

The Israel National Immunization Registry

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ABSTRACT: Immunization coverage is a major health indicator. In Israel, routine childhood immunizations are provided at community public well-baby clinics. Immunization monitoring is an important cornerstone of a national health policy; however, data obtained through sampling carries the risk of underrepresentation of certain population strata, particularly high risk groups. Despite high national average immunization coverage, specific subpopulations are under-immunized, as highlighted by outbreaks of vaccine-preventable diseases. The mean national immunization coverage at age 2 years (2006 data) was: DTaP-IPV-Hib4 (all 93%), HBV3 (96%), MMR1 (94%), HAV1 (90%). These reports are based on a 17% population-based sample in some districts and on cumulative reports in others. A national immunization registry requires data completeness, protection of confidentiality, compulsory reporting by providers, and links to other computerized health records. It should provide individual immunization data from infancy to adulthood and be accessible to both providers and consumers. In 2008 the Israel Ministry of Health launched a national immunization registry based on immunization reporting from well-baby clinics using a web-based computerized system. As of January 2010, 120 well-baby clinics are connected to the nascent registry, which includes the records of some 50,000 children. The implementation of a comprehensive national immunization registry augurs well for the prospect of evidence-based assessment of the health status of children in Israel.

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measure of the susceptibility to vaccine-preventable diseases and also indicates the level of protection in a defined population [1–6]. Childhood immunization coverage is defined by the World Health Organization and the United Nations Children's Fund as a comparable indicator reflecting the state of health of children worldwide [7,8]. High quality data are essential to improve immunization coverage and accurately monitor progress towards Millennium Development Goal 4 – namely, a reduction in child mortality [9].

Passwell and Spierer [10] stated that successful immunization programs are the most efficient, cost-effective means to prevent infectious diseases and are therefore a major component of quality health care in Israel and worldwide. Monitoring immunization coverage is an important part of public health surveillance. Moreover, evaluation of immunization coverage enables international comparisons with the goals set by the WHO towards the control, elimination and eradication of communicable diseases [11,12].

GOALS AND DEFINITIONS OF IMMUNIZATION COVERAGE MONITORING

Immunization coverage is defined as the proportion of immunized children in a defined area of the total candidate population of children who constitute the target population. The population definition may change according to the objectives and purposes of the evaluation [13–15]. The target population may be retrieved from databases such as: a) the official demographic registry of live births, b) the population of infants aged 12 months, c) the population of children registered in the national health insurance files or databases of health insurers and/or providers, d) the population of children registered as residents in a defined area, or e) the population of children who are registered or who applied for registration in educational facilities.

The risk approach to estimating immunization coverage is aimed at detecting low coverage in specific geographic areas and population subgroups, thereby enabling further investigation of possible causative factors for under-immunization. Such causes may be related to processes and determinants of the health ser-

The prevention and control of vaccine-preventable communicable infectious diseases is a cornerstone of primary prevention in public health. Immunization coverage is considered a major health indicator because it is a sensitive

DTaP = diphtheria-tetanus-acellular pertussis

IPV = inactivated polio vaccine

Hib = *Haemophilus influenzae* b

HBV = hepatitis B virus

MMR = measles-mumps-rubella

HAV = hepatitis B virus

WHO = World Health Organization

vices structure (accessibility, convenience) or to the special characteristics of the subgroups, including beliefs and perceptions affecting compliance with immunizations [16]. Identification of under-immunized populations and the causative factors enables the planning of action to improve utilization of health services based on principles of health promotion, improved outreach activities within the communities, use of various educational and information tools, and allocation of personnel and designated financial resources [17,18]. In a recent Israel Medical Association national survey of parental attitudes and compliance with routine childhood vaccinations, 90% of parents stated that they vaccinate their children and 87% trust doctors' vaccination recommendations [19]. The missing 10% should be the area of concern.

At an individual level, assessment of immunization coverage can provide updated information on a person's immunization scheduling, vaccine indications and contraindications, and side effects and adverse events. These data should be incorporated in the personal medical file. Individual immunization monitoring also facilitates appointment scheduling, and provides information for health care professionals and parents.

Immunization coverage data are drawn from routine administrative reporting by countries, through health management information systems and specific surveys, to produce estimates of national coverage of selected vaccines. These data are processed and used by the WHO, UNICEF, GAVI (the Global Alliance for Vaccines and Immunization), governments, and other immunization stakeholders. There is, however, evidence from various reports and studies demonstrating the lack of accuracy in immunization coverage estimates [20,21]. Furthermore, global, regional and national figures mask inequities of access to immunization within specific groups, for example, socioeconomically deprived or minority groups.

METHODS OF MEASURING IMMUNIZATION COVERAGE WORLDWIDE

The methods of measuring immunization coverage differ, based on the sources of information and the surveillance methodologies [4,17,22]. Surveys based on sampling of households have been developed by the WHO. The most useful is the Demographic and Health Survey which is used in developing countries and in some developed countries [23].

Immunization coverage is a major health indicator reflecting the level of protection against vaccine-preventable diseases in a defined population

Most developed countries use cumulative administrative data based on health care providers' reports. Full-reporting is usually based on a national computerized database that includes all children in a certain country (registry based). Alternatively, sample-based reports are used by governmental agencies through periodic, random and statistically representative samples. Many western countries perform periodic sample-based immunization coverage surveys. Registries exist in Australia, the United

Kingdom and several Canadian provinces [13,24,25]. In the United States, a combination of regional immunization information systems and a national sample-based immunization

survey is used [26-28]. The Netherlands, Norway, Portugal and Sweden also maintain national registries; Spain combines regional and national sample-based data [29]. France utilizes a provider-based reporting system [30] [Table 1].

Statistical analysis of the data includes descriptive epidemiologic analysis of immunization coverage and trends with respect to time, place, population groups, schedules, and types of vaccines. It involves various comparisons using epidemiologic analysis, looking for immunization under-coverage, and variables and factors that might be associated with disparities.

IMMUNIZATION COVERAGE MONITORING IN ISRAEL

In Israel, the universal immunization program for the routine administration of childhood immunization is provided in public well-baby clinics across the country. The program includes vaccines against diphtheria, pertussis, tetanus, poliomyelitis, *Haemophilus influenzae* type b, measles, mumps, rubella, varicella, hepatitis B and hepatitis A. Booster doses are provided via the school health services.

Pneumococcal conjugate vaccine was introduced in July 2009. The introduction of the rotavirus vaccine is planned for 2010 and of human papilloma virus vaccine for 2011. These vaccines are currently available through health care providers. Influenza vaccination in childhood is recommended and is also available through health care providers. The immunization program in Israel, based on recommendations from the Ministry of Health advisory committee on immunization, is presented in Table 2 [33].

Immunization coverage information is provided by the well-baby clinics to the subdistrict and district health offices in the country. A national report is subsequently issued and the coverage data are reported to the international agencies.

During the years 2000–2008 there was an annual average of 145,000 live births in Israel. The average national immu-

UNICEF = United Nations Children Fund

Table 1. Methods of monitoring immunization coverage in 11 developed countries

Country	IC registry	IC survey	IC monitoring system	Population	Ref.
Australia	National, computerized	–	Australian Childhood Immunization Register (ACIR)	Covered by Medicare, 0–17 yrs	[13]
Canada	Provincial/territorial, computerized	National Immunization Coverage Survey	National Immunization Strategy (NIS)	Covered by mandatory health insurance, 0–18 yrs	[25]
France	National, manual	National	Carnet de santé/Carnet des vaccinations Health Certificates. Institute de Veille Sanitaire (InVS)	Reported by doctor as vaccinated, 24 mos	[29,30]
Germany	–	National, annual	German Health Interview examination Survey (KiGGS)	Representative sample, 2–17 yrs	[29]
Netherlands	National, computerized	–	National Immunization Program (NIP)	Population-based registry, all ages	[29]
Norway	National, computerized	–	Norwegian National Immunization Registry (SYSVAC)	Population-based registry, recorded from first vaccination, all ages	[29,31]
Portugal	Local/nationally linked, computerized	–	National Health Information system	Population-based, attending local public health centers	[29]
Spain	Local	National	Administrative	0–18 yrs	[29]
Sweden	National, computerized	Annual National Survey, 24–35 mos, at school	National Surveillance Register, SmiNet	Children registered at Child Health Care Centers	
Taiwan	National, computerized	–	National Immunization Information System (NIIS)	Covered by National Health Insurance	[32]
United Kingdom	National, computerized	National	Cover of Vaccination Evaluated Rapidly (COVER)	Registered with GP, 0–18 yrs	[24,29]
United States	State/City, computerized	National Immunization Survey	Immunization Information System (IIS)	0–6 yrs	[27,28]

IC = immunization coverage

Table 2. Routine immunization schedule for infants and children, Israel, 2009

	First year					Second year		Third year	School		
	Birth	1 mo	2 mos	4 mos	6 mos	12 mos	18 mos	24–30 mos	6 yrs (1st grade)	7 yrs (2nd grade)	13 yrs (8th grade)
Hepatitis B	HBV	HBV			HBV						
Inactivated poliovirus			IPV	IPV	IPV	IPV				IPV	
Diphtheria-tetanus-acellular pertussis			DTaP	DTaP	DTaP	DTaP				dTap	*dTap
<i>Haemophilus influenzae b</i>			Hib	Hib	Hib	Hib					
Pneumococcal conjugate			PCV7	PCV7		PCV7					
Measles-mumps-rubella						MMR			MMR		
Varicella						Var			Var		
Hepatitis A							HAV1	HAV2			

*Children who have not received a booster dose of DTaP since the age of 7 years

HBV = hepatitis B vaccine, IPV = inactivated polio vaccine, DTaP = diphtheria-tetanus-acellular pertussis vaccine for use in children, dTap = diphtheria-tetanus-acellular pertussis vaccine for use as booster in children and adults, Hib = *Haemophilus influenzae b* vaccine, PCV7 = Pneumococcal conjugate vaccine, MMR = measles-mumps-rubella vaccine, Var = varicella vaccine, HAV = hepatitis A vaccine

nization coverage at age 2 years in 2006 (the most recent available data) was: DTaP-IPV-Hib4 (all 93%), HBV3 (96%), MMR1 (94%), and HAV1 (90%) [34]. Reporting is dependent on a 17% population-based sample in some districts and on cumulative reports in others. Notably, children who are not registered in the well-baby clinics are not included in the reports. Despite a high national average coverage, specific subpopulations are under-immunized and under-

reported, as highlighted by recent outbreaks of vaccine-preventable diseases such as measles [35]. Sampling carries the risk of under-representation of some population strata, particularly high risk groups. Comparison of coverage rates among districts and aggregation of districts' estimates for national reporting are hindered by differences in coverage assessment methods and the absence of regular and consistent data collection.

A national registry of immunization coverage in Israel was designed to:

- Compare the demographic database with the immunization coverage database and identify populations across Israel with low immunization coverage and inadequate utilization of preventive well-baby services. This will facilitate investigation of causative factors and planning of appropriate public health intervention programs.
- Provide information on age cohorts (annually cross-sectional at age 1, 2, 3 years and in the first, second and eighth school grades) and populations, vaccine-specific coverage, and up-to-date or on-time immunization.
- Monitor national immunization coverage trends over time, thus contributing to the evaluation of programs and progress towards the achievement of targets.
- Facilitate sharing of immunization information among districts, while enhancing the reporting capabilities of immunization registries or other information systems.
- Lay the groundwork for the eventual development of a comprehensive immunization registry network covering the entire population – pediatric and adult, which is a key objective of the National Immunization Strategy.
- Be part of the national computerized health records initiative.
- Provide individual-based immunization data from infancy to adulthood to providers, health care professionals and consumers.
- The national immunization registry requires data completeness, protection of confidentiality, compulsory reporting by health service providers, and links to other computerized records.

In 2008 the Ministry of Health in Israel launched a national computerized web-based immunization registry based on reporting from well-baby clinics

of 1 January 2010, all well-baby services are provided free of charge. Previously, a copayment fee was employed, although impecunious families were exempted from paying.

The immunization program in the computerized system includes details of the vaccines used in Israel (generic and trade names, batch numbers) held in an enterprise resource planning-based system (System Analysis and Program Development, Walldorf, Germany), and those data are automatically imported into the register. This again avoids errors in data entry. The program is updated in accordance with the Ministry of

Health immunization schedule. Extremely stringent precautions and safeguards to ensure data protection are *sine quibus non* in the system.

As of January 2010, over 120 Ministry of Health well-baby clinics report online. To date, the system holds records of some 50,000 children. The aim is to eventually connect all health services in Israel that provide immunizations, thereby enabling health providers and consumers to access individualized, up-to-date information on the immunization status of every person at any age and in any medical facility.

In the future, the Ministry of Health will be able to obtain invaluable data and reports concerning various immunizations on a variety of population cross-sections (age, socioeconomic groups, geographic area, etc.), which will expedite planning and interventions as needed.

Policy makers are becoming more aware of the importance of preventive health programs in general and immunizations in particular. In July 2009, during the term of the 18th Knesset (Israeli parliament), a significant amendment was introduced to Para 66 of The Public Health Ordinance (1940), specifying that the Minister of Health is to establish a national immunization registry [36]. Individual data on immunization status may be used to create an incentive program involving Child Endowment Allowances [37].

The implementation of the national immunization registry has been greeted with enthusiasm by the staff of the well-baby clinics. It has been found to be user-friendly and informative. This important step towards improving vaccination coverage augurs well for the future of public health data collection and analysis in Israel.

THE ISRAEL NATIONAL IMMUNIZATION REGISTRY

In September 2008 the trial of a computerized national childhood immunization registry (known by the Hebrew acronym "Raheli" – *Rishum Hisunim Leumi Yisrael*) was implemented as a pilot project in seven Ministry of Health well-baby clinics (one in each district). The system is based on registering each child individually during the initial clinic visit, using entries extracted from the national population demographic database of the Ministry of the Interior. The link to the Ministry of the Interior database ensures unique automatic identification of the child, thereby preventing database entry errors. In the event that a child is not registered in the Ministry of the Interior database (e.g., children of foreign workers and tourists), passport numbers or serial numbers can be used. Every child residing in Israel is entitled to receive health services in the public well-baby clinics, regardless of the legal civil status of the family. As

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“When you get to the end of your rope, tie a knot and hang on”

Franklin D. Roosevelt (1882-1945), 32nd President of the United States and a central figure in world events during the mid-20th century, leading the U.S. during a time of global economic crisis and world war. Known by his initials, FDR took office in the depths of the Great Depression. His combination of optimism and economic activism is often credited with keeping the country's economic crisis from developing into a political crisis. He named his approach to the economic situation the New Deal.

“In the end, we will remember not the words of our enemies, but the silence of our friends”

Martin Luther King Jr. (1929-1968), American clergyman, activist and prominent leader in the African American civil rights movement. It was during the 1963 March on Washington that King delivered his “I Have a Dream” speech. There, he raised public consciousness of the civil rights movement and established himself as one of the greatest orators in U.S. history. In 1964, King became the youngest laureate of the Nobel Peace Prize, which he received for his work to end racial segregation and discrimination through civil disobedience and other non-violent means. He has become a human rights icon.