyze key factors and methods involved in the consideration of vaccination during emergencies. The expectation from such an exercise is to improve our understanding of current recommendations in emergency manuals as well as relevant recent field

Box 1: Search terms

[VACCINATION]: Immunization [MeSH] Immunization Programs [MeSH] OR immunization OR Vaccination [MeSH] OR Mass Vaccination [MeSH] OR mass campaign OR supplemental immunization activities OR Immunization campaign [MeSH] OR vaccination campaign OR vaccine OR Vaccines [MeSH]

[HUMANITARIAN EMERGENCIES] : humanitarian OR humanitarian emergency OR relief work [keyword and MeSH] OR forced displacement OR mass population displacement OR Emergencies [keyword and MeSH] or complex emergency OR refugee camp OR humanitarian assistance OR disaster-affected OR crisis-affected OR refugees [keyword and MeSH] OR refugee* OR displaced population* OR disaster* OR Disasters [MeSH] OR natural disaster

experiences concerning the use of vaccines in humanitarian emergencies. The systematic collation and analysis of such information would be helpful in the development of future decision making framework for use by persons planning and implementing immunization programmes within a larger package of interventions during the acute phase of an emergency. A rapid scan of the literature showed that no such systematic reviews existed regarding the use of vaccines in humanitarian emergencies.

An initial broad-based review of the literature of existing guidelines and experiences in the use of vaccines in humanitarian emergencies was conducted and shared at the preparatory working group meeting on 20-21 September 2011. Subsequently, a more refined review of the literature was undertaken searching the following databases - Medline, Embase, CAB abstracts for articles published from January 1, 2000 to week 3 October 2011 using the OvidSP interface. Search terms included keywords and medical subject headings describing the concepts of [vaccination] AND [humanitarian

emergencies] (Box 1). A trial search for similar document before 2000 did not yield anything different. Therefore, the search was limited to post 2000 literature only. The findings of this expanded review were collated and shared at the second working group meeting on 17-18 February 2012

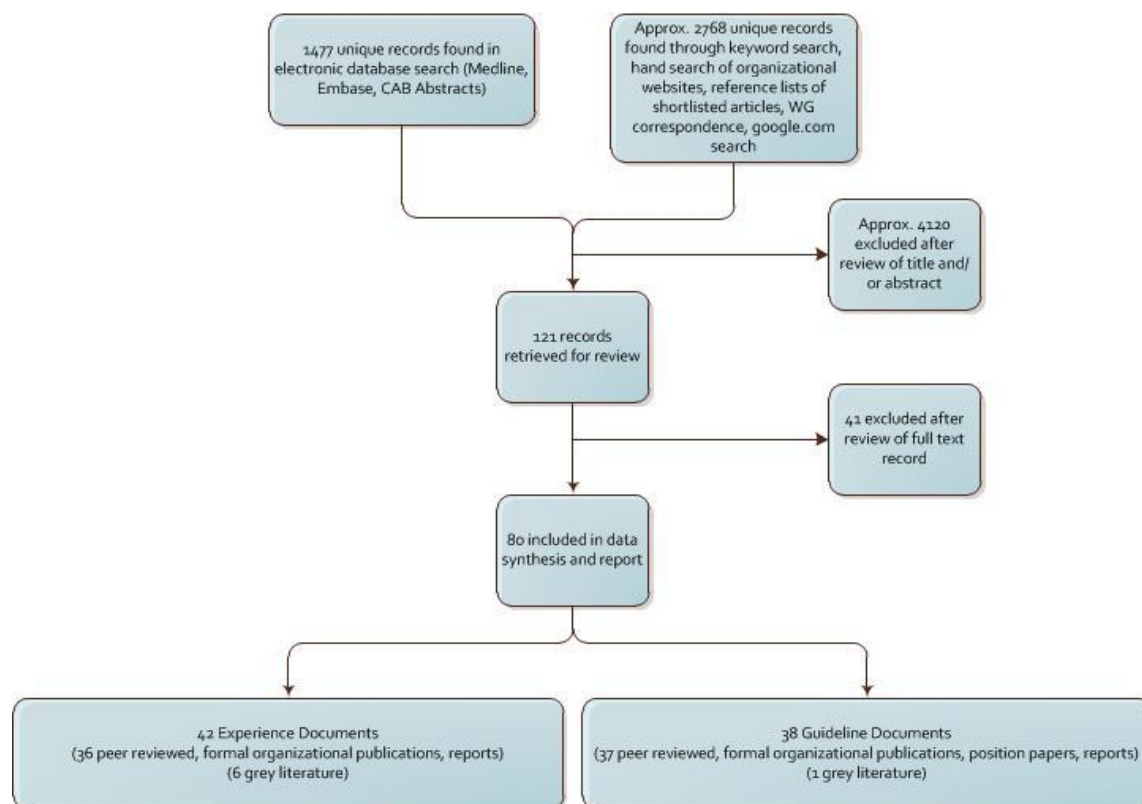
Box 2. Summary of the findings and conclusions of the literature review

- This literature review revealed varied and non-standardized criteria used by organizations to plan and implement vaccination in emergencies. Very little data is available to evaluate the process of how decisions are made and assess the impact of vaccination in the wider public health landscape of an acute humanitarian emergency.
- Although decision making process was not described in the vast majority of the literature reviewed, most considered certain criteria when planning and implementing vaccination in emergencies. In general the phases of emergency in which vaccination is considered is vague and inconsistently defined.
- The most prominent considerations towards a decision to vaccinate are practical aspects such as cold chain, logistics, implementation feasibility, human resources, vaccine availability to name a few. Epidemiological issues such as risk assessments were considered important, but often the decision to vaccinate or not preceded the risk assessment. Vaccine characteristics appear to be the least considered.
- Reports of vaccination in emergencies state factors under consideration for planning and implementation, but the weighting or analysis of the information and how it all feeds into the final decision is generally missing. Guideline documents offer recommendations of which vaccines are and are not appropriate in an emergency context, but do not offer a comprehensive method of evaluating and prioritizing public health interventions in the field. Experiences of vaccination in emergency settings offer no further insight into how guidelines are interpreted or used in decision making.
- Political considerations often outweigh objective evidence in the decision making process to use or not to use vaccines in humanitarian emergencies.
- Ethical considerations are not well captured in this review. There is little guidance or experience noted on how organizations manage decisions when needing to resolve prioritization of interventions, targeting high risk groups, equity, and informed consent.
- There is a clear need for a framework to ensure a standardized and consistently applied methodology for decision making. The use of such a framework would minimize excess mortality, maximize resources, reduce wastage, ensure equity, and ultimately improve accountability to the population at risk and other stakeholders. Tools being developed require input from key agencies for a feasible, pragmatic approach to this challenge.

2. The search result

From the search 80 documents (38 guidelines & 42 experience documents) were deemed appropriate for inclusion in the analysis (see Fig 1.) Data was extracted into Excel spreadsheet prepared for information analysis; a guide was also developed to ensure consistency in the recording and analysis of information.

Fig. 1. The search result



2.1 (a) Results of Guidelines review

Measles is most often recommended, and is well accepted as a priority health intervention in emergencies^{8,13-16}. Simultaneous introduction with other antigens is not generally recommended, but campaigns can include polio vaccination where outbreaks or threats to eradication programs exist^{1,6,14,17} and tetanus vaccination for all those with open wounds^{16,18,19}, or pregnant women²⁰. Vitamin A supplementation is almost universally recommended for implementation during a measles vaccination campaign. Where measles is recommended, vaccine coverage or needs assessments are also recommended to determine specific age ranges for targeting. Coverage rates of less than 90% for those under 15 years old are given as a qualifying criteria for recommendation of immediate mass immunization^{7,16,19}, however, in none of the documents is it specifically recommended that measles vaccination campaign can be delayed if estimates of pre-emergency vaccination coverage rates exceed a threshold, for example $\geq 90\%$.

With respect to the phase of the emergency in which vaccines are recommended for implementation, the only vaccines reliably and consistently recommended for introduction “immediately” were measles, polio, and tetanus (for people with open wounds). Of the vaccines considered for diseases with epidemic potential, three are recommended only after the outset of an outbreak: hepatitis A; meningococcal meningitis; and yellow fever, while measles and polio are both recommended preventatively and after the start of an outbreak, and cholera is not recommended after the start of an outbreak. The documents that recommend polio vaccination preventatively during an emergency, also address the potential threat to an eradication programme¹ or are specifically recommended for a region in which polio outbreaks are a risk⁶. Vaccines for tetanus, pertussis, and diphtheria are generally not recommended for mass vaccination campaigns, and rather should be implemented through routine immunization programs when conditions stabilize. Influenza and typhoid vaccines are generally not recommended at all during emergencies, regardless of the phase.

Prevention of meningococcal meningitis outbreaks in sub-Saharan Africa with the use of a new meningococcal A conjugate vaccine, implemented proactively prior to the start of an outbreak, may be considered in the future. The new vaccine was introduced in parts of the African meningitis belt in December 2010²¹. The search criteria used for this review did not produce any documents in which vaccination to prevent meningococcal meningitis outbreaks are recommended or performed proactively in an emergency context.

Routine immunizations through national expanded programme for immunization (EPI) services should be reinstated as soon as conditions stabilize, and may indeed be one indication of a rehabilitating health system². Crisis conditions and risk factors for diseases listed were generally indicative of the emergency context, and not necessarily specifically related to the disease being recommended for vaccination.

Table 1: Summary of recommendations for vaccination in emergencies by type of vaccine-preventable disease and organization

| VPD (VACCINE) | ORGANIZATION | SUMMARY OF RECOMMENDATIONS | CRISIS CONDITIONS FOR RISK FACTORS FOR DISEASE | RECOMMENDED TIMING OF VACCINATION RELATIVE TO EMERGENCY ONSET |
|---|--|---|---|--|
| Cholera (OCV*) | WHO ^{11,12,14,22} UNHCR ²⁰ UNICEF ⁸ IFRC ⁷ IAP ² US CDC ²³ | <p>The use of OCV in emergencies continues to be under dispute⁷. The UNHCR and UNICEF recommend seeking expert advice²⁰ and considering the use of OCV under the most recent evidence-based guidelines⁸.</p> <p>The use of OCV should be assessed in light of other public health priorities and other priority interventions^{11,12,22}. It is not recommended for use after the start of an epidemic²². Risk assessment and decision making tool has been developed and requires field validation^{11,22}.</p> <p>Under some circumstances, for example in Haiti after the 2010 earthquake, it was not recommended⁴, and the CDC does not recommend OCV for evacuees following a disaster²³.</p> <p>Cholera vaccine may be considered preventatively, in a stable, endemic environment, but is of limited use once an epidemic has begun^{2,14}. High risk populations may be targeted for pre-emptive use².</p> | Overcrowding, inadequate sanitation facilities and contamination of water sources, poor hygiene conditions (personal, domestic and environmental), poor nutritional status and low immunity prior to the infection ⁸ | No recommendation relative to the phase of emergency. Before a cholera outbreak has been declared. |
| <i>Haemophilus influenza type b</i> (Hib) and <i>S. pneumoniae</i> (PCV) | | Recommended for use in the prevention of severe bacterial infections, but these vaccines not often available in emergencies ⁹ . | | Early phase of displacement. |
| Hepatitis A | Various | In case of an outbreak, targeted vaccination with Hep A for populations at risk ¹⁴ and may be considered for contacts ²⁴ . Not recommended for mass immunization, and may be considered for persons at high risk, i.e. those involved in management of drinking water, waste water, or sewage ²⁴ . Hep A not routinely recommended after disasters ¹⁸ , as a result of evacuation due to natural disaster alone ²³ or in the drought and famine in the Horn of Africa ⁶ . | Lack of water, sanitation and hygiene | Mainly recommended in case of outbreak |
| Hepatitis B | | No indication for mass vaccination with Hep B vaccine in emergency generally ¹⁴ , however some indication for vaccination for those handling dead bodies who may be more at risk of blood borne infections ²⁵ . | Unsafe injection practices, blood transfusion, injection drug use, occurrence of mass casualties in endemic countries ²⁶ , workers with exposure to with dead bodies ²⁴ | Not a general concern during the acute phase. |
| Influenza | US CDC ²³ WHO ²⁷ | Recommended for evacuees in crowded group settings after a natural disaster ²³ (if cannot prove to have recently received it). Not proven to be useful post-earthquake, beyond routine selective usage ²⁸ . Seasonal influenza vaccine is not recommended for an outbreak of a | Crowded group setting ²³ | Not stated. |

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|---------------------------------|--|---|---|--|
| Measles (MCV*, MMR*) | WHO ^{6,13,14,29,30} UNICEF ^{8,13,15} UNHCR ²⁰ IFRC ^{7,17} US CDC ^{23,31} Sphere ¹⁶ Indian Academy of Pediatrics ² Various organizations ^{1,18,19,32-34} | <p>novel influenza virus in displaced populations, as there will likely not be sufficient quantities to cover the global population²⁷.</p> <p>Measles immunization is a priority health intervention in emergencies^{6,8,13-15,29,30,35} and may be considered the only essential immunization in the early stages of an emergency^{2,20,34}.</p> <p>Should be administered to all children 6 months through 12²⁰, 14^{6,8,13-15,18,29,30,35} or 15^{16,20,32} years of age, and at minimum to all children aged 6-59 months. An opportunity for second dose should be given to those immunized prior to 9 months of age, once they reach 9 months, with a minimum of one month between doses. In some cases groups older than 15 should be considered in the target age, based on risk assessment.^{32,33}</p> <p>Where resources are limited, priority groups are children <5 and those at high risk (i.e. malnourished)^{7,17}. Measles morbidity and mortality in malnourished children is easily preventable with vaccination³⁵. Non-selective approach³² with at least 90% coverage is required²⁰</p> <p>Recommended coupling with Vitamin A supplementation to reduce complications of measles^{1,6,8,13,14,17,19,33,35}.</p> <p>The US CDC recommends in conditions of displacement to crowded group settings after disaster, evacuees should be given MMR, unless proof of coverage is provided.^{23,31}</p> <p>Phased approach to implementation of interventions, based on a needs assessment¹⁵. Provide simultaneous vaccination campaigns in the refugee populations and the surrounding host community³³.</p> | Displacement, severe food shortage, malnutrition, overcrowding, low measles vaccine coverage, lack of essentials for life | During the immediate 6-8 weeks ⁸ of a crisis, or as soon as possible ¹⁷ , and should not await a single case ³⁰ . |
| Meningococcal Meningitis | WHO ¹⁴ , UNHCR ²⁰ , IFRC/Johns Hopkins ¹⁷ IAP ² | Meningitis is one of the major vaccines used in complex emergencies ¹ . Meningitis vaccine offers effective control of epidemics. Should be implemented only after expert advice, when surveys suggest necessity ²⁰ , and only at the outset of an outbreak to children >2y old ¹⁷ . | Overcrowding in areas where disease is endemic (often has local dry season seasonal pattern) ²⁰ | At outset of an outbreak |
| Pertussis | WHO ³⁶ | Vaccination in response to a pertussis outbreak are generally avoided due to theoretical concerns regarding adverse events in adolescents and adults when given the whole cell DTP vaccine ³⁶ . | Crowding, malnutrition, coinfection with other illness (HIV, malaria, TB, etc.) ³⁶ | Not applicable. |
| Polio (OPV*) | WHO ⁶ IFRC/Johns Hopkins ¹⁷ | Polio transmission is a threat to eradication programs, and is linked to poor water and sanitation ¹ . In the Horn of Africa, during drought and famine, recommend OPV to all children <5 in conjunction with measles and vitamin A supplementation ⁶ . | Famine, malnutrition, crowded refugee camps, low pre-existing vaccine coverage, conflict, floods | Immediately after onset of emergency, or at the outset of an outbreak. |
| | | At the outset of an outbreak, all children should receive at least 1 dose, | | |

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|--|--|---|--|--|
| | | with a second round of mass vaccination after 30 days ¹⁷ . Vaccination is recommended with bivalent vaccine rather than trivalent ⁵ vaccine. | | |
| Rabies | CDC ²³ | For post-exposure prophylaxis only | Exposure to rabies | Not specifically related to emergency |
| Routine Immunizations and Expanded Programme on Immunizations (EPI) | WHO ¹⁴ UNICEF ¹⁵ UNHCR ²⁰ US CDC ²³ Sphere ¹⁶ IAP ² . | Routine immunization/EPI services should be implemented once the conditions of the emergency stabilize ^{14-16,20,23} or in the rehabilitation phase after disaster ² . | | Upon stabilization of emergency or in the rehabilitation phase |
| Tetanus (TT*, Td*) | UNICEF ⁸ UNHCR ²⁰ IFRC/Johns Hopkins ¹⁷ WHO ⁶ Sphere ¹⁶ | For pregnant women ^{8,20} and women of child-bearing age ¹⁷ . In post-emergency, EPI should include either TT or Td, at least 2 doses ¹⁷ . For open wounds: Mass tetanus vaccination not recommended ^{6,16} . Targeted active and passive ¹⁰ vaccination to individuals who sustain open wounds ¹⁶ or are involved with clean up after a disaster. Not necessary to give TT or tetanus immunoglobulin (TIG) to patients who have had complete series and a booster within the last 10 years ¹⁰ . Immediate provision of Td vaccine and tetanus anti-toxin to persons injured during earthquake and those undergoing emergency surgeries ¹⁹ . | Unhygienic conditions, sustainment of injury and wounds with potential for contamination | Early stages of emergency and in post-emergency stage. |
| Typhoid | UNHCR ²⁰ IFRC/Johns Hopkins ¹⁷ US CDC ²³ | Not recommended as it only offers low, short-term individual protection and little or no protection against the spread of disease ^{17,20} . In the recent drought and famine in the Horn of Africa, typhoid vaccine was cited as a possible useful tool if an outbreak starts ⁶ . | Overcrowding, contamination of water and food. Lack of hygiene. ²⁰ | Not stated. |
| Varicella | US CDC ²³ | For evacuees in crowded group settings ²³ . | Crowded group setting ²³ | Not stated. |
| Yellow Fever | WHO ^{1,14} | Mass vaccination recommended to control an outbreak ^{1,14} . | Overcrowding, Exposure to mosquito bite | To control outbreak |

*Hib = *H. influenzae type b conjugate vaccine*, MCV = *Measles containing vaccine*, OCV = *Oral cholera vaccine*, OPV = *Oral Polio Vaccine*, PCV= *pneumococcal conjugate vaccine*, TT=Tetanus toxoid, Td = *Tetanus, Diphtheria*

2.1 (b). Decision making aids/ tools for implementing guidelines

Only two decision making tools were identified in the review of guideline documents. These include a proposed decision matrix for the consideration of the use of new vaccines in emergencies by MSF Epicentre³⁷, and the newly proposed decision making tool for the use of oral cholera vaccine developed by the WHO's Global Task Force on Cholera Control^{11,12,22}.

Eleven of the guidelines reviewed did not provide any details regarding the decision making process, nor do they describe the evaluation of criteria when recommending the use of a particular vaccine^{3,9,18,24,26,28,30,35,38-40}. These documents simply recommend, or not, the use of vaccines based either on a review of literature, or on recommendations of other agencies such as the WHO. Out of 23 experiences in which reasons for vaccination were provided, the vast majority (17) recommended measles vaccine implementation, while in the list of documents that did not provide any justification for the recommendations to vaccinate or not, only three were related to measles.

The types of variables considered were those related to contextual factors, epidemiological/risk assessment, vaccine characteristics, logistical concerns and ethical considerations (Table 2). The most common variable considered in the planning or justification for recommendation of a vaccination campaign was epidemiological assessment and/or risk of increased cases or outbreak. Vaccination campaigns are generally non-selective, administering vaccine to all eligible members of a population without regard for vaccination history. In approximately half of the guidelines reviewed, epidemiological assessment is recommended and specifically vaccination history, and low vaccination coverage rates are used to assess population immunity status and determine the risk of an outbreak. Thresholds for "low coverage" are not consistently referenced except for measles. The assessment of the local epidemiology is recommended, and serves as an important tool for implementation and operational decisions, such as determination of target population and age of beneficiaries³².

With respect to vaccine characteristics, the WHO Communicable Disease Control in Emergencies Field manual¹⁴ provides a summary of vaccine characteristics in charts helping contribute to decision making around feasibility of use in a mass campaign – with age, dosage, reactions, side effects, contraindications, route of administration, storage, reconstitution, instructions for care providers, records, storage once reconstituted. The UNICEF Emergency Field Handbook⁸ also contains detailed information on the characteristics of the vaccine, and the logistical requirements of carrying out a campaign.

2.2 (b) The use of decision making tools

Of all the experiences reviewed, there were only four experiences in which an actual guideline or tool was cited as justification for implementation of vaccination campaign or not.

The decision to implement vaccines included in the country's regular childhood vaccine schedule via a phased approach in Haiti after the 2010 earthquake, was guided by^{64,65} UNICEF's Core Commitments to Children¹⁵ and the WHO/UNICEF Joint Statement on Measles vaccination^{13,73,74}.

The other experiences describing the use of a tool or guideline concern the use of oral cholera vaccine (OCV). The only event describing actual implementation of oral cholera vaccine used the WHO 1999 guidelines as justification for vaccination delivery^{41,71}, in Indonesia after the 2004 tsunami. A commentary recommending the use of OCV in flood-affected Pakistan in 2010, also reported WHO recommendations as justification for implementation, but that perceived logistic difficulty in implementation resulted in its non-use^{66,67}.

Another example of how a decision making tool was used also concerns the use of OCV and details the process undergone by the US CDC, PAHO and Ministère de la Santé Publique et de la Population (MSPP) (Haitian Ministry of Public Health and Population), in Haiti, during the cholera outbreak 9 months following the 2010 earthquake. Specifically highlighted was the inability to use the decision tool developed by WHO for OCV in complex emergencies due to a lack of available information. However, detailed and thoughtful consideration is made to the epidemiological situation of the outbreak, logistic constraints posed by the destruction of infrastructure and the important role of the MSPP in determining that any intervention, planned without the aim of covering the entire population, was unacceptable⁷⁴⁻⁷⁸.

Table 2: Decision making characteristics of vaccination experiences in emergency settings

| TYPE OF VARIABLE | SUMMARY OF ISSUES CONSIDERED |
|--|---|
| Context | <p>Prioritization of geographical areas: high risk districts and cities with largest number susceptible children^{58,59}, limited access to some geographical areas^{80,82}, linking of vaccination teams to priority camps^{73,74}, security situation restricting access to populations and movements of teams^{50,51,65}, civil unrest⁷⁶</p> <p>Prioritization of interventions: vaccination as a priority⁸², utilization of phased approach to introduction of immunization activities^{73,74}, due to damage of health care structures, system would be unable to handle an outbreak^{41,71}, vaccination not to disrupt provision of other high priority interventions⁷⁵⁻⁷⁸</p> <p>Coordinated response involving several public health interventions⁸⁰</p> <p>Seasonality^{50,51}</p> <p>Mobility of the population^{76,80}</p> |
| Epidemiological / risk assessment | <p>Immunity status: pre-disaster vaccine coverage rates^{50,51,53,58-60,82}, low natural immunity^{41,71},</p> <p>Epidemiology of local situation: identification of an outbreak^{53,55,59,62,63,65,73,74}, perceived risk of outbreak^{41,71} reports of cases^{52,56,71,72}, contribution of crisis to threatening of global eradication initiatives^{66,67}, risk factors for increased morbidity and mortality identified⁸⁵, determination of target age range⁴³, use of surveillance system⁵⁵, vaccine coverage survey to assess need for supplemental activities⁵³</p> <p>Size of population at risk^{75,76}</p> |
| Vaccine characteristics | <p>Availability of vaccine^{65,67,73-78,82}</p> <p>Dose schedule: two dose regimen considered problematic^{65,67,75,77}, timing of dosage strict for children⁷⁷,</p> <p>Effectiveness⁸²: appropriateness (strain or serotype)⁵², time to confer protection⁶⁵, coverage required for protective effect⁷⁶, duration of protection and single dose efficacy^{75,77}</p> |
| Logistics | <p>Resources: Human resources and staff training^{50,51,58,59,75}, WHO pre-qualification required for funding mechanisms⁷⁵⁻⁷⁸</p> <p>Cold-chain and storage^{75-77,80,82},</p> <p>Supplies: procurement^{73,74,82}, safe drinking water^{65,75-77}</p> <p>Time: required for planning and implementation⁶⁵</p> <p>Waste: vaccine wastage⁷⁵ and waste management^{58,59,80}</p> |
| Ethics | <p>Prioritization of subgroups of the population: based on size of population^{73,74}, location in camps⁸², prioritize pro-active vaccination of groups not yet affected by outbreak^{75,76}</p> <p>Safety: injection technique^{65,66}, limit on number vaccinated per day⁵⁸⁻⁶⁰ and training on adverse events^{50,51,58,59,80}</p> <p>Informed consent: obtained for health survey⁸¹</p> <p>Equity: issue of provision of vaccine to all members of a population (unethical to provide to only a subset if all at risk)^{65,76}, including host community⁵³</p> |
| Other | <p>Monitoring: adequate supervision^{50,51}, meetings with partners⁵⁵, program coverage and impact, opportunity to implement and evaluate vaccine use in complex emergency setting despite low risk of outbreak^{41,71}, adverse events^{50,51,77}</p> <p>Social mobilization^{50,51,80}</p> <p>Public perception: vaccination not in lieu of other public health measures⁷⁵, public experience with the pathogen and control measures⁷⁵⁻⁷⁷</p> |

3. Outcomes, barriers faced and lessons learned

Outcomes largely focused on vaccination coverage, with impact assessment being less common, and relatively very few reports of reduction of excess burden of disease, and even fewer reports on the effect of vaccination on transmission parameters.

Benefits of vaccination campaigns included capitalizing on partnerships to improve routine services and capacity of staff, improvement of cold-chain, the potential use of data collected for future interventions and increased social awareness of the disease.

Barriers faced were largely in keeping with the considerations for decision making. Notably, population factors related to defining and accessing the target population, competing health interests, logistic constraints related to insecurity, destruction of infrastructure and maintenance of cold chain, and limitations concerning human resources were the most common barriers to program implementation in an emergency setting. Interestingly, cost factors were not a major barrier and not detailed to any extent. The availability of vaccines and the concept of a stockpile was raised for cholera vaccine specifically⁷⁶ although has not been implemented anywhere yet.

The identification of specific programmatic objectives and targets to be reached was not a common feature in the description of vaccination experiences in emergencies. It would have been beneficial to understand the reasons for when targets were not achieved, or when delays in programme implementation occurred.

The lessons learned highlight the importance of pre-existing health infrastructure, providing essential components of systems, trained staff, and population targets to the success of implementation of a vaccination campaign in an emergency context. A small scaled intervention in a stable, non-mobile and accessible population will encounter fewer barriers to implementation than interventions targeting large mobile populations in the direct aftermath of a disaster.

A multi-sectoral approach, with commitment of all stakeholders and partners is also an essential component of a successful vaccination campaign. Competing interests between clusters and within the public health response should be evaluated with respect to priorities and mortality reduction goals, in order to avoid issues around resource allocation and perceived benefit of vaccination campaigns. The use of modeling exercises to predict vaccine impact, may be of limited value, given the scarcity of data⁷⁶ in the early stages of an emergency.

While the evidence for coordination with other services is underrepresented in this review of literature regarding vaccination in emergencies, combining the efforts of different clusters and maximizing distributions with health interventions may provide cost-effective solutions² for service delivery and maximize participation from the community. The successful implementation of the health cluster strategy after the 2008-2009 Pakistan IDP crisis⁶⁹ provides a good example of how immunization in an emergency context may be implemented.

The WHO decision making tool for the use of OCV in emergencies resulted from experiences after the tsunami in Indonesia and in Darfur⁴¹, and it is clear that the tool developed requires more field testing after its limited applicability during the cholera outbreak in Haiti 2010⁷⁶. Monitoring of campaigns, including rapid evaluations and coverage surveys are valuable tools in determining future campaigns and supplemental immunization activities⁵³.

4. Limitations of this review

There are several limitations to this review. The definition of humanitarian emergency was deliberately chosen to allow a broad sample of emergency settings; however, it is possible that some crises of mixed or uncertain etiologies, especially large scale population displacements may have been missed. In an effort to obtain information regarding how decisions on the use of vaccines in emergencies are made, we decided to include only records which in some way provide justification for or details of the implementation of vaccine interventions. For this reason, many press releases that simply reported the occurrence of a campaign, with no other details were excluded, and hence, this likely resulted in fewer documents being reviewed than there are reports of vaccination in existence. It is expected however, that these documents would have provided little or no information of value to the analysis of decision making.

There is a likely a strong publication bias in the types of documents selected for this review. Approximately half were obtained via bibliographic database search and the rest through hand-search of websites and mainly publically available information. There are very few 'grey literature' sources tapped for this review.

The literature reviewed is also skewed toward experiences in which vaccination was carried out, and the representation of decisions to not vaccinate may be under-represented. This is likely a result of the fact that reports of what is "not done" are not usually published, and if reports are indeed completed by institutions working in the field, this information is internally housed, not publically available. In most cases, it is expected that decision making is simply not recorded in a systematic way that is easily accessible by the organizations working in humanitarian emergencies.

The types of documents retrieved for review do not lend well to analysis. A varied cross section of documentation was reviewed and did not consistently offer similar data for capture. No quantitative analysis was possible, nor was it possible to perform a meta-analysis or statistical evaluation of the findings.

The analysis performed was largely subjective, requiring grouping of information under similar headings, and there could have been both systematic and non-systematic errors in this process.

Part II: Case studies

5. Introduction

During the first SAGE working group meeting of 20-21 September 2011, preliminary findings of the formal literature review showed that the multifaceted and complex contextual, political and epidemiological considerations would not be well captured in the available literature and that in particular the most useful evidence would be found in grey literature, if available, or through the recounting of experiences by organizations who implement such programmes. In order to gain further insight as to how decisions are made regarding vaccination in emergencies, case studies of 5 recent disasters/emergencies was recommended

A simple questionnaire was designed and distributed through informal contacts by the members of the Working Group to contacts that were in the field following the occurrence of the humanitarian emergency to obtain their feedback on the questions. The recent humanitarian emergencies considered were (i) Haiti 2010 Earthquake, (ii) Fiji 2010 Cyclone Tomas, (iii) Thailand 2011 Floods, (iv) Horn of Africa 2010/2011 Drought/Famine, and the recent (v) Pakistan 2010 Floods.

6. Lessons learned from the case studies

Although no major new findings were obtained from these case studies (Table 3), they provided a fascinating insight into the complexities of decision process in a multidimensional event such as a humanitarian emergency where suddenly many actors are brought in a scenario where systems are either weakly functioning or totally wiped out. They also highlighted several instances where clearly inappropriate decisions were undertaken on the basis on local epidemiology or a process that clearly did not benefit from an existing robust decision-making tool or guidelines. While several recent emergencies and crises were evaluated using this standardized method, the working group decided to expand the exercise to include some additional recent experiences.

Some of the salient features from these case studies are as follows:

- Many of the same issues were highlighted in these case studies as in the formal literature review; epidemiology, operational factors, and vaccine availability were most considered when deciding use of vaccines in acute humanitarian emergencies while existing guidance, ethical issues, alternative interventions, competing needs, immunization coverage, and environmental risk factors played a less significant role in the decision making whether to use any particular vaccine

- Formal decision making tools, guidelines or processes were not detailed. Guidelines were rarely if ever consulted.
- All respondents cite epidemiological factors as being considered, but that is not always reflected in the choice of antigens being implemented.
- Programmatic factors, which are more practical in nature are more well described, but as found in the literature review, this is likely because these factors are more important to logistical issues and implementation
- It appears that ethical considerations did not really factor in to decision making and in general it was stated that this was not an issue. This was also the case with competing public health interests, vaccination coverage, and environmental risk factors, such as overcrowding, poor water and sanitation which also did not appear to be major factors in decision making
- Political and contextual/security issues came through as strongly affecting the actual decisions or the ability to make decisions regarding implementation; where there was no central government such as Somalia as the lead decision maker, NGO's failed to reach a consensus regarding choice of vaccines and in some case implemented different vaccines for the same affected population
- The objectives of a vaccination campaign in emergency setting were not always clear.
- The impression is that if there are cases or perceived cases of a particular VPD, and there is vaccine and funding available, then the decision is to vaccinate. Where decision was made not to vaccinate, as in the case of cholera in Thailand and in the Horn of Africa, it is not detailed why the decision was made.
- Implementation during acute phase of the emergency was very difficult to achieve and it appears in these cases that campaigns always ran into post-acute phases of the emergency.
- Formal performance and impact evaluation and monitoring were almost never done.

Table 3a. Vaccine use decision making in acute humanitarian emergencies

| Place/ type of disaster | Target population | Key decision makers | Vaccines considered | Vaccines, use and non-use considerations |
|---|----------------------------------|---------------------|--|---|
| 1. Somalia famine & conflict (affected population: 2.8million in south central Somalia) | Displaced population in Kenya | Government & NGOs | <p>Used:</p> <p>Measles, OPV & DPT</p> <p>Not used:</p> <p>Cholera, TT</p> | <p>a). Epidemiology baseline incidence and recent outbreaks</p> <p>b). Ethics Host communities vaccinated; formal consent not sought; refusals respected</p> <p>c). Institutional context Consensus easier to achieve with government in the lead</p> <p>d). Immunization coverage Coverage and data reliability considered; non-vaccinated new arrivals was a factor</p> <p>e).Existing guidelines No mention of role of guidelines in decision making</p> |
| | Displaced population in Ethiopia | Government & NGOs | <p>Used:</p> <p>Measles & OPV</p> <p>Not used:</p> <p>None</p> | <p>a). Epidemiology baseline incidence and recent outbreaks</p> <p>b). Ethics Host communities vaccinated; formal consent not sought; refusals respected</p> <p>c). Institutional context Consensus easier to achieve with government in the lead</p> <p>d). Immunization coverage Coverage and date reliability considered; non-vaccinated new arrivals was a factor</p> <p>e).Existing guidelines No mention of role of guidelines in decision making</p> |
| | Displaced population in Somalia | Militias & NGOs | <p>Used:</p> <p>Measles & OPV</p> <p>Not used:</p> <p>OPV in areas served by MSF</p> | <p>a). Epidemiology baseline incidence and recent outbreaks; mortality alone not a factor e.g. use of OPV</p> <p>b). Ethics Refusals respected</p> <p>c).Operations & supplies Insecurity including militias expulsions of relief workers (e.g. WHO & UNICEF), murders (e.g. MSF staff), kidnappings and restricted access; mass campaigns forbidden; lack of vaccine supplies</p> <p>d). Institutional context Lack of consensus with NGOs in the lead and lack of clear guidelines (OPV rejected by one of the NGOs)</p> <p>e). Immunization coverage Coverage and data reliability considered; non-vaccinated new arrivals were a factor</p> <p>f). Existing guidelines No mention of role of any guidelines in decision making</p> |
| 2. Haiti earthquake (affected population: 2million) | Internally displaced population | Government & NGOs | <p>Used:</p> <p>Measles, DPT, Td & OPV</p> <p>Not used:</p> <p>None</p> | <p>a). Epidemiology Outbreaks of measles and diphtheria; baseline incidence for diphtheria; Tetanus among trauma cases</p> <p>b).Operations & supplies Available nearly expiring tetanus vaccine influenced use</p> <p>c). Ethics Host communities vaccinated; formal consent not sought</p> <p>d). Alternative interventions/ Competing needs Consensus not to include other vaccines due to competing needs for limited resources</p> <p>e). Institutional context With government in the lead, decisions implemented with differing opinions</p> <p>f). Immunization coverage Coverage was a major consideration</p> <p>f). Existing guidelines SPHERE mentioned but inconclusive guidance regarding criteria for DPT use</p> |

Table 3b. Vaccine use decision making in acute humanitarian emergencies

| Place/ type of disaster | Target population | Key decision makers | Vaccines considered | Vaccine use and non-use considerations |
|---|--|---------------------|---|---|
| 3. Fiji cyclone & flooding (affected population: 0.27million) | Internally displaced population | Government & NGOs | <p>Used:</p> <p>Typhoid</p> <p>Not used:</p> <p>None</p> | <p>a). Epidemiology Past outbreaks in affected areas</p> <p>b).Operations & supplies Limited vaccine supply, campaigns in most affected</p> <p>c). Ethics Verbal consent was sought</p> <p>d). Institutional context Consensus easier to achieve with government in the lead</p> <p>e). Environmental factors Poor water and sanitation situation</p> |
| 4. Pakistan floods (affected population: 20million) | Flood affected population including the internally displaced | Government & NGOs | <p>Used:</p> <p>Measles, OPV, TT, Typhoid, Cholera</p> <p>Not used:</p> <p>Cholera vaccine</p> | <p>a). Epidemiology Past outbreaks in affected areas</p> <p>b).Operations & supplies Limited supply of cholera vaccine</p> <p>c). Ethics Host communities vaccinated; formal consent not sought</p> <p>d). Alternative interventions/ competing needs Water and sanitation interventions for cholera and diarrhoeal diseases; adequate supply of other vaccines implemented - measles and OPV</p> <p>e). Institutional context Consensus easier to achieve with government in the lead</p> <p>f). Vaccination coverage Low coverage was a facto</p> <p>g). Environmental factors Poor water and sanitation situation</p> <p>h).Existing guidelines WHO recommendations was a major consideration for non-use of cholera vaccine</p> |
| 5. Thailand floods (affected population: 12million) | Flood affected population including the internally displaced | Government only | <p>Used:</p> <p>Hib, TT, Measles, Influenza, Rabies & EPI vaccines</p> <p>Not used:</p> <p>Cholera; only as pilot project</p> | <p>a). Epidemiology Incidence of vaccine preventable disease & outbreaks</p> <p>b).Operations & supplies Vaccine supply in case of influenza</p> <p>c). Ethics Verbal consent; on voluntary basis</p> <p>e). Institutional context Government in control, international partners not consulted</p> <p>f). Environmental factors Overcrowding</p> <p>g).Existing guidelines Guidance not consulted</p> |

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