There are children not receiving a single dose of any vaccine: from ‘data to policy’ in immunisation and health systems. Data quality and socio-economic determinants of unvaccination in low- and middle-income countries
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Chapter 1. Introduction and objectives

Health systems

Health related Millennium Development Goals (MDG 4, 5 and 6) will not be achieved in many low- and middle-income countries (LMIC) by 2015 [1]. Current trends show stagnation or draw backs of MDG monitoring indicators despite the existence of effective interventions to reduce childhood mortality, or to improve maternal health, and to reduce the burden of the major diseases affecting the populations living in those countries. Importantly, these trends have not been totally reversed by the increase in financing aid for health in the last two years [2].

Weak health systems have been widely recognised as barriers to the implementation and scaling up of effective interventions [3,4,5]. In order to boost the uptake of effective clinical and public health interventions, several health systems arrangements and strategies have been tried over recent decades. The early emphasis on Primary Health Care [6] in the 1970s and 1980s was followed by health sector reforms, as well as a shift of the focus from more holistic approaches, with prioritisation of the cost-effectiveness of interventions [7]. However, the magnitude of major diseases affecting populations of LMIC, such as malaria, tuberculosis and HIV/AIDS, led to the establishment Global Health Initiatives (GHI) – large partnerships of public, private, multilateral agencies and civil society stakeholders. This was based on the assumption that unifying efforts for a single objective would be a more effective approach. In the immunisation area, The GAVI Alliance (GAVI) was created in the year 2000 with the mission of “saving children’s lives and protecting people’s health by increasing access to immunisation in poor countries” [8].

The growing evidence on the inability of health systems to cope with increasing pressures to deliver services and programmes for specific conditions, and the critics highlighting the vertical nature of GHI operations, among other factors, have led to the concept of health systems strengthening, although there is no agreed definition of the term [9]. This concept was subsequently adopted by GHIs as well. In parallel, health systems and health systems research have increased their space in the research and services domains. Health systems research is becoming a priority [10], and the challenges of carrying out this type of research have been emerging over recent years. For example, the first Global Symposium on Health Systems Research was held in Lausanne (Switzerland) in 2010, and the second in Beijing (China, 2012) [11].

More recently, it has been emphasised that health systems should not only deliver services and programmes, but should also do so in a way that all populations can benefit from them, as well as protecting users and the wider population from the financial risks arising from ill health, in the line of universal coverage [12].

Childhood immunisation

Systematic childhood vaccination is one of the most cost-effective health interventions [7], it is carried out in every country, and has saved millions of lives over decades. The global
immunisation programme was created in 1974 under the form of the Expanded Programme of Immunisation (EPI) and was a part of the holistic and selective PHC concepts. The EPI introduced routine childhood vaccination against six diseases in health services worldwide (tuberculosis, diphtheria, tetanus, whooping cough, poliomyelitis and measles), as well as tetanus vaccination in pregnancy. An immunisation indicator (measles) is used to monitor the achievement of MDG 4, and it has a direct impact on the reduction of childhood mortality. Routine immunisation is probably the oldest, most implanted and most standard health intervention in the world and the best documented over many years, with data available from numerous countries since 1980. For these reasons it is a very suitable theme to examine determinants of utilisation, as well as access of childhood public health interventions.

Despite the steady increase in immunisation coverage over the years [13,14], the stagnation of coverage in the 90s triggered the creation of GAVI in the year 2000 to support immunisation services in countries with a per capita GNI below 1,500 USD [15]. GAVI’s partners include the Bill and Melinda Gates Foundation, the World Health Organisation (WHO), the United Nations Children Fund (UNICEF), the World Bank, development and industrialised countries governments, and industry, civil society and research and technical health institutes [16]. GAVI offers different types of support and plays a critical role in the promotion of under-used and new vaccines. However, GAVI was soon criticised of distorting, or weakening, health systems with its vertical approach to immunisation, and consequently in the year 2004 the GAVI Board approved a support line for countries on health systems strengthening [17]. The ‘Health systems Funding platform’ was created in in order to synergise GHI efforts to improve health systems (GAVI, WHO and the World Bank) [18].

Immunisation remains one of the cornerstones of child health with enormous achievements. Polio, for example, is close to eradication; and the availability of new vaccines, such as pneumococcal and rotavirus vaccines, have raised enormous hopes for further reducing childhood mortality. Immunisation initiatives have been galvanised by several stakeholders, including international agencies and governments, and initiatives such as the most recent ‘Decade of Vaccines’ initiative [19], which maintain immunisation at the top of the international health agenda and at the core of countries child health strategies.

Nevertheless, old and new challenges in formulating policies and strategies to incorporate new vaccines, and financial and logistic constraints, produce major stresses in health systems, which are already weak in many LMIC. Furthermore, coverage rates in countries and regions of the world show that there are major inequities, between and within countries, in accessing immunisation services, with particularly vulnerable groups remaining unvaccinated. In the case of polio vaccine, eradication has been achieved almost worldwide; yet, four countries in the world are still reporting wild poliovirus transmission in 2012 (Afghanistan, Chad, Nigeria and Pakistan) [20]. Vaccination against major killers, such as pneumonia and rotavirus, is still in the phase of scaling up in most LMIC, despite having been introduced at the same time as in many high-income countries. Strategies to overcome inequitable access to vaccination have been designed and implemented (e.g. Reaching Each District, RED [21]), but hard to reach populations still remain inaccessible due to geographic, financial and cultural barriers.
Equity in accessing vaccination services

The causes which can explain why there are still children unreached by vaccination are only partially understood. Several reasons can illustrate this fact, for example: global or even regional increases in coverage mask inequities between and within countries; administrative reporting systems from services cannot capture those children who precisely do not attend vaccination sessions; hard to reach populations are also hard to assess [22]. Immunisation programme performance is routinely monitored using mainly the third dose of diphtheria-tetanus-pertussis vaccine (DTP3), but it is much more difficult to document the number of children who have received not even a single dose of any vaccine, and these are those most at risk. This ‘last mile’ quantifying the numbers of children not receiving vaccinations is more difficult to achieve. Even when there is evidence on inequities, it is a long way to translate this evidence into actionable policies. This relates to challenges in generating and translating evidence into guidance in order to inform policies, and the difficulties of formulating health policies in complex systems, as is often the case in fragile states, with budgetary constraints and competing interests [23].

The Strategic Advisory Group of Experts (SAGE) is a group of worldwide immunisation experts [24] having an advisory role to WHO on global immunisation policies. The group meets in Geneva (Switzerland) twice a year. Cognisant of the existing inequities in immunisation, SAGE called for the production of more systematic and global evidence to describe the problem of unvaccination and to assess the socio-economic and gender-related determinants of unvaccinated children. This is needed in order to inform specific decisions, as well as global and national policies. These demands were channelled through the Immunisation, Vaccines and Biologicals (IVB) and the Initiative for Vaccines Research (IVR) of the WHO, respectively. Studies were carried out by a team led by the candidate over the last few years, at the Swiss Tropical and Public Health Institute (Basel, Switzerland).

Aims and objectives

The overall aim of this dissertation is to bridge the evidence to policy gap in order to inform national and global immunisation policies on the status and determinants of unvaccinated children; i.e. those children not having received a single dose of routine vaccinations.

The objectives are:

1. To develop an algorithm and software to harmonise data for analyses of different designs of national representative household surveys.
2. To compare the quality of individual subjects vaccination data from household surveys with data from vaccination administrative monitoring.
3. To describe socio-demographic and gender-related determinants of unvaccination in children.
4. To assess the evidence base of immunisation related to health system strengthening in funding proposals.

These objectives were fulfilled by a series of analyses reported in the articles included in this dissertation. The first objective addresses the methodological challenge of harmonising large
numbers of datasets with different formats used in the analyses. The second objective refers to the types and quality of immunisation data from different sources. For the third objective, the analyses of determinants of unvaccination are presented. The fourth objective addresses the use of data and other evidence to inform policies.

In many LMIC, national-representative household surveys are conducted to produce estimates of demographic and health indicators. More than 200 surveys in around 100 countries have been included in these analyses. Databases of these surveys with individual subjects data are available and downloadable from different sites. The first challenge was to harmonise the structure, format and contents of the databases and variables of this large number of surveys. This was done by developing and algorithm to harmonise the names and values of the variables used (described in Chapter 2).

Surveys are not the only source to assess immunisation indicators. Administrative service data generated at immunisation delivery sites is recorded, aggregated and sent to the central levels of the health systems in most countries. However, discrepancies between administrative and surveys data have been reported. In Chapter 3 we describe the quality of administrative immunisation data based on Data Quality Audits (DQA) conducted in 41 countries. The candidate carried out himself the field work in four DQAs (Angola, Democratic People’s Republic of Korea, Nigeria and Zambia). In Chapter 4 an analysis of these discrepancies is presented, challenging the assumption that survey data are the gold standard. Chapters 4 and 5 describe the determinants of unvaccination based on the analyses of national representative household surveys. These two studies were commissioned by the SAGE. The analyses were based on logistic regression techniques, as described in detail in the chapters, applied to a large number of datasets from LMIC, which were previously harmonised using the algorithms described in Chapter 2. These analyses described socio-economic (Chapter 5) and gender-related (Chapter 6) determinants of unvaccination.

Finally, we conducted a desk review of all 44 countries proposals for health systems strengthening related to immunisation services submitted to GAVI. We described what types of requests for funding were included in these proposals, and the use of existing evidence to support those requests.
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