EPI Newsletter

Expanded Program on Immunization in the Americas

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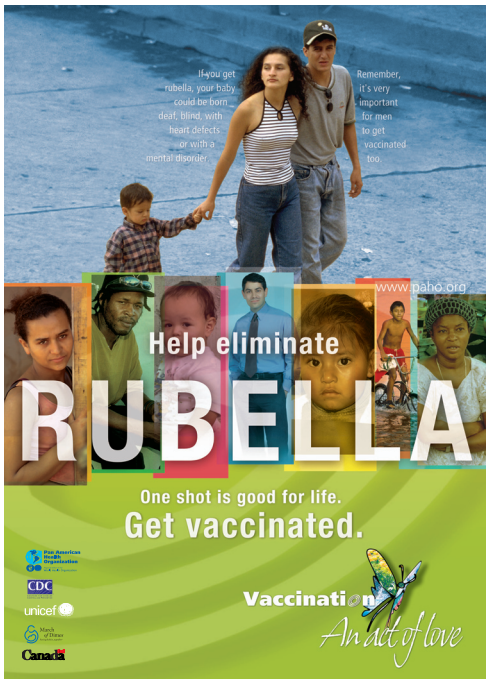
Rubella and Congenital Rubella Syndrome Elimination in the Americas: The Beginning of the End

Rubella is a febrile rash illness sometimes considered as a mild disease; however it has devastating consequences when contracted by a woman in the early stages of her pregnancy. Infection during pregnancy can result in miscarriage, stillbirth, and serious birth defects such as deafness, blindness, and congenital cardiopathy, together known as congenital rubella syndrome (CRS).



Rubella virus circulation in the Americas has been documented through data from the epidemiological surveillance system. Rubella outbreak investigations have identified CRS cases. It has been estimated that before vaccine introduction into national immunization schedules, more than 20,000 children were born with CRS in the Region each year.

Direct and indirect costs of CRS are very high due to the need for specialized diagnostic procedures and treatment, as well as the chronic nature and severity of its symptoms. Studies conducted in the Americas have determined that the cost of care for a child with CRS is US $50,000 to $63,900 throughout the child's lifespan. This does not account for indirect and social costs.[2] Elimination of rubella and CRS has shown to be cost-effective.

Progress to date

To date, 72% of countries in the Region have large cohorts of protected adults through implementation of different strategies. On the other hand, countries such as Canada, Cuba, Panama, the United States, and Uruguay introduced the rubella vaccine into their childhood immunization schedules more than 30 years ago.

From 1998 to 2004, the English-speaking Caribbean, Costa Rica, Ecuador, El Salvador, and Honduras have conducted mass vaccination campaigns in adult men and women to quickly interrupt rubella virus transmission and prevent CRS. Similarly, between 1999 and 2002, Brazil and Chile implemented strategies for CRS prevention, and mass vaccinated only women of childbearing age. Campaign coverage reached over 95% in several countries.

Bolivia, Colombia, and Peru have programmed a joined campaign in the Andean Sub-Region for September 2005. Other countries in the Region have also planned to conduct rubella vaccination campaigns in men and women between 2005 and 2006 as shown in Figure 1.

Given the complexity of adult vaccination and the lessons learned during the campaigns recently conducted in countries of the Region, PAHO's Immunization Unit (IM) is programming two workshops on rubella and CRS elimination. One will be held in Bogotá, Colombia, from 2-6 May 2005 and the other in Santa Cruz, Bolivia, from 12-16 May 2005.

Following vaccine introduction and implementation of vaccination campaigns, rubella incidence decreased by 99.5%, from 135,000 reported cases in 1998 to 1,652 cases in 2004. Indicators of integrated measles/rubella surveillance are >80%. At this stage of the elimination initiative in the

In this issue:

Figure 1. Planned Immunization Campaigns for Rubella and CRS Elimination, by Country and by Year

Source: Country Reports as of 27 February 2005

Americas, two new indicators have been proposed to monitor surveillance quality: proportion of transmission chains with representative samples for virus isolation and proportion of cases with adequate investigation.*

The number of countries/territories in the Americas reporting CRS cases has increased from 18 (13%) in 1998 to 100% in 2003. However, CRS surveillance is still not complete. Argentina, Brazil, Costa Rica, El Salvador, and Peru have conducted retrospective studies in children and obstetrics hospitals, schools for the death and blind, and the community to identify children with probable or confirmed CRS. In other countries, like Peru, research is being conducted jointly with the World Health Organization. The goal of these studies is to identify ways to improve CRS surveillance and detect suspected cases at the primary care level, while involving specialists. Later this year, IM will convene an ad-hoc meeting of experts from different countries of the Region to determine lessons learned, define good public health practices for establishing CRS surveillance, and help with refining strategies for surveillance and case detection.

High quality CRS surveillance is essential for the detection of birth defects in infants. It also contributes to the strengthening of integrated perinatal care and promotes consultations for congenital infections and newborns at risk and a more thorough check-up of healthy children.

Currently, few specimens are processed for viral isolation and molecular typing, which could help us determine the source of infection and rubella virus variations. Phylogenetic studies of rubella viruses have shown two virus clades (formerly called genotypes) and 7 genotypes. In the Americas, the 1C rubella virus has been identified as endemic.** Clade 2 viruses have not been found circulating in the Region; thus, if clade 2 viruses were to be isolated, they would be considered importations. In order to improve the viral isolation technique, IM, FIOCRUZ in Brazil, and the US Centers for Disease Control and Prevention (CDC) will hold a workshop on this technique at the FIOCRUZ laboratory in Rio de Janeiro from 4-8 April 2005. Also, to increase timeliness and facilitate laboratory diagnosis, Peru, PAHO/WHO, and CDC are conducting a study for rubella diagnosis using filter paper and oral fluids.

Implementing the rubella elimination strategy greatly contributes to the reduction of inequities in maternal health outcomes,[3] strengthens the political commitment for immunization services, and promotes the culture of prevention. In addition to CRS prevention, women's health care can be further improved by the strengthening of adult health services, staff education, improvements in epidemiological surveillance, decentralization of decision-making, boost in program management, enhanced health awareness, and community participation that result from the implementation of the strategy.[4]

Besides being technically sound, PAHO's rubella elimination strategy is backed by political will, financial sustainability, social acceptance, and feasibility. The support and involvement of the Inter-agency Coordinating Committee within each country will be critical for sustaining commitment and galvanizing necessary resources to achieve the goal.

* See Table on page 4 of this issue.

**Molecular Epidemiology of Rubella. Presented by Dr. J. Icenogle, Team Leader, Rubella Virus Laboratory, Centers for Disease Control and Prevention, at the Measles/Rubella Laboratory Meeting during the Technical Advisory Group Meeting in Mexico City, November 2004.

Main Strategies for Rubella and CRS Elimination in the Americas

In September 2003, the 44th Directing Council of the Pan American Health Organization adopted a resolution to eliminate rubella and CRS by 2010. The elimination of rubella and CRS in the Americas has been defined as the successful interruption of endemic transmission of rubella virus in all countries of the Region without the occurrence of CRS cases associated with endemic transmission.

The main strategies for rubella and CRS elimination in the Americas, based on knowledge acquired about the disease, the vaccine, and rubella control experiences, are as follows:

- Introducing the rubella vaccine in routine immunization schedules and reaching >95% vaccination coverage in the target population in each municipality;
- Implementing a one-time mass vaccination campaign of men and women in all countries with endemic transmission. This strategy reduces significantly the time to interrupt rubella virus circulation and rapidly prevents the occurrence of CRS;
- Continuing the use of the measles-rubella vaccine in *follow-up* campaigns for measles elimination;
- Integrating rubella surveillance to the epidemiological surveillance system used for measles elimination, immediately investigating cases, and rapidly implementing response measures;
- Implementing CRS surveillance implementation before rubella vaccine introduction, which will provide base information to document impact of immunization programs;
- Strengthening laboratory diagnosis of rubella and CRS and virus isolation in all countries of the Region; and
- Disseminating information for action at all levels of the health system.

References:

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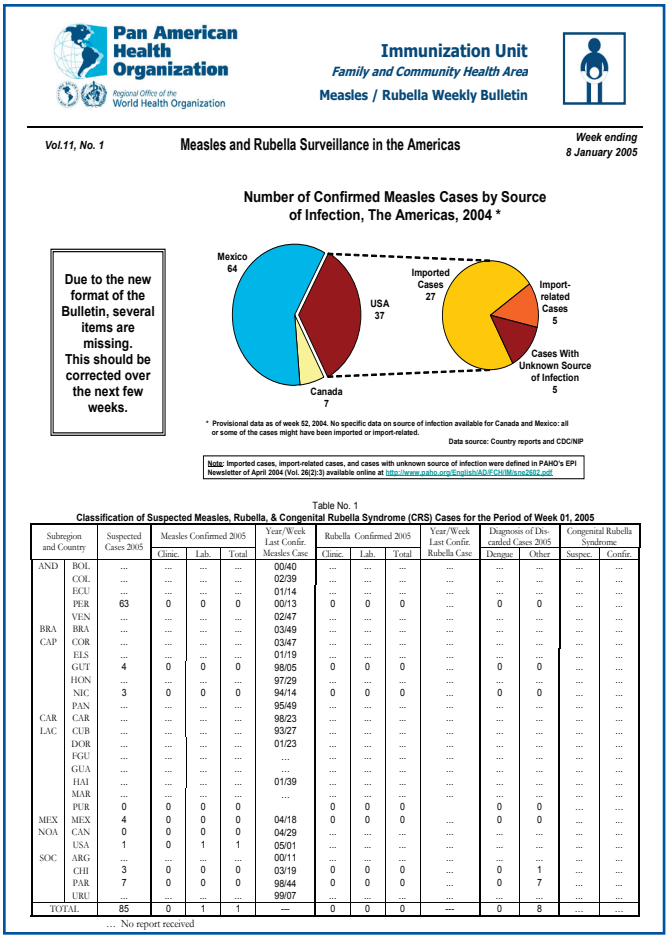
4. Castillo-Solórzano C, Andrus JK. Rubella Elimination and Improving Health Care for Women. *Emerging Infectious Diseases* 2004; 10(11):2017-21.

Measles/Rubella Weekly Bulletin: New Format



Pan American Health Organization
Regional Office of the World Health Organization

Immunization Unit
Family and Community Health Area
Measles / Rubella Weekly Bulletin

Vol.11, No. 1 — Measles and Rubella Surveillance in the Americas — *Week ending 8 January 2005*

Number of Confirmed Measles Cases by Source of Infection, The Americas, 2004 *

Due to the new format of the Bulletin, several items are missing. This should be corrected over the next few weeks.

* Provisional data as of week 52, 2004. No specific data on source of infection available for Canada and Mexico: all or some of the cases might have been imported or import-related.

Data source: Country reports and CDC/NIP

Note: Imported cases, import-related cases, and cases with unknown source of infection were defined in PAHO's EPI Newsletter of April 2004 (Vol. 26(2):3) available online at http://www.paho.org/English/AD/FCH/IM/sne2602.pdf

Table No. 1
Classification of Suspected Measles, Rubella, & Congenital Rubella Syndrome (CRS) Cases for the Period of Week 01, 2005

Subregion	and Country	Suspected Cases 2005	Measles Confirmed 2005			Year/Week Last Confir.	Rubella Confirmed 2005			Year/Week Last Confir.	Diagnosis of Discarded Cases 2005		Congenital Rubella Syndrome	
			Clinic.	Lab.	Total	Measles Case	Clinic.	Lab.	Total	Rubella Case	Dengue	Other	Suspec.	Confir.
AND	BOL	...	...	...	...	00/40	...	...	...	...	...	...	...	...
	COL	...	...	...	...	02/39	...	...	...	...	...	...	...	...
	ECU	...	...	...	...	01/14	...	...	...	...	...	...	...	...
	PER	63	0	0	0	00/13	0	0	0	...	0	0	...	...
	VEN	...	...	...	...	02/47	...	...	...	...	...	...	...	...
BRA	BRA	...	...	...	...	03/49	...	...	...	...	...	...	...	...
CAP	COR	...	...	...	...	03/47	...	...	...	...	...	...	...	...
	ELS	...	...	...	...	01/19	...	...	...	...	...	...	...	...
	GUT	4	0	0	0	98/05	0	0	0	...	0	0	...	...
	HON	...	...	...	...	97/29	...	...	...	...	...	...	...	...
	NIC	3	0	0	0	94/14	0	0	0	...	0	0	...	...
	PAN	...	...	...	...	95/49	...	...	...	...	...	...	...	...
CAR	CAR	...	...	...	...	98/23	...	...	...	...	...	...	...	...
LAC	CUB	...	...	...	...	93/27	...	...	...	...	...	...	...	...
	DOR	...	...	...	...	01/23	...	...	...	...	...	...	...	...
	FGU	...	...	...	...	...	...	...	...	...	...	...	...	...
	GUA	...	...	...	...	...	...	...	...	...	...	...	...	...
	HAI	...	...	...	...	01/39	...	...	...	...	...	...	...	...
	MAR	...	...	...	...	...	...	...	...	...	...	...	...	...
	PUR	0	0	0	0		0	0	0		0	0	...	...
MEX	MEX	4	0	0	0	04/18	0	0	0	...	0	0	...	...
NOA	CAN	0	0	0	0	04/29	...	...	...	...	...	...	...	...
	USA	1	0	1	1	05/01	...	...	...	...	...	...	...	...
SOC	ARG	...	...	...	...	00/11	...	...	...	...	...	...	...	...
	CHI	3	0	0	0	03/19	0	0	0	...	0	1	...	...
	PAR	7	0	0	0	98/44	0	0	0	...	0	7	...	...
	URU	...	...	...	...	99/07	...	...	...	...	...	...	...	...
TOTAL		85	0	1	1	---	0	0	0	---	0	8	...	...

... No report received

Since the first epidemiological week of 2005, the Measles/Rubella Weekly Bulletin published by the Immunization Unit (IM) of the Pan American Health Organization (PAHO) has displayed a new format. This new format reflects PAHO's efforts to strengthen the integrated epidemiological surveillance of measles and rubella in order to sustain the interruption of indigenous measles transmission and to achieve rubella and congenital rubella syndrome (CRS) elimination in the Region. These changes reflect the recommendations given by the Technical Advisory Group after their last meeting in Mexico City in November 2004[1].

One of IM's specific program strategies is to strengthen the information system. As part of these efforts, IM is spearheading the development of a new Integrated Surveillance Information System (ISIS), a flexible and user-friendly software for surveillance and evaluation of immunization programs in the Region of the Americas. As a first step, ISIS will replace the existing DOS-based Measles Elimination Surveillance System (MESS) and will include the new variables shown in the updated Measles/Rubella Weekly Bulletin.

The table on the following page summarizes the main changes in the Measles/Rubella Weekly Bulletin for 2005.

[1] EPI Newsletter: *XVI Meeting of the PAHO Technical Advisory Group on Vaccine-preventables Diseases: Conclusions and Recommendations*. December 2004,Vol.XXVI (6) available at http://www.paho.org/english/ad/fch/im/Epi_newsletter.htm.

Changes to the Measles/Rubella Weekly Bulletin

Table 1 Changes: Classification of Suspected Measles, Rubella & Congenital Rubella Syndrome (CRS) Cases	
Rubella	A column displaying the date of the last confirmed rubella case has been added, as it is already done for measles.
Surveillance of Congenital Rubella Syndrome (CRS)[1]	**Suspected CRS Case**: Any infant aged <1 year in whom a health care worker at any level of the health care system suspects CRS. CRS is usually suspected in an infant: (1) when he or she presents one or more of the following conditions: congenital cataract, congenital heart defect, purpura or deafness; or (2) if the mother had confirmed or suspected rubella infection during pregnancy. **Confirmed CRS Case:** A suspected CRS case confirmed by laboratory, ELISA IgM testing, or viral isolation.
Table 2 Changes: Infection Source of Measles and Rubella Confirmed Cases	
Classification of **confirmed measles and rubella cases** by source of infection	**Imported Case:** A case exposed outside of the Western hemisphere during the 7-21 days prior to rash onset for measles and 14 - 23 days prior for rubella, as supported by epidemiological and/or virologic evidence. **Import-related Case:** A locally-acquired infection occurring as part of a chain of transmission originated by an imported case as supported by epidemiologic and/or virologic evidence. **Case with Unknown Source of Infection:** A case where the infection source has not been identified after a thorough investigation. Such a case should not be classified as imported or import-related.
Table 4 Changes: Indicators of Integrated Measles/Rubella Surveillance	
Number of active municipalities replaced by **Proportion of transmission chains with representative samples for virus isolation** from confirmed measles and rubella cases	Countries are asked to report each week the number of measles and rubella transmission chains, defined as two or more cases with epidemiological link. In order to ensure at least one viral isolate, samples for viral isolation[2] are considered representative when collected from the first 5–10 suspected cases of each transmission chain. If the transmission chain continues in time, additional samples collected at 2-3 months intervals and toward the end of the outbreak are also considered representative. Attempts to obtain samples for viral isolation from sporadic cases should also be made, although such indicator has not been adopted yet.
A new surveillance indicator, **Proportion of cases with adequate investigation**, will replace the indicator of timely home visit	The new indicator consists of 3 components: 1) Home visit within 48 hours following case notification. 2) Completeness relevant data. The notification file should include at least: date of reporting, date of investigation, date of rash onset, date of blood sample collection, type of rash, presence of fever, date of the last measles/rubella vaccines. 3) Active case search following report of a measles/rubella case. An active case search is defined as the field investigation made by public health officials in order to detect suspected cases that were not reported. The search is done following one or more of these strategies: • Door-to-door in the community: An active search in the community is considered appropriate if at least an investigation similar to a rapid coverage survey is conducted in the neighborhood where the case resided during his or her period of communicability. • Medical chart review in health units and hospitals for at least 30 days prior to rash onset of the case. • Visits to institutions such as schools, workplaces, and penitentiary facilities.

[1] The definition to be used for CRS surveillance and clinical diagnosis may be different. For clinical diagnosis, a more specific definition may be more appropriate, with laboratory confirmation remaining the gold standard.

[2] A nasopharyngeal swab is preferred for both measles and rubella virus isolation; urine samples are an acceptable alternative for measles. Specimens for viral isolation/detection should always be collected on first contact with a patient.

Annual Immunization Data Collection in the Americas: PAHO EPI Tables Meet the WHO/UNICEF Joint Reporting Form

The collection of immunization indicators has been instrumental in developing control and elimination strategies for vaccine-preventable diseases in the Americas and monitoring their progress. This has allowed the Western Hemisphere to be the first WHO Region to be certified polio-free, the first to have interrupted the endemic transmission of measles, and the first to be pursuing the goal of rubella and congenital rubella syndrome elimination.

Background

Since the 1980's, the Immunization Unit of the Pan American Health Organization (PAHO) collects data on immunization indicators and vaccine-preventable diseases. Originally, a DOS-based system ("PAISIS") collected morbidity, mortality, and population data, and doses administered allowing for the calculation of administrative coverage. Over the years, several other questions were added to what became known as the "PAHO EPI tables", including items regarding morbidity and mortality by age group, coverage by municipality, immunization schedule, system performance indicators, financing data, and safety. Data were initially requested quarterly and later bi-annually. In 2004, an electronic format in Excel and a shortened mid-year version were introduced.

In 1997, the World Health Organization (WHO) and the United Nations Fund for Children (UNICEF) joined efforts to collect immunization-related data as many program indicators were being collected and used by both organizations. Thus the WHO/UNICEF Joint Reporting Form (JRF) was born, allowing data standardization for WHO Regions and reconciliation of WHO and UNICEF reports. Historically, WHO has received most of the immunization indicators for the Region of the Americas from PAHO, yet data standardization and comparability with core indicators from the rest of the world has been increasingly difficult.

2004 WHO–UNICEF Meeting

In November 2004, a meeting took place to exchange experiences about current regional data collection and analysis process, gain consensus on the 2005 JRF version (2004 data), revise the content and streamline the collection process of the WHO/UNICEF JRF. Participants included representatives from all WHO Regions (including PAHO), UNICEF, and members of WHO's Division of Vaccine & Biologicals.

At the meeting, core immunization data to be collected from throughout the world were determined and agreed upon. However, Regions are free to make modifications and additions to accommodate local immunization strategies and priorities. Additionally, WHO and UNICEF bolstered their commitment to work together to facilitate the work of immunization managers and other national authorities completing the EPI Tables and JRF.

2005 JRF for the Americas (2004 data)

This year, the PAHO EPI Tables have been "merged" with the WHO/UNICEF JRF under the name PAHO-WHO/UNICEF JRF. The countries will now need to complete only one unified form, available as a Word document and an Excel file, to comply with both PAHO and UNICEF annual immunization data requests. The form will be distributed to the Immunization program managers and other appropriate national health authorities through PAHO country offices and UNICEF. Once completed, it should be returned following the same channels.

PAHO-WHO/UNICEF Joint Reporting Form: How are the Data Used?

- Allow countries to organize and produce useful data for the management of their own immunization programs;
- Produce feedback that allows countries in the Americas and other WHO Regions to compare immunization programs, vaccine-preventable disease indicators, and strategies;
- Assist PAHO in guiding regional immunization strategies;
- Meet PAHO and WHO's obligation to disseminate immunization data (global-, regional-, and country-specific) and provide input for publishing WHO/UNICEF coverage estimates;
- Are used to report progress to partners who fund PAHO in support of countries;
- Assist with estimating the burden of vaccine-preventable diseases;
- Are part of an integrated approach to monitor the Millennium Development Goals, in combination with other information (water and sanitation, education, emergencies, other health issues, and human rights);
- Are used for presentations and publications, such as:
  - PAHO (www.paho.org): AIS Basic Health Indicators in the Americas, Immunization Newsletter (www.paho.org/english/ad/fch/im/Epi_newsletter.htm)
  - WHO (www.who.int): Vaccine-preventable Diseases Monitoring System–Global summary ("Orange Book")
  - UNICEF (www.ChildInfo.org): State of the World's Children (UNICEF's annual report), Progress of Nations (UNICEF advocacy document), and the Millenium Development Goals: The WHO-UNICEF Immunization Summary

The form will collect information on vaccine-preventable disease morbidity and mortality, coverage rates, immunization schedule, source of vaccines, vaccine supplies, system indicators and performance, neonatal tetanus elimination progress, vaccine quality, surveillance, immunization safety, financing, and supplementary immunization activities. As countries complete the form, the most relevant national immunization data are thoroughly reviewed, thus facilitating the planning of their future activities. Additionally, reviewing the JRF during an Inter-Agency Coordinating Committee meeting provides an opportunity not only to improve the quality of the data, but also as a framework to develop national plans of action.

Cleaning Up the Regional MESS Database

Previous *EPI Newsletter* articles have addressed the importance of data quality and the "cleaning" of data after entry into the Measles Eradication Surveillance System (MESS) database. Ideally, country managers should review the quality of the data entered prior to sending weekly data files to PAHO/Washington. Such efforts will likely decrease errors and improve data quality for all aspects of surveillance. To evaluate the quality of the data entered into the MESS database, thirty key variables were reviewed for the years 2002-2003. A similar assessment of data quality of the MESS system was conducted for the years 2000-2001.[1]

Table 1. Missing Information and Data Entry Errors by Variables in MESS The Americas, 2002-2003

	Year 2002 (n=21,021)			Year 2003 (n=10,326)		
Variable	**Blank**	**ZZ**	**Error**	**Blank**	**ZZ**	**Error**
Date reported	0	0	9	0	0	1
Date of rash onset	0	0	2	0	0	0
Site type	193	128	0	4	81	0
Type of rash	482	685	10	167	202	1
Date investigated	2898	784	2	878	290	0
Source	418	155	0	12	95	0
Case classification	0	0	0	0	0	0
Classification code	10	0	0	7	0	0
Gender	20	16	0	5	3	0
Age	51	109	3	5	32	2
Number of doses (Measles)*	389	2632	8	137	1688	2
Date of last measles dose**	550	565	10	392	8	12
Fever	262	144	0	122	31	0
Date of fever onset	409	0	17	263	0	12
Trip	468	2224	0	295	871	0
Conjunctivitis	356	629	0	246	222	0
Coryza	340	555	0	225	188	0
Cough	314	439	0	187	156	0
Contact	603	3588	0	343	1492	0
Date of confirmation	36	1	0	1	0	1
Lymphatics	397	769	0	271	303	0
Hospitalization	338	524	0	200	349	0
Death	344	601	0	263	355	0
Initial diagnosis	3	0	0	43	0	0
Final diagnosis	10	7287	0	7	3579	0
Number of doses (Rubella)*	633	3125	4	261	1974	1
Date of last rubella dose**	403	21	7	98	1804	2
Arthralgias	640	1604	0	532	687	0
Pregnancy status***	386	232	1	273	215	0
Weeks pregnant****	14	9	1	11	13	0
TOTAL	**10967**	**26826**	**74**	**5248**	**14638**	**34**

* Among persons at least 1 year of age
** Among persons at least 1 year of age & with at least 1 dose of vaccine
*** Among women 15-39 years of age
**** Among pregnant women

Data for each year were extracted into EPI INFO 2002 and simple frequencies were tabulated on the selected variables. For each variable the following was determined: the number of variables that lacked information or were left blank, the number of "ZZ" responses indicating the information was unknown, and the number of obvious data entry errors, e.g., entering an impossible date of onset such as 2022 or entering a "D" when only "A", "B", "Y", or "Z" are options. No attempt was made to verify the accuracy of the data entered. The evaluation is summarized in Table 1.

In 2002, a total of 21,021 records were examined with a possible 566,941 responses. In 2003, 10,326 records were evaluated with 280,232 possible responses. As seen in Table 1, during both years only 0.012% of possible responses had obvious errors (0.013% in 2002, and 0.012% in 2003). Most of these errors dealt with incorrectly entered dates, i.e., of the total 108 data entry errors detected in the two years,

[1] EPI Newsletter: *Regional Measles Database: How "clean and complete" are the data?* April 2002, Vol. XXIV (2): 4-5 available at http://www.paho.org/english/ad/fch/im/Epi_newsletter.htm.

75 (69%) were associated with dates. Some dates were entered as DD/MM/YY instead of the standard DD/MM/YYYY format. Others had dates of onset in 2004 or 2202. However, the number of data entry errors overall was very small –indicating high quality of data entry at the country level.

Conversely, numerous fields lacked information in both years. For year 2002, 6.67% of all responses had missing information with 1.9% of the responses left blank and 4.7% marked "ZZ" for unknown. For year 2003, 7.10% of all responses had missing information with 1.9% of the responses left blank and 5.2% marked "ZZ" for unknown. The amount of missing information varied greatly by variable. Three variables contained no blanks or "ZZ" responses: (1) date reported, (2) date of rash onset, and (3) case classification.

In 2002, among the 15,398 suspected cases at least one year of age, 3,021 (19.6%) had no information on their measles vaccination status. Among persons with at least one dose of measles vaccine, 15.6% had no date of vaccination. In 2003, the comparable percentages were 24.5% and 9.2%. In 2002, of 3,550 persons vaccinated against rubella 12.2% had no date of vaccination. In 2003, 4.1% of the 2,678 persons vaccinated against rubella had no date of vaccination.

Assessment of the quality of data on pregnancy status shows that in 2002, of the 104 females aged 15-39 years who were diagnosed with rubella, 10 (9.6%) were missing information on their pregnancy status. In 2002, four women were diagnosed with rubella during pregnancy. All had information on their gestational age in weeks.

In 2003, only 13 (17%) of 75 women aged 15-39 years diagnosed with rubella were missing information on their pregnancy status. Four pregnant women diagnosed with rubella had information on their gestational age.

Editorial Comment: Overall quality of data entered into the MESS database remains high and substantial improvements have been made in rubella surveillance when compared to the previous evaluation of years 2000 and 2001. In 2000, the 30 variables above were evaluated for 24,552 records, or 657,175 possible responses. In 2001, 16,675 records were evaluated with 440,077 possible responses. During both years, 0.017% of possible responses had obvious errors. Of the total 183 data entry errors detected in the two years, 134 (73%) were associated with dates.

This evaluation (which did not address accuracy of the data entered) suggests that there are few obvious errors, and that errors have decreased in 2002 and 2003. In fact, comparing "error ratios" (number of errors/number of possible responses) from the year 2000 to 2003, data entry errors were 1.83 times more common in 2000 than in 2003 ($p<0.005$). Thus, even though the number of errors is small, the number of data entry errors has decreased over time.

When compared to 2000 and 2001, the evaluation of years 2002 and 2003 showed less missing data for vaccination status, with the greatest improvements on the date of vaccination (Table 2). The importance of documenting vaccination status and obtaining information on the date of vaccination was stressed in the previous review and data managers have succeeded in greatly improving the quality of this data.

Table 2. Selected Missing Data Over Time, 2000-2003

	2000	2001	2002	2003
Overall missing information	11.2%	7.7%	6.7%	7.1%
Percentage missing measles vaccination status *	30%	21%	19.6%	24.5%
Percentage of persons without last measles vaccination date **	52%	47%	15.6%	9.2%

* Among persons at least 1 year of age
** Among persons at least 1 year of age & with at least 1 dose of vaccine

Final diagnosis was missing (blank or "Unknown") in 24% of suspected cases for 2000 and 2001. Final diagnosis was missing in 35% of suspected cases for 2002 and 2003. Data managers should ensure that final diagnosis is reported for all suspected cases by utilizing the "Measles", "Rubella", "Dengue", or "Other" categories, as final diagnosis is a critical component of the surveillance system. Suspected cases with negative laboratory results for measles, rubella, and dengue should be classified as "Other".

When compared with data from 2000-2001, rubella surveillance data in 2002-2003 was of better quality (Table 3).

Table 3. Rubella Surveillance in The Americas, 2000-2003

	2000	2001	2002	2003
Percentage of missing date of rubella vaccination	78%	62%	12.2%	4.1%
Percentage of women ages 15-39 without pregnancy status	35%	39%	9.6%	17%
Percentage of pregnant women with rubella missing gestational age	16%	7%	0%	0%

National managers should continue to ensure the quality of data entered into the national MESS databases. This evaluation suggests many improvements have been made in data quality, including the number of obvious errors, missing data, and information on vaccination status. Most importantly, pregnancy status indicators for females aged 15-39 years with confirmed rubella infection have greatly improved. Documentation of immunization status, information on the date of last immunization, and pregnancy status of women with rubella should remain high priorities in data collection. Infants born to women with rubella during pregnancy must be closely followed and evaluated for signs of congenital rubella syndrome (sensorineural hearing loss, cataracts, and congenital heart disease).

PAHO's Revolving Fund Vaccine Prices for 2005

Prices for vaccines purchased through the PAHO Revolving Fund for Vaccine Procurement in 2005 are listed in Table 1.

Prices increased in 2005 from 2004 by 6% on average, with a range between Pentavalent (+0.9%) and DPT 10 (+12%). However, most vaccines have experienced minimum change, and some have even experienced a price decrease versus 2004, such as MR 10 (-8%), MMR 10 (-6%), and MMR 1 (-4%). An active partnership between Member States, suppliers, and PAHO in managing changes to demand forecasting helped maintain price control. Accurate forecasting also contributes to improvements in customer satisfaction, as countries benefit from an uninterrupted vaccine supply.

Managing change in the supply chain processes is an ongoing effort of the PAHO Revolving Fund. Improving the efficiency and effectiveness of the demand, procurement, fulfillment, and cash flow processes will enhance performance and control costs, thus facilitating the introduction of new vaccines.

Table 1. Prices for Vaccines Purchased Through the PAHO Revolving Fund, 2005
(Prices shown in U.S. Dollars)

Vaccine	Doses per vial	FCA* price per dose
BCG	10	$0.0952
DPT	10	$0.1100
DT (Adult)	10	$0.0650
DT (Pediatric)	10	$0.0750
DPT Hib	1	$3.2000
	10	$2.8000
DPT/Hep B/Hib (Pentavalent)	1	$3.8900
Hib Lyophilized	1	$3.1000
Hepatitis B 20MCG Recombinant	1	$0.4950
	10	$0.2300
Measles (Edmonston)	1	$0.9000
Measles/Rubella (MR)	1	$1.2000
	2	$0.9000
	10	$0.4400
Measles/Mumps (URABE)/ Rubella (MMR)	1	$1.6000
	10	$1.1950
Measles/Mumps (LENINGRAD/ ZAGREB)/Rubella (MMR)	1	$1.3500
	10	$0.8500
Polio (Plastic Vial)	10	$0.1416
	20	$0.1320
	25	$0.1350
Rabies Human Purified Chick Embryo Cell	1	$9.9000
TT	10	$0.0500
Yellow Fever	5	$0.6500
	10	$0.8700
Influenza Pediatric with Syringe, Southern Hemisphere	1	$3.0000
Influenza Adult with Syringe Southern Hemisphere	1	$3.0000

*** FCA: Free Carrier**

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