U.S. Centers for Disease Control and Prevention
National Center for Health Statistics
International Statistics Program

Assessing Vital Statistics

These materials have been developed by the National Center for Health Statistics, International Statistics Program, Hyattsville, Md., as part of the CDC Global Program for Civil Registration and Vital Statistics Improvement.

Outline

- **Adequacy of vital statistics**
- **Quality of vital statistics**
  - **Accuracy**
  - **Timeliness**
  - **Comparability**
  - **Relevance**
  - **Accessibility**
- **ANACoD: a tool for Analyzing Mortality Levels & Cause of Death Data**

SOURCES: NCHS, Unit 18.

Adequacy of Vital Statistics

Good statistical systems are:
efficient, credible, objective

Adequacy of statistics:

- **Data content**
- **Tabulations**
- **Availability of population data for rate computation**
- **Quality of vital statistics data**

Register of births. Panos/Jenny Matthews.

SOURCES: NCHS, Unit 18; Mahapatra.

Quality of Vital Statistics

- **Quality of vital statistics data**
  - **Accuracy**
  - **Timeliness**
  - **Comparability**
  - **Relevance**
  - **Accessibility**

Data manager. WHO/Evelyn Hockstein.

SOURCES: NCHS, Unit 18; Mahapatra.

Mahapatra et al. (2007) Assessment Framework

Timeliness
- Production time
- Regularity

Accuracy
- Completeness / coverage
- Missing data*
- Use of ill-defined categories
- Improbable classifications

Comparability
- Over time
- Across space

Relevance
- Routine tabulations
- Small area statistics

Accessibility
- Media
- Metadata
- User service

* other models also include erroneous data

SOURCES: Mahapatra, Table 1 (slightly modified for better understanding and consistency with other sources).

Accuracy of Vital Statistics

Coverage Error

1. Completeness / coverage

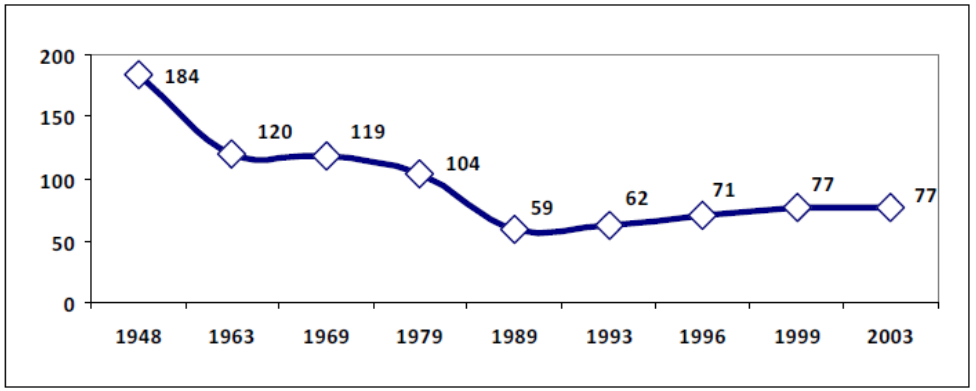
Content Error

2. Missing & erroneous data

3. Use of ill-defined categories

4. Improbable classifications

FIGURE 2 National trends in Infant Mortality Rate from 1948 to 2003



- Evaluated by : analysis of trends & frequency distributions
- Anomalies caused by reporting practices, i.e. digit preference

SOURCES: NCHS, Unit 15, 18; PRVSS2, Ch. V.

Accuracy of Vital Statistics

1. Completeness / coverage

- **Civil registration systems**: every vital event that has occurred is registered in system
  - Complete : ≥ 90% of events registered
  - Incomplete: < 90% of events registered
- **Vital statistics**: all registered events are forwarded to agency to compile & produce vital statistics
- Coverage error (various measures)
- Explore reasons for under-coverage

SOURCES: NCHS, Unit 15, 18; Mahapatra; PRVSS2, Ch. V, Glossary; WHO/HMN, Box 1.

Completeness / Coverage

- **Coverage errors in *civil registration systems***

Geographic coverage

% access level = # in districts with registration points X 100
total population of the country

Civil registration system coverage of deaths (WHO)

% coverage = total deaths reported from system in year X 100
total deaths estimated for year (by WHO)

Coverage of medical certification of cause of death (COD)

% covered by COD certification = # in districts with certification X 100
total population of country

SOURCES: Mahapatra; PRVSS2, Ch. V, Glossary; WHO/UQ, Box 3.3; WHO/IMR; Freedman, p 24.

Completeness / Coverage

- **Coverage errors in *civil reg. systems* (cont'd):**

Approximations of completeness by comparison with corresponding statistics

Estimated birth registration completeness (%)

$$= \frac{\text{Actual \# registered births}}{\text{(Crude birth rate per 1,000* x total population size/1,000)}} \times 100$$

Estimated death registration completeness (%)

$$= \frac{\text{Actual \# registered deaths}}{\text{(Crude death rate per 1,000* x total population size/1,000)}} \times 100$$

* As estimated by the United Nations or other sources

SOURCES: PRVSS2, p 88; WHO/HMN, Box 1.

Completeness / Coverage

- **Coverage errors in *civil reg. systems* (cont'd):**

Checking entries against independent sources

- **Using death register to verify birth registration**
- **Administrative & social records**
- **Matching to census & survey records**
- **Dual record system**

Panos/Heldur Netocny. Medical workers register women and babies.

SOURCES: NCHS, Unit 18.

Completeness / Coverage

"Dual record system"

- **Retrospective survey of vital events (quarterly/annually)**
- **Census enumeration**

- **Classify matched events:**

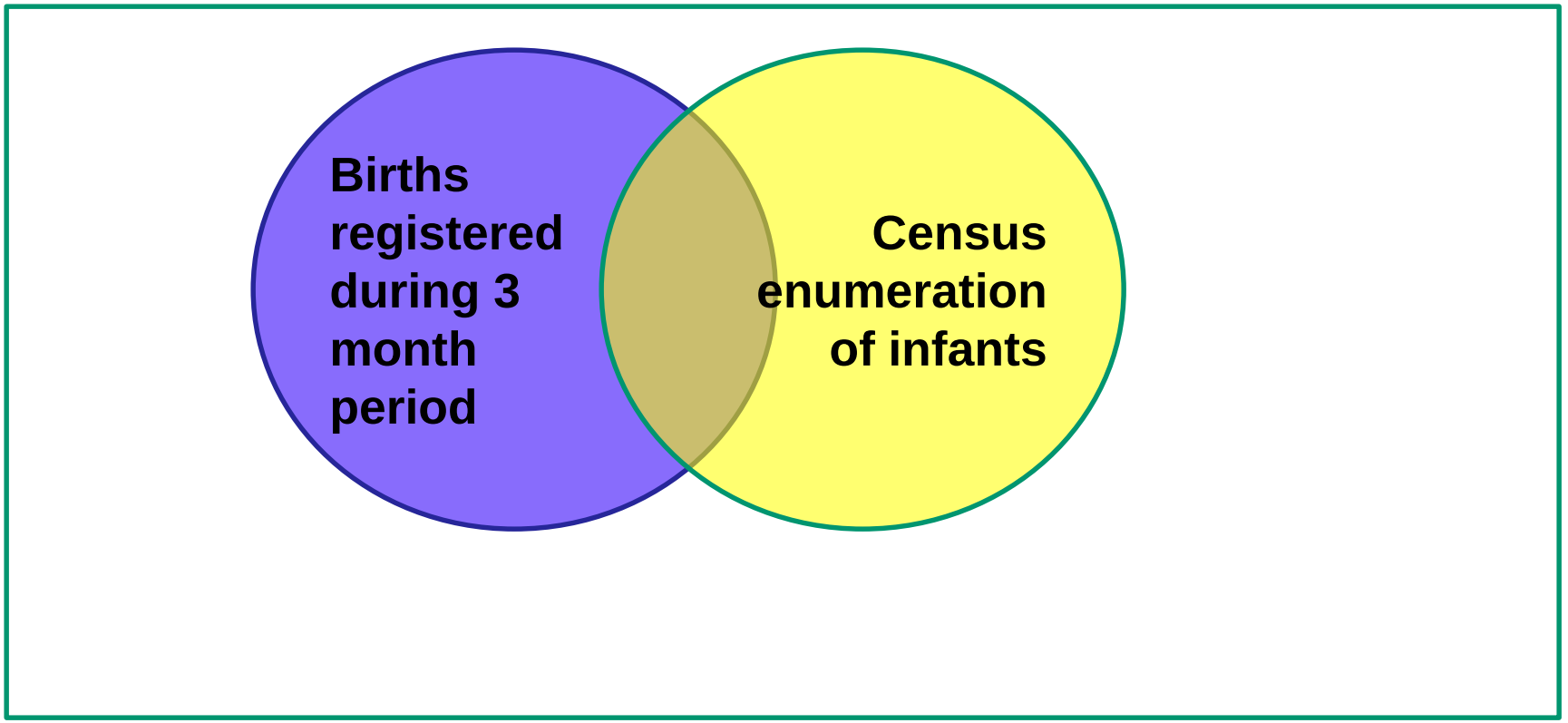
1) **Events recorded in both register and other system**
2) **Events recorded in register but not other system**
3) **Events reported in other system but not register**
4) **Estimate unknown number of events omitted from both systems***

* Chandra Sekar, C. and Deming, W. Edwards. "On a Method of Estimating Birth and Death Rates and the Extent of Registration." Journal of the American Statistical Association. 44(245):101-115, March, 1949.

SOURCES: NCHS, 18; PRVSS2, p 86-87, 93-44.

Completeness / Coverage

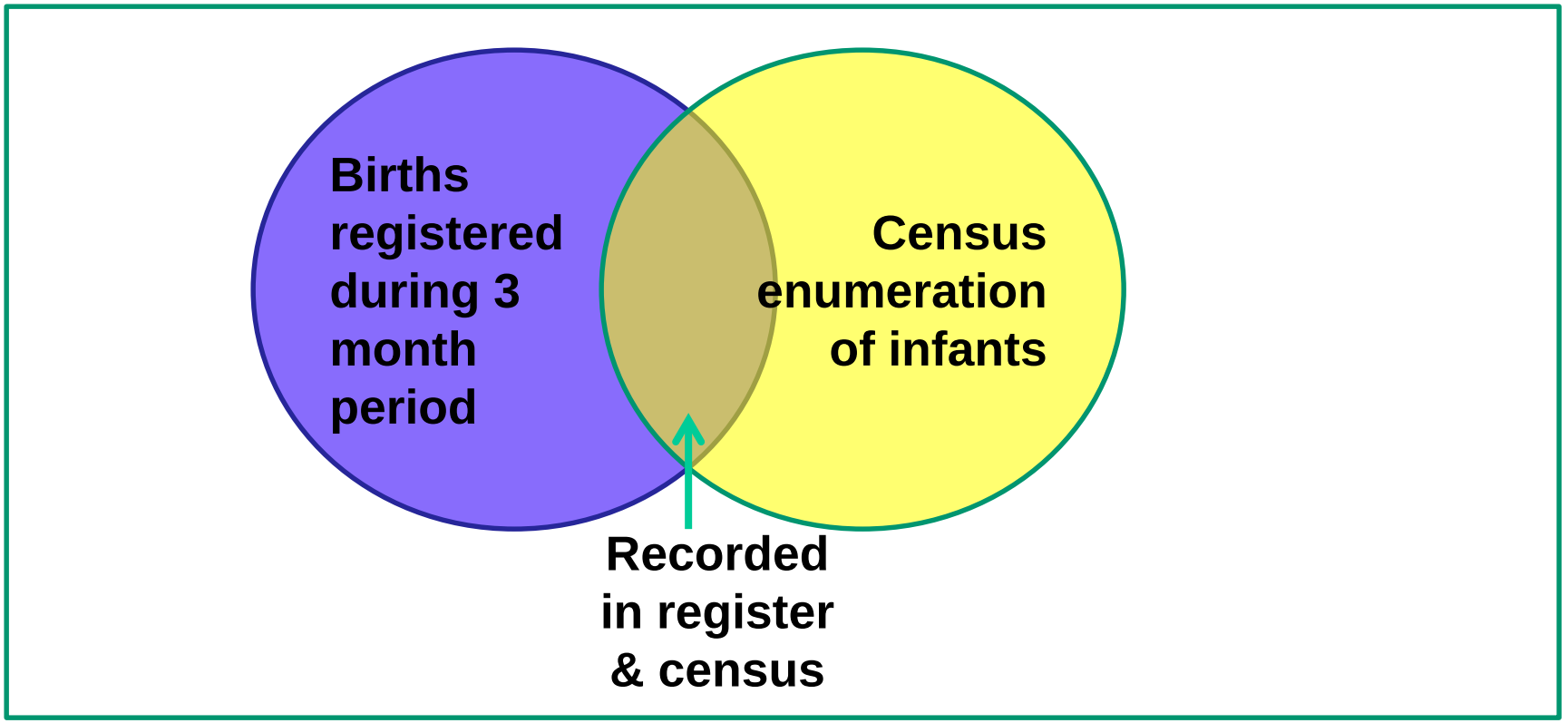
- Example: birth registration coverage



SOURCES: Elis S. Marks, William Seltzer and Karol J. Krotki. Population Growth Estimation: A Handbook of Vital Statistics Measurement. New York: The Population Control, 1974; NCHS 18.

Completeness / Coverage

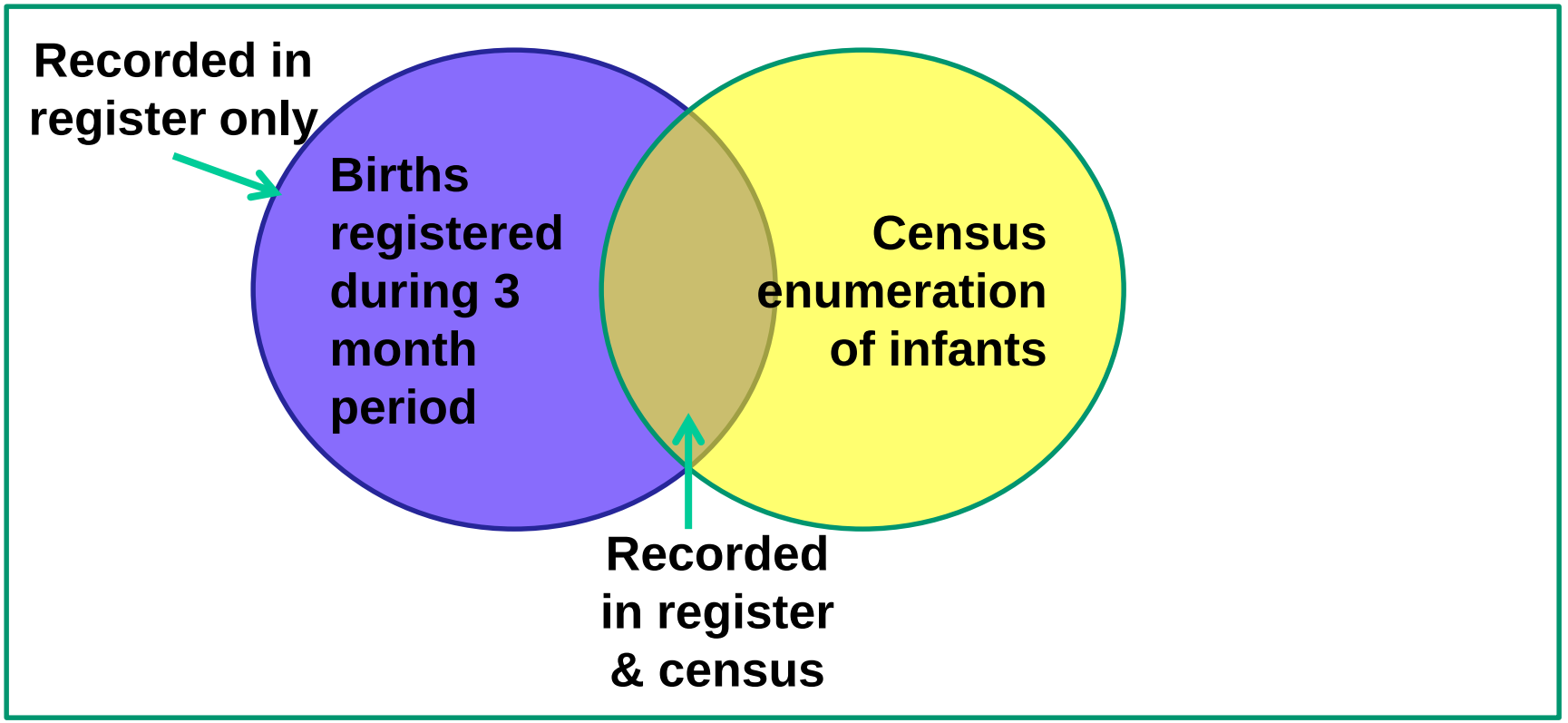
- Example: birth registration coverage



SOURCES: Elis S. Marks, William Seltzer and Karol J. Krotki. Population Growth Estimation: A Handbook of Vital Statistics Measurement. New York: The Population Control, 1974; NCHS, 18.

Completeness / Coverage

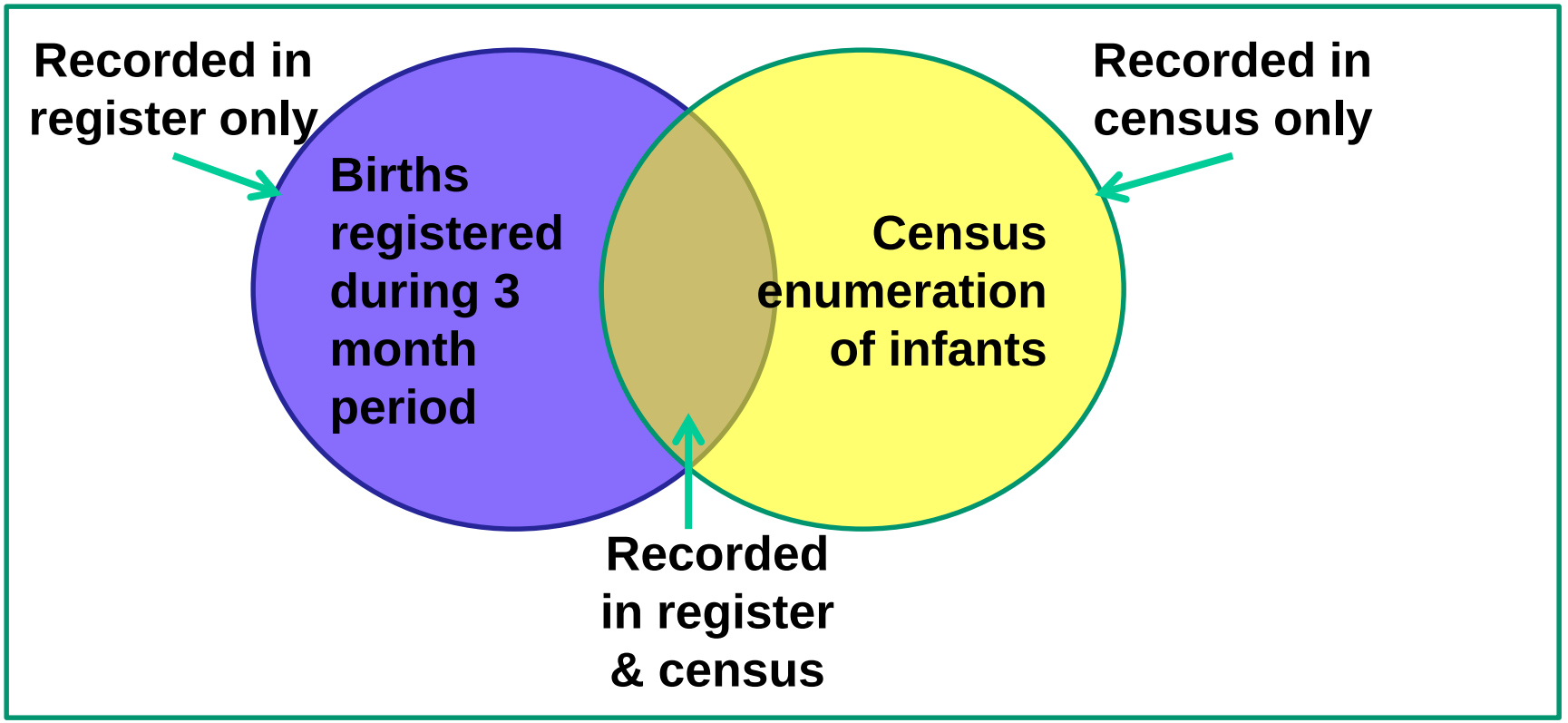
- Example: birth registration coverage



SOURCES: Elis S. Marks, William Seltzer and Karol J. Krotki. Population Growth Estimation: A Handbook of Vital Statistics Measurement. New York: The Population Control, 1974; NCHS 18.

Completeness / Coverage

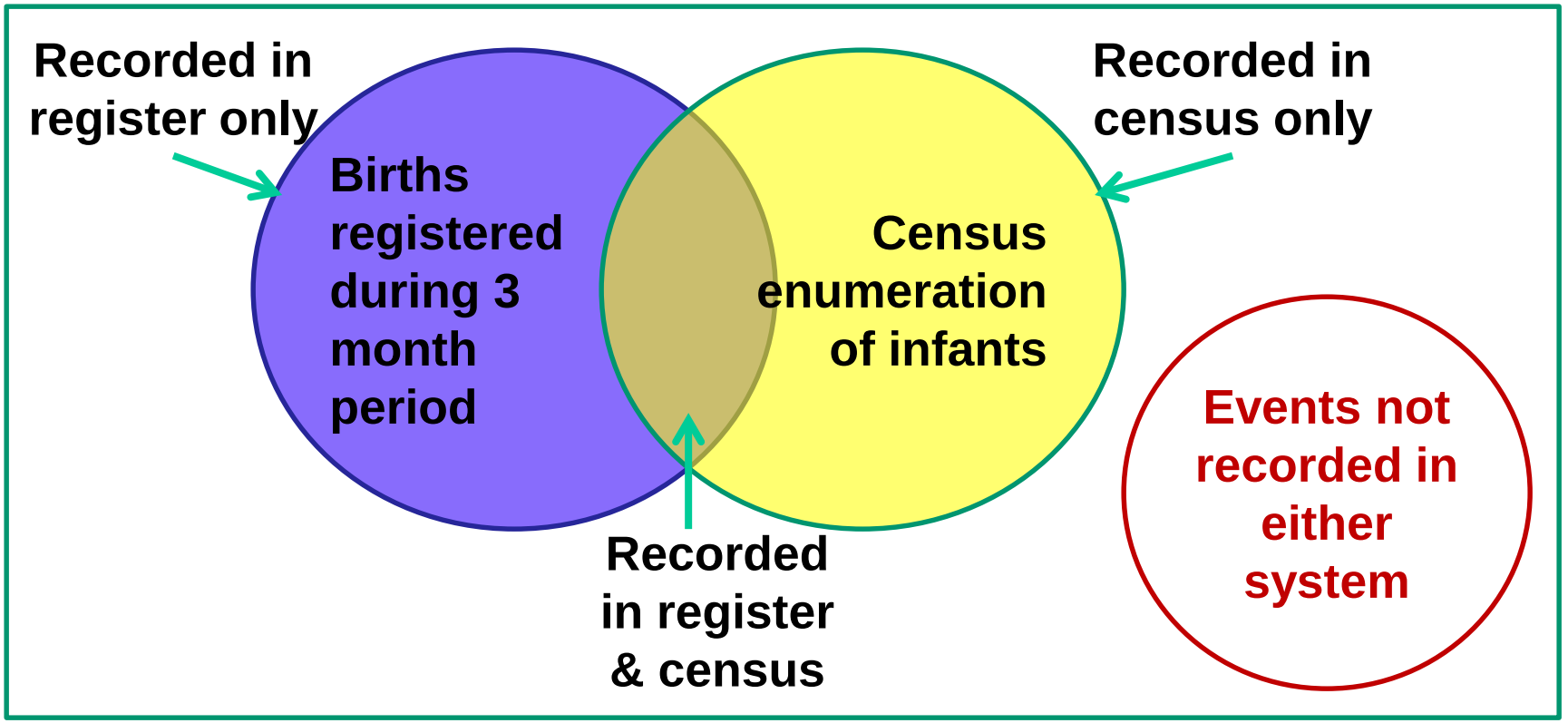
- Example: birth registration coverage



SOURCES: Elis S. Marks, William Seltzer and Karol J. Krotki. Population Growth Estimation: A Handbook of Vital Statistics Measurement. New York: The Population Control, 1974; NCHS 18.

Completeness / Coverage

- Example: birth registration coverage



SOURCES: Elis S. Marks, William Seltzer and Karol J. Krotki. Population Growth Estimation: A Handbook of Vital Statistics Measurement. New York: The Population Control, 1974; NCHS, 18.

Completeness / Coverage

- **Coverage errors *in vital statistics***

Direct Assessment

– **Monitoring registrar returns**

- **Reports received on time**
- **Every registration area has reported**

Health Metrics Network

- **Frequencies of events reported similar to expected values**

– **% of deaths with medically-certified cause of death**

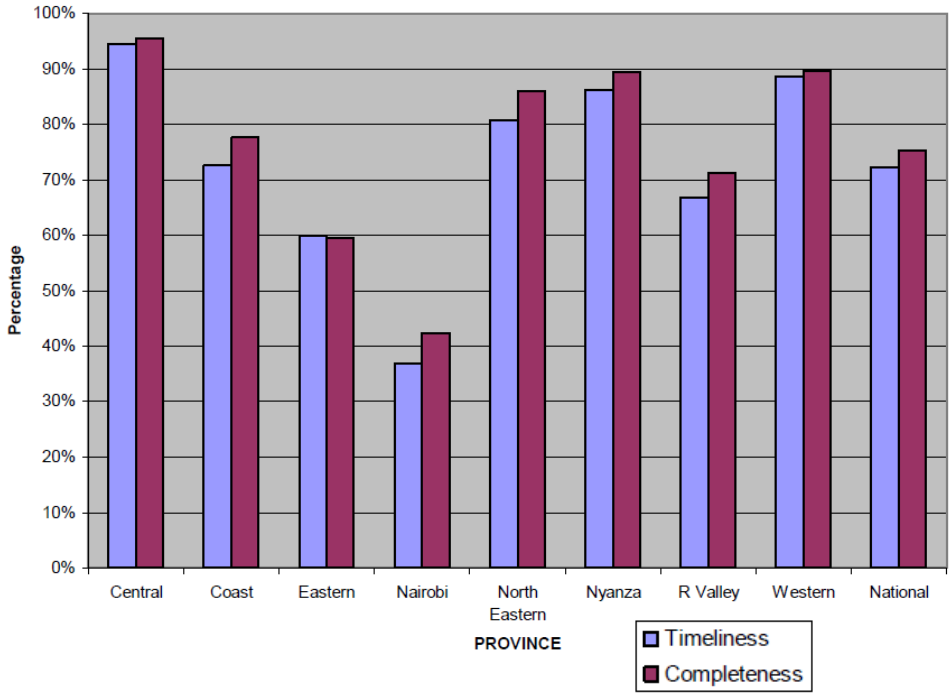
SOURCES: NCHS, Unit 15, 18; Mahapatra; PRVSS2, Ch. V.

Completeness / Coverage

- **Coverage errors *in vital statistics* (cont'd)**

Indirect Assessment

- **Comparison of trends**
- **Delayed registration**
- **Incomplete data methods**
- **Comparison w/ rates observed in similar populations or previous periods**



SOURCES: NCHS, Unit 15, 18; Mahapatra; PRVSS2, Ch. V.

Completeness / Coverage

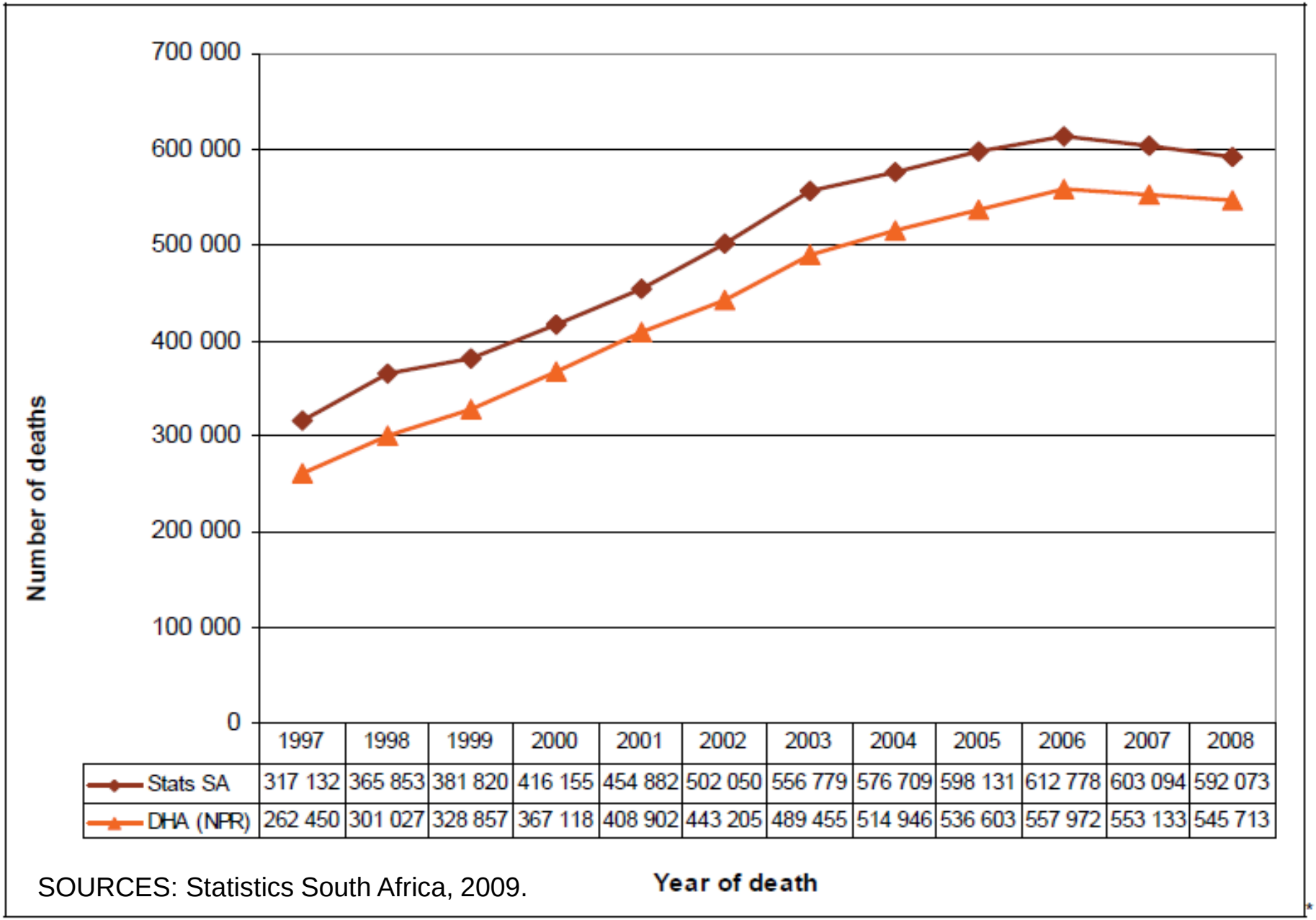
- **Coverage errors *in vital statistics* (cont'd)**

Comparisons

- **VS (# of events registered) in a given period with corresponding VS in previous years**
- **VS in a given period with population census or other estimates**
- **Proportion of delayed registrations as estimate of under-reporting in previous years**
- **Portions of VS with corresponding data collected through other means (i.e. fertility surveys)**
- **Vital rates with corresponding rates for similar countries**
- **Sex ratio at birth (under certain circumstances)**

SOURCES: NCHS, 18; PRVSS2, p 84; Freedman, p 27-28.

Number of registered deaths by source of data and year of death, 1997-2008*



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Stats SA	317 132	365 853	381 820	416 155	454 882	502 050	556 779	576 709	598 131	612 778	603 094	592 073
DHA (NPR)	262 450	301 027	328 857	367 118	408 902	443 205	489 455	514 946	536 603	557 972	553 133	545 713

SOURCES: Statistics South Africa, 2009.

Data for 1997–2007 have been updated to include late registrations processed in 2009/10.

Completeness/Coverage

- **Reasons for under-coverage**
  - **Geographic: lack of access to the system**
  - **Late registration**
  - **Health infrastructure**
  - **Under-registration: *most crucial aspect of evaluation***
    - **Poor legislation**
    - **Failure of informant to comply with law**
    - **Lack of proficiency of registrars**

SOURCES: NCHS, Unit 15, 18; Mahapatra; PRVSS2, Ch. V; HMN/UQ, Subcomponent B3; Freedman p 25.

Improving Completeness/Coverage

- Reduce barriers to registration
- Hire part-time & adjunct registration officials
- Track pregnant women
- Educational campaign to improve registration of infant deaths & stillbirths
- Improve relationships between local registrars and coroners & police
- Review classification of maternal deaths
- Statistical adjustment for under-coverage

SOURCES: Freedman, p 28-31.

Improving Completeness/Coverage

1) Completeness & coverage

- Coverage as a measure of completeness
- Comparisons with corresponding statistics
- Checking with independent sources (dual record system)
- Coverage errors in vital statistics
- Reasons for under-coverage
- Improving completeness/coverage

Methods for Completeness/ Coverage in [COUNTRY]

- List the methods that are used for measuring completeness in [country]. Consider methods for measuring completeness in the civil registration system and methods for measuring completeness in the country's vital statistics.

Discuss

Discuss what geographic areas and population groups exist in your country. Do any of these groups present reporting or data-collection problems for civil registration?

What is the best way to make it easy for the public to participate but still collect complete information for either births or deaths?

Accuracy of Vital Statistics

2) Missing & Erroneous Data

Missing data

- % of key variables with no response
- % of COD reports with missing age/sex

Erroneous data

- Response error:
  - Matching sample of reports with independent records
  - % responses classified as “unknown”
  - Internal consistency of data
- Coding error: double coding

SOURCES: NCHS, Unit 15, 18; Mahapatra; PRVSS2, Ch. V; Freedman, p 32.

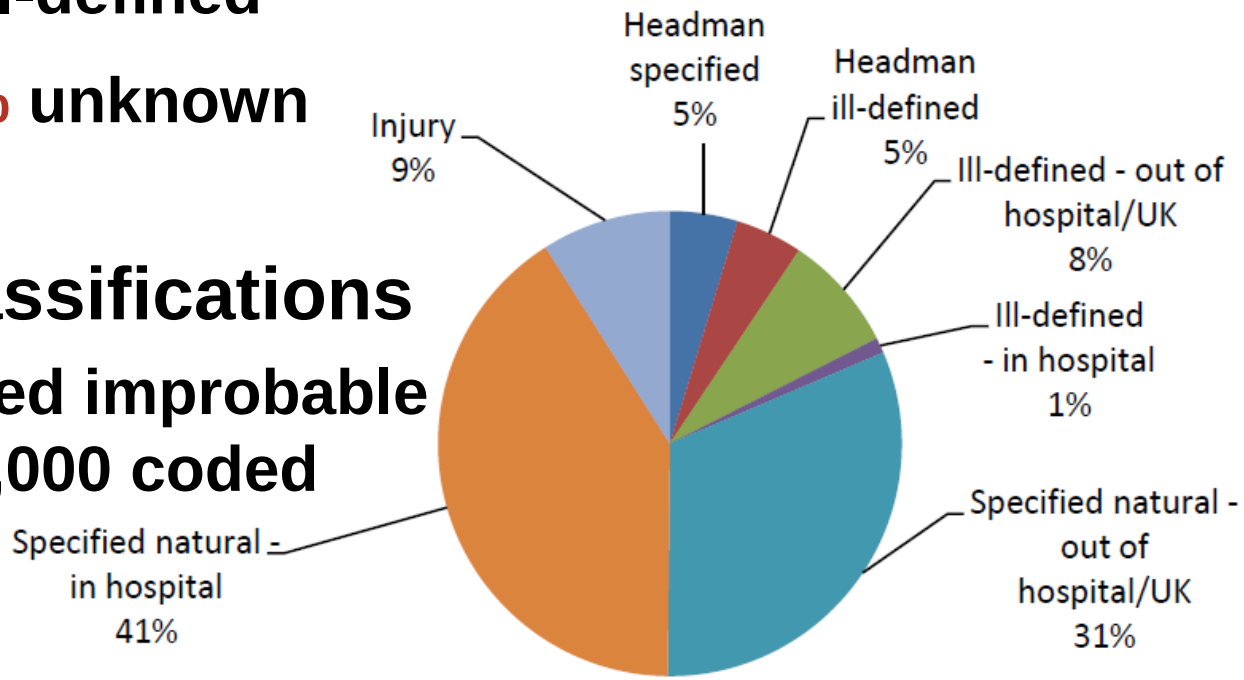
Accuracy of Vital Statistics

3) Use of ill-defined categories

- % of deaths classified as miscellaneous/ill-defined
- Should be < 25% unknown

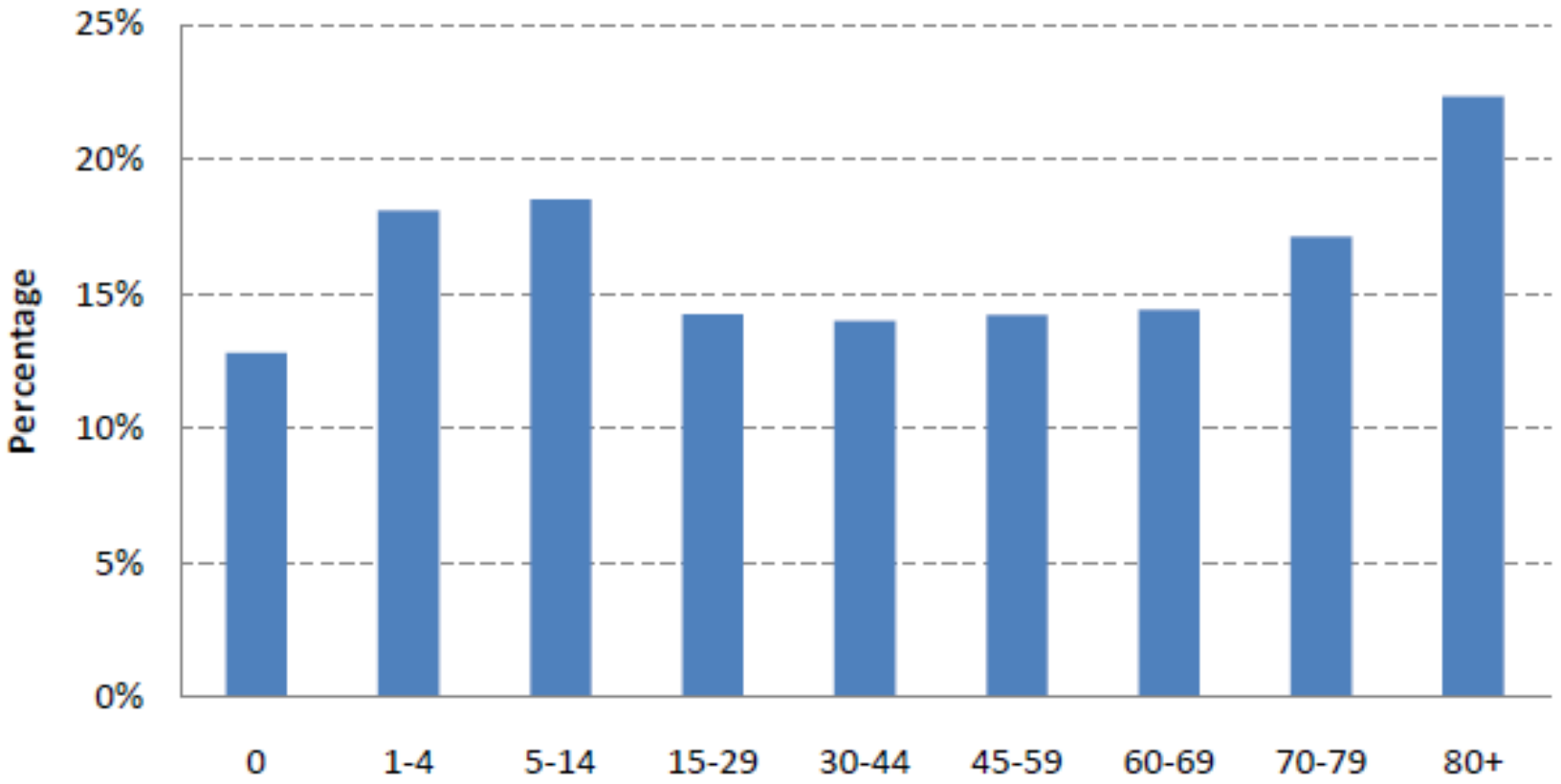
4) Improbable classifications

- # deaths assigned improbable age/sex per 100,000 coded deaths



SOURCES: NCHS, Unit 15, 18; Mahapatra; PRVSS2, Ch. V.

Proportion of natural deaths due to ill defined natural causes by age group – South Africa, 2007



Source: Statistics, South Africa

SOURCES: Bradshaw D, et al. Cause of death statistics for South Africa: Challenges and possibilities for improvement. Medical Research Council, South Africa. November 2010.

What to do with Imperfect Data

- When you're not confident on the certification of cause of death:

  combine causes into broader groups

- When you have ill-defined causes of death:

  you can allocate deaths across other causes using advanced techniques

  (see National Burden of Disease Studies: A Practical Guide. Edition 2.0)

Accuracy of Vital Statistics in [COUNTRY]

List the following for the country, if known (use the most recent data year available):

2) Missing data

- % of key variables with no response
- % of COD reports with missing age/sex

Erroneous data

- Response error:
  - Methods used for matching sample of reports with independent records?
  - % responses classified as "unknown"
- Coding error: is double coding conducted?

Accuracy of Vital Statistics in [COUNTRY] (cont.)

List the following for the country, if known (use the most recent data year available):

3) Use of ill-defined categories

- % of deaths classified as miscellaneous/ill-defined
- Is this < 25% unknown (ideal)?

4) Improbable classifications

- # deaths assigned improbable age/sex per 100,000 coded deaths

Review: Accuracy of Vital Statistics

1) **Completeness & coverage**

2) **Missing & erroneous data**

3) **Use of ill-defined categories**

4) **Improbable classifications**

Timeliness of Vital Statistics

- **Factors influencing timeliness:**

  (1) Promptness of event registration

  (2) Transmission of data

  (3) Promptness of data production & dissemination

Health Metrics Network

- **Enforcing laws can be challenging**
- **Know magnitude & effect of delayed registration**

SOURCES: NCHS, Unit 15, 18; PRVSS2, p 82; Freedman, p 40-44.

Timeliness of Vital Statistics

Indices of timeliness:

- **% of events that occurred in previous years**
- **Production time: mean time from end of reference period to publication**
- **Regularity: SD of production time**

SOURCES: NCHS, Unit 15, 18; Mahapatra.

Timeliness of Vital Statistics

- **Delayed reporting of certain types of events**
  1. **Delay release of national file**
  2. **Publish without delayed records**
  3. **Use surrogate statistics (e.g. 9/11 World Trade Center attacks in United States)**

SOURCES: Freedman, p 43.

Timeliness of Vital Statistics

Table 2.3: Number of deaths published in November 2009 and late registrations processed in the 2009/10 processing phase by year of death, 1997–2007

Year of death	Number of deaths published in November 2009	Additional forms received in the 2009/10 processing phase	Total number of deaths (by September 2010)
1997	317 131	1	317 132
1998	365 852	1	365 853
1999	381 820	0	381 820
2000	415 983	172	416 155
2001	454 847	35	454 882
2002	502 031	19	502 050
2003	556 769	10	556 779
2004	576 700	9	576 709
2005	598 054	77	598 131
2006	612 462	316	612 778
2007	601 133	1 961	603 094
Total	**5 382 782**	**2 601**	**5 385 383**

SOURCES: Statistics South Africa, 2009

Timeliness of Vital Statistics Data in [COUNTRY]

List the following for COUNTRY, if known (use the most recent year for which data are avialable):

- % of events that occurred in previous years
- Production time: mean time from end of reference period to publication
- Regularity: SD of production time
- Was there a delay in the release of the national file? If yes, for how long?
- Were reports published without delayed records?

Discuss

What factors can affect the timeliness of vital statistics?

Comparability

- **Need to accommodate necessary changes**
  - **Proper procedures**
  - **Implemented so users can employ new statistics**
- **Comparability**
  - **Across space: within country & between countries**
    - **Uniformity of definitions across areas**
    - **ICD to certify & code deaths; version used; code level used**
  - **Over time:**
    - **Stability of key definitions for VS**
    - **Consistency of cause specific mortality proportions**

SOURCES: NCHS, Unit 15, 18; Mahapatra.

Comparability: Differences in Reporting Requirements: "Live Birth"

Table 1. Requirements for reporting a live birth, United States and selected European countries, 2004

Reporting requirement	Country
All live births	Austria, Denmark, England and Wales, Finland, Germany, Hungary, Italy, Northern Ireland, Portugal, Scotland, Slovak Republic, Spain, Sweden, United States
Live births at 12 weeks of gestation or more	Norway
Live births at 500 grams birthweight or more, and less than 500 grams if the infant survives for 24 hours	Czech Republic
Live births at 22 weeks of gestation or more, or 500 grams birthweight or more	France
All live births for civil registration, births at 500 grams birthweight or more for the national perinatal register	Ireland
Live births at 22 weeks of gestation or more, 500 grams birthweight or more if gestational age is unknown	Netherlands
Live births at 500 or more grams birthweight	Poland

SOURCE: NCHS/National Vital Statistics System for U.S. data and European Perinatal Health Report, p. 40 for European data: http://www.europeristat.com/bm.doc/european-perinatal-health-report.pdf.

SOURCES: MacDorman, MF and Mathews TJ. Behind International Rankings of Infant Mortality: How the United States Compares with Europe. NCHS Data Brief No. 23. Nov. 2009 (see references).

Comparability: International Comparisons

Data Quality

- Consistency
- Methodology
- Coverage
- Time period

Choice of Countries

- Comparability

Presentation & Interpretation

- Presentation
- Explanation
- Underlying differentials
- Context

SOURCES: Australian Institute of Health and Welfare 2012. A working guide to international comparisons of health. Cat. No. PHE 159. Canberra: AIHW.

Relevance

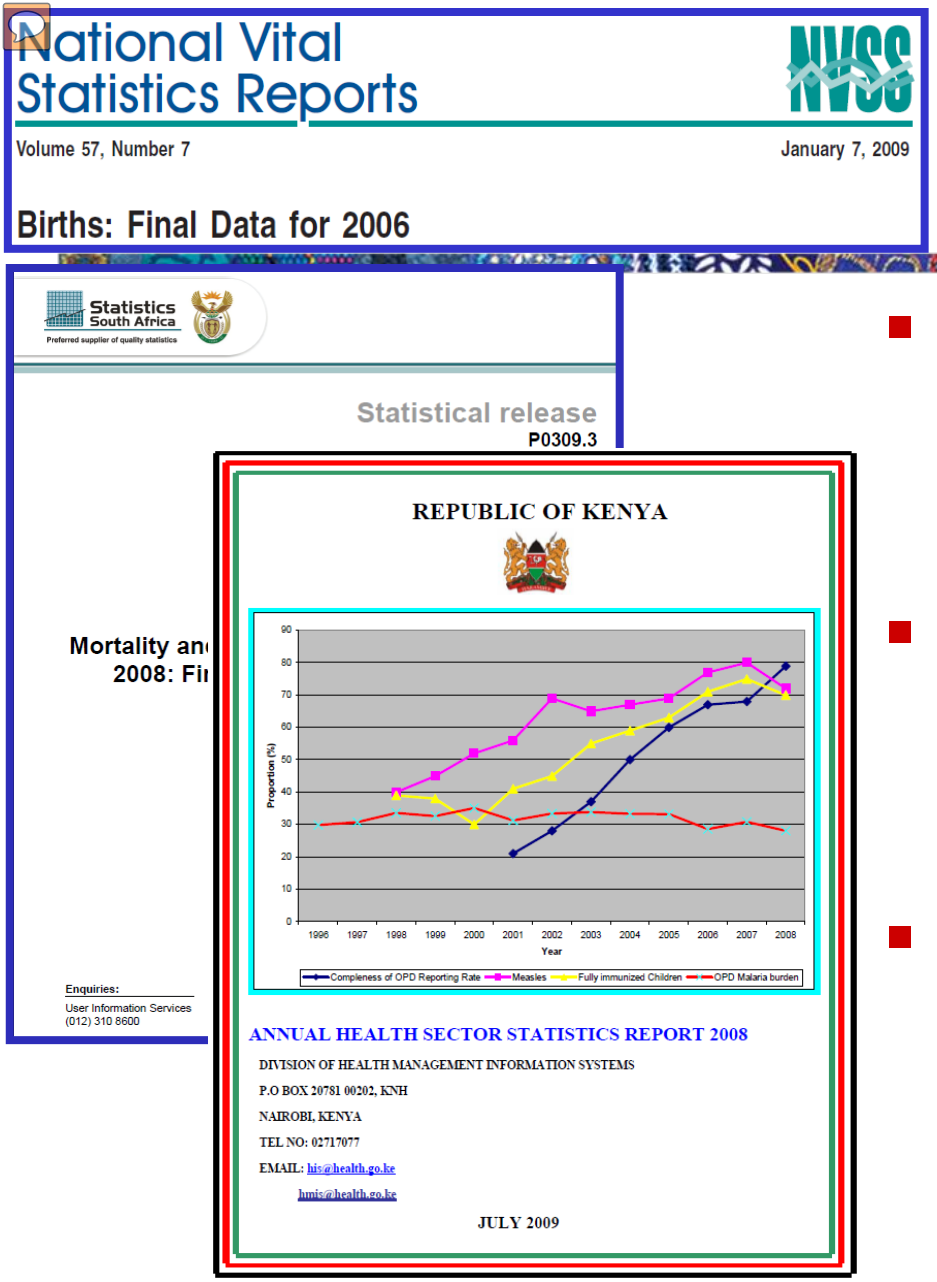
- **Routine tabulations: by sex & specified age groups**
- **Small area statistics: # of tabulation areas per million population**

Trends in infant mortality rate by province

Province	1989	1993	1998	1999	2000	2003
	KDHS	KDHS	KDHS	census	MICS	KDHS
Central	37	31	27	37	36	44
Nairobi	46	44	41	50	51	67
Rift Valley	35	45	50	51	48	61
Eastern	43	47	53	44	57	56
Western	75	64	64	101	87	80
Coast	107	68	70	86	65	78
Nyanza	94	128	135	112	117	133
North Eastern	n.a.	n.a.	n.a.	65	n.a.	91
Residence:						
Urban	57	46	55	n.a.	59	61
Rural	59	65	74	n.a.	73	79
Gender:						
Males	63	67	75	n.a.	75	84
Females	54	59	67	n.a.	65	67
National	59	62	71	77	73	77

SOURCES: Mahapatra; WHOSIS.

Accessibility



- **Media:** # of formats in which data are released
- **Metadata:** availability & quality of documentation
- **User service:** availability & responsiveness of user service

SOURCES: Mahapatra.

SOURCES: Statistics South Africa. Mortality and causes of death in South Africa, 2009: Findings from death notification. Statistical release P0309.3. (p16)

Example of Mahapatra Framework: South Africa Death Notification Data, 2009

General vital statistics		Cause-of-death statistics	
Criteria and indicators	**Measure**	**Criteria and indicators**	**Measure**
Accuracy (%)		**Accuracy**	
Completeness of death registration	93%	Proportion of deaths that occurred in healthcare facilities	48,6%
Missing data		Proportion of deaths assigned to symptoms and signs of disease not elsewhere classified	13,7%
Population group	26,2%		
Province of birth	21,8%		
Province of residence	10,0%		
Age	0,2%		
Sex	0,2%		
Relevance		**Relevance**	
Routine tabulations by sex and 5-year age groups	100%	Routine tabulation by sex and 5-year age groups	100%
Deaths in children under five years tabulated by 0 and 1-4 year age group	100%	Number of cause-of-death tabulation areas	9 Provinces and 52 district municipalities
Comparability		**Comparability**	
Stability of key definitions over time	100%	Consistency of cause specific mortality proportions over consecutive years	100%
Uniformity of definitions across areas	100%	ICD coding for certification and coding of causes of deaths, revision used and code level to which tabulations are published	No coding for certification; coding causes of death using the tenth revision at 3-digit level
Timeliness			
Processing time	18 months		
Mean time from end of reference period to publication	Two years		
Accessibility			
Media – number of formats in which data are released	Two: website and compact discs		
Metadata	Published with compact disc and available on request		
Availability of user service	Email: info@statssa.gov.za / Tel: 012 310 8600 / Fax (012) 310 8500 / 8495		

Review: Quality of Vital Statistics Data

- **Accuracy**
  - **Vital Statistics**
  - **Civil Registration**
- **Timeliness**
- **Comparability**
- **Relevance**
- **Accessibility**

Assessing the Quality of Mortality Data: 10 step process

1) Prepare basic tabulations of deaths by age, sex and cause of death
2) Review crude death rates
3) Review age and sex-specific death rates
4) Review the age distribution of deaths
5) Review child mortality rates
6) Review the distribution of major causes of death
7) Review age patterns of major causes of death
8) Review leading causes of death
9) Review ratio of noncommunicable to communicable disease deaths

SOURCES:
World Health Organization (2011). *Analysing mortality levels and causes of death (ANACoD) Electronic Tool*. Department of Health Statistics and Information Systems. Geneva, World Health Organization. Available from healthstat@who.int (ANACoD)
AbouZahr C, Mikkelsen L, Rampatige R, and Lopez A. Mortality statistics: a tool to improve understanding and quality. Health Information Systems Knowledge Hub, University of Queensland. Working Paper Series 13. November 2010. http://www.uq.edu.au/hishub/wp13 (UQ Working Paper 13)

WHO recommends the use of the International Form of Medical Certification of Cause of Death to document the **underlying cause of death**

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) Traumatic shock	.....
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) Internal injuries	.....
	due to (or as a consequence of)	
	(c) Pedestrian hit by car	.....
	due to (or as a consequence of)	
	(d)	.....
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	..... AIDS	.....
	.....	.....

*This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.

International Statistical Classification of Diseases and Related Health Problems: 10th Revision (ICD-10)

includes natural causes & external causes of death

Chapter	Blocks	Title
I	A00-B99	Certain infectious and parasitic diseases
II	C00-D48	Neoplasms
III	D50-D89	Diseases of the blood and blood-forming organs…
IV	E00-E90	Endocrine, nutritional and metabolic diseases
V	F00-F99	Mental and behavioral disorders
VI	G00-G99	Diseases of the nervous system
VII	H00-H59	Diseases of the eye and adnexa
VIII	H60-H95	Diseases of the ear and mastoid process
IX	I00-I99	Diseases of the circulatory system
X	J00-J99	Diseases of the respiratory system
XI	K00-K93	Diseases of the digestive system
XII	L00-L99	Diseases of the skin and subcutaneous tissue
XIII	M00-M99	Diseases of the musculoskeletal system and connective tissue
XIV	N00-N99	Diseases of the genitourinary system
XV	O00-O99	Pregnancy, childbirth and the puerperium
XVI	P00-P96	Certain conditions originating in the perinatal period
XVII	Q00-Q99	Congenital malformations, deformations and chromosomal abnormalities
XVIII	R00-R99	Symptoms, signs and abnormal clinical and laboratory findings…
XIX	S00-T98	Injury, poisoning and certain other consequences of external causes
XX	V01-Y98	External causes of morbidity and mortality
XXI	Z00-Z99	Factors influencing health status and contact with health services
	IU00-U99	Codes for special purposes

ANACoD:

Analysing mortality levels & cause-of-death data

- An electronic tool to automate the 10 step process
- Step-by-step tool for analysis of data on mortality levels and cause of death
- Developed by:
  - WHO
  - The University of Queensland Health Info. Systems Knowledge Hub
  - Health Metrics Network (financial support)

SOURCES FOR ANACoD SLIDES:
(ANACoD) World Health Organization (2011). Analysing mortality levels and causes of death (ANACoD) Electronic Tool. Department of Health Statistics and Information Systems. Geneva, World Health Organization. Available from healthstat@who.int.;
(UQWP13) AbouZahr C, Mikkelsen L, Rampatige R, and Lopez A. Mortality statistics: a tool to improve understanding and quality. Health Information Systems Knowledge Hub, University of Queensland. Working Paper Series 13. November 2010.

Health Information Systems Knowledge Hub
School of Population Health
University of Queensland

World Health Organization

HMN

ANACoD version 1.1
Analysing mortality level and cause-of-death data

Click on the buttons to select analysis

Step by step core analyses			
	Input data: raw mortality data by age, sex and ICD10 3 or 4 character codes; population by age and sex		Distribution of deaths according to the Global Burden of Disease list
	Basic check of input data		Age pattern of broad groups of causes of deaths
	Crude death rates		Leading causes of death
	Age- and sex-specific death rates		Ratio of non-communicable to communicable causes of death
	Age distribution of deaths		Ill-defined causes of death
	Child mortality rates		Summary of analyses
Supplementary analyses			
	Age pattern of individual cause of death		Age-specific death rates of individual cause of death
Background information			
	About the tool		List of ICD-10 codes valid for underlying causes of death
	Global Burden of Disease cause categories and ICD-10 codes		

Health Information Systems Knowledge Hub
School of Population Health
University of Queensland

World Health Organization

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ANACoD version 1.1
Analysing mortality level and cause-of-death data

Click on the buttons to select analysis

Step by step core analyses

INPUT DATA

- Input data: raw mortality data by age, sex and ICD10 3 or 4 character codes; population by age and sex
- Basic check of input data

MORTALITY LEVELS ANALYSIS

- Crude death rates
- Age- and sex-specific death rates
- Age distribution of deaths
- Child mortality rates

CAUSES OF DEATH ANALYSIS

- Distribution of deaths according to the Global Burden of Disease list
- Age pattern of broad groups of causes of deaths
- Leading causes of death
- Ratio of non-communicable to communicable causes of death
- Ill-defined causes of death
- Summary of analyses

Supplementary analyses

- Age pattern of individual cause of death
- Age-specific death rates of individual cause of death

Background information

- About the tool
- Global Burden of Disease cause categories and ICD-10 codes
- List of ICD-10 codes valid for underlying causes of death

Getting Started

Open Excel file: *ANACoD version 1.1 2013Feb_blank.xls*

- Enable macros

Go to sheet "step0-Input data"

- Enter information at top of page:
  - Country: Colombia
  - Year: 2009
  - Source of data: Civil registration
  - ICD level used: ICD-10, 4-character codes
- Input data from Excel file: *Country Data_Anacod.xlsx*
  - Copy "Population" data; paste into ANACoD tool, starting in E14
  - Copy "Deaths: data; paste into ANACoD tool, starting in C20

ANACoD - PART I: INPUT DATA

Step 0 - Input data: raw mortality data by age and sex and ICD 3 or 4 character codes; population data by sex and age

Population

Sex	All ages	0 year	1-4 year	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	30-34 years	35-39 years
1=male	22464882	466526	1828674	2250657	2240827	2201572	2050933	1894170	1707701	1510151
2=female	23189162	446815	1753044	2160252	2155587	2130962	2019554	1912832	1774594	1612906

Number of deaths

Cause in ICD	Sex	All ages	0 year	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	30-34 years	35-39 years
A010	2	1	0	0	0	0	0	0	0	0	0
A020	1	3	1	0	0	0	0	0	0	0	0
A020	2	2	0	0	0	0	0	1	0	0	0
A021	1	1	1	0	0	0	0	0	0	0	0
A021	2	2	1	0	0	0	0	0	0	0	0
A039	2	1	0	0	0	1	0	0	0	0	0
A042	1	1	0	0	0	0	0	0	0	0	0
A046	2	1	0	0	0	0	0	0	0	0	0
A047	1	12	6	2	0	0	1	0	0	0	0
A047	2	7	2	2	0	0	0	0	0	0	0
A049	1	12	1	3	0	0	0	0	0	0	0
A049	2	8	1	0	0	0	0	0	0	1	0
A059	1	2	0	0	0	0	0	0	1	0	0
A060	1	1	0	0	0	0	0	0	0	0	0
A060	2	2	0	0	0	0	0	0	0	0	0
A061	2	1	0	0	0	0	0	0	0	0	0

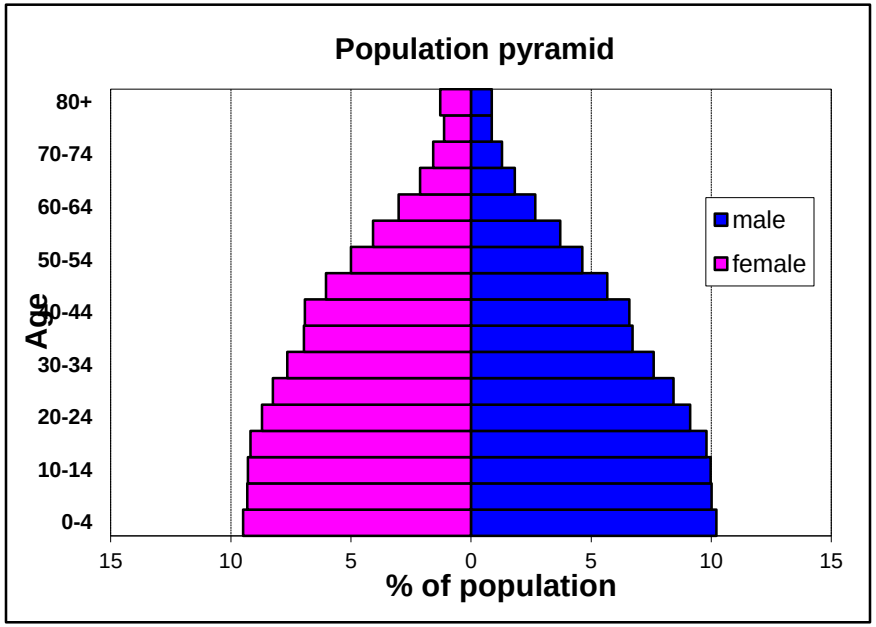
ANACoD - PART I: INPUT DATA

Step 1 - Basic check of input data

Population: The entered data automatically generate a table and population pyramid (discussed further in Step 2).

1. Population

Age-group (yrs)	Population	
	male	female
All ages	22 464 882	23 189 162
0	466 526	446 815
1-4	1 828 674	1 753 044
5-9	2 250 657	2 160 252
10-14	2 240 827	2 155 587
15-19	2 201 572	2 130 962
20-24	2 050 933	2 019 554
25-29	1 894 170	1 912 832
30-34	1 707 701	1 774 594
35-39	1 510 151	1 612 906
40-44	1 479 874	1 603 908
45-49	1 275 551	1 399 558
50-54	1 040 753	1 158 799
55-59	833 936	945 156
60-64	600 560	697 959
65-69	408 106	492 649
70-74	289 037	366 559
75-79	193 494	261 311
80+	192 360	296 717



Any non-zero numbers indicate age groups for which country data are not consistent.

ANACoD - PART I: INPUT DATA

Step 1 - Basic check of input data

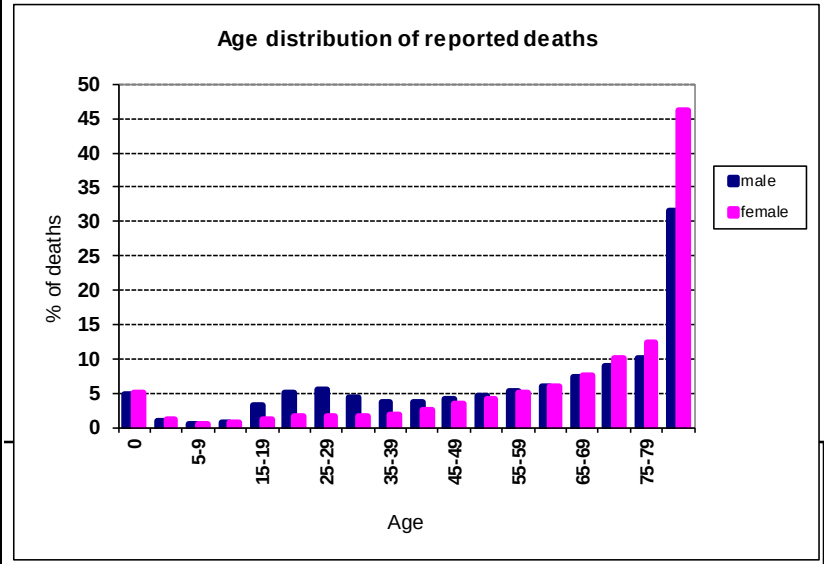
sex	all ages	0	1-4	5-9	10-14	15-19	20-24	...
No deaths in "AAA": all causes								
m	113327	5333	1121	629	848	3604	5622	...
f	83354	4225	931	469	523	1042	1255	...
Sum of deaths in all other codes								
m	113327	5333	1121	629	848	3604	5622	...
f	83354	4225	931	469	523	1042	1255	...
Difference: should be zero								
m	0	0	0	0	0	0	0	...
f	0	0	0	0	0	0	0	...

An attempt should be made to query and correct the specific death certificate.

See cite slide 54.

2.2 Distribution of total death

Age-group (yrs)	No of deaths		Percentage of total deaths	
	male	female	male	female
All ages	113 327	83 354		
0	5 368	4 234	4.7	5.1
1-4	1 128	933	1.0	1.1
5-9	633	470	0.6	0.6
10-14	854	524	0.8	0.6
15-19	3 628	1 044	3.2	1.3
20-24	5 659	1 258	5.0	1.5
25-29	6 112	1 289	5.4	1.5
30-34	4 863	1 361	4.3	1.6
35-39	4 197	1 582	3.7	1.9
40-44	4 187	2 117	3.7	2.5
45-49	4 646	2 791	4.1	3.3
50-54	5 129	3 525	4.5	4.2
55-59	6 046	4 132	5.3	5.0
60-64	6 808	4 863	6.0	5.8
65-69	8 366	6 323	7.4	7.6
70-74	9 990	8 396	8.8	10.1
75-79	11 431	10 206	10.1	12.2
80+	24 281	28 307	31.5	46.2



ANACoD - PART I: INPUT DATA

Step 1 - Basic check of input data

Look for expected patterns:
Deviations may indicate errors in age or sex information.

2.2 Distribution of total death

Age-group (yrs)	No of deaths		Percentage of total deaths	
	male	female	male	female
All ages	113 327	83 354		
0	5 368	4 234	4.7	5.1
1-4	1 128	933	1.0	1.1
5-9	633	470	0.6	0.6
10-14	854	524	0.8	0.6
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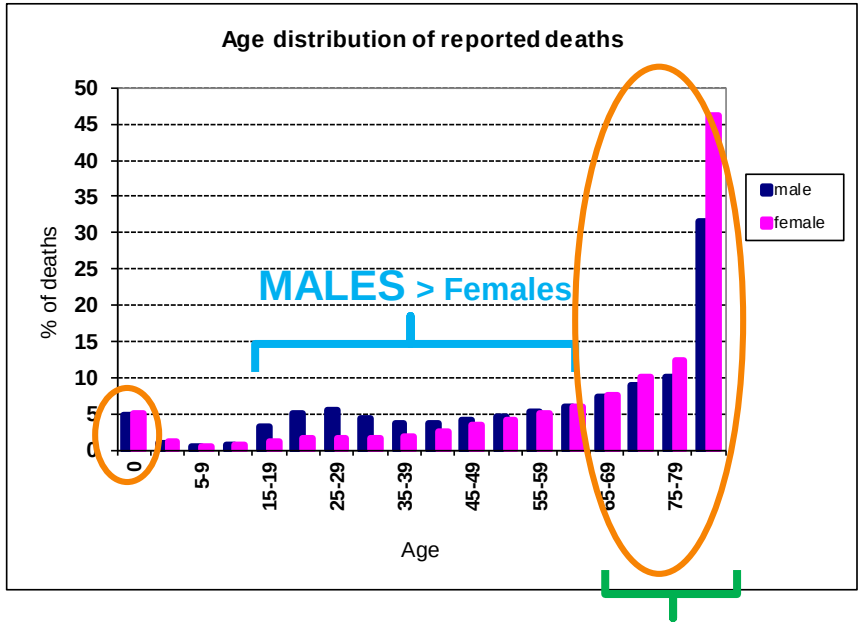


- **Higher percentages in the 0 and 65+ age groups**
- **Higher percentages for males compared to females in the 15-64 age groups, due to a higher number of deaths from external causes**
- **Higher percentages for females compared to males in the oldest age groups**

ANACoD - PART I: INPUT DATA

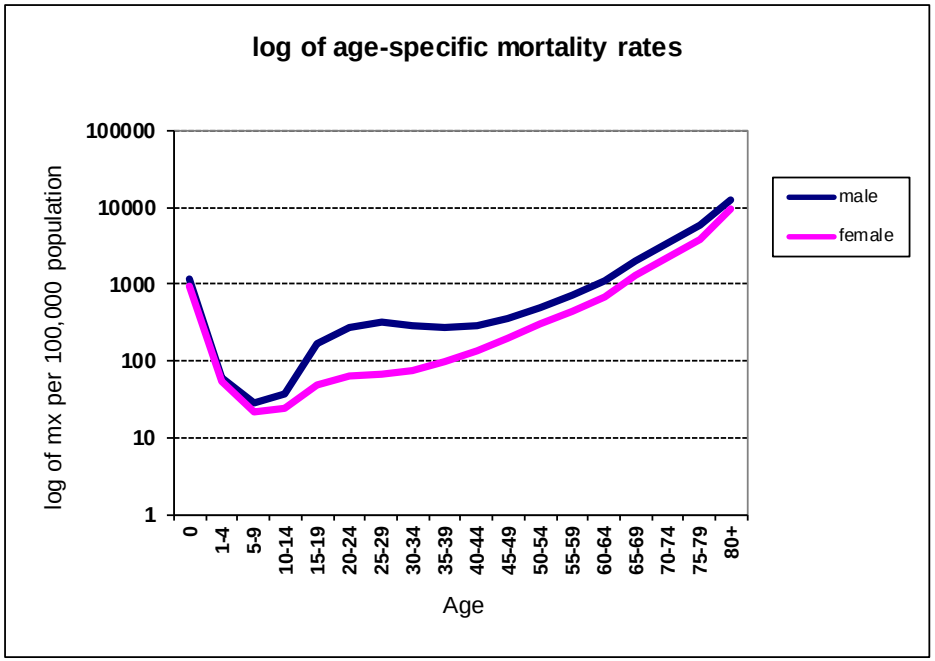
Step 1 - Basic check of input data

Check for standard patterns:

- ***Generally higher rates of male versus female mortality.***
- ***Smooth, increasing lines after age 35 years.***

2.3 Age-specific mortality rate

Age-group (yrs)	Age-specific mortality rate per 100 000 (m_x)	
	male	female
0	1 151	948
1-4	62	53
5-9	28	22
10-14	38	24
15-19	165	49
20-24	276	62
25-29	323	67
30-34	285	77
35-39	278	98
40-44	283	132
45-49	364	199
50-54	493	304
55-59	725	437
60-64	1 134	697
65-69	2 050	1 283
70-74	3 456	2 290
75-79	5 908	3 906
80+	12 623	9 540



ANACoD - PART I: INPUT DATA

Step 1 - Basic check of input data

Checking for invalid ICD codes -- All cells should contain a "0" or "0%."

2.4 Deaths (in years) labelled with codes not valid for underlying cause of death according to ICD10

2 cases: Deaths with ICD10 codes that should not be used for causes of deaths.
Codes not existing in ICD10.

	sex	all ages	0	1-4	5-9	10-14	15-19	
No	m	0	0	0	0	0	0	
	f	0	0	0	0	0	0	
As % of total	m	0%	0%	0%	0%	0%	0%	...
	f	0%	0%	0%	0%	0%	0%	...

ICD10 — Go to the list of valid ICD10 codes for underlying causes of deaths

Go — Go to step1-Input data sheet, column AB flags non valid codes

Click to see a list of valid ICD codes for underlying cause of death or to see where non valid codes are flagged.

ANACoD - PART I: INPUT DATA

Step 1 - Basic check of input data

2.5 Cause, age, sex specific check

Includes invalid codes

Sex specific codes. Pink: female only, blue: male only		
ICD	**Disease**	**No of deaths**
O00-O99	Pregnancy, child birth and the puerperium - male	0
C53	Cervix uteri cancer - male	0
C54-C55	Corpus uteri cancer - male	0
C56	Ovary cancer - male	0
C61	Prostate cancer - female	0
N40	Benign prostatic hypertrophy - female	0
Pls check if sum is not equal to zero --->		0

Diseases unlikely to cause death		
ICD	**Disease**	**No of deaths**
F32-F33	Unipolar major depression	3
F43	Post-traumatic stress disorder	0
F42	Obsessive-compulsive disorders	0
NA in ICD103	Panic disorder	0
F51	Sleep disorders	0
G43	Migraine	0
F70-F79	Mental Retardation	5
NA in ICD103	Presbyopia	0
H90-H91	Deafness	0
K02	Dental caries	0
Pls check if sum is not equal to zero --->		8

An attempt should be made to query and correct the death certificate for any deaths listed in these columns that indicate unlikely disease/sex combinations or unlikely causes of death.

ANACoD - PART I: INPUT DATA

Step 1 - Basic check of input data

2.5 Cause, age, sex specific check

Includes invalid codes

Disease-Age-specific check: for some diseases, ages unlikely to have deaths,			
ICD	**Disease**	**Ages**	**No of deaths**
O00-O99	**Maternal conditions**	<10&> 54yr	0
P00-P96	**Conditions arising during the perinatal period**	> 4yr	28
P05-P07	Prematurity and low birth weight	> 4yr	0
P03, P10-P15, P20-P29	Birth asphyxia and birth trauma	> 4yr	23
P00-P02, P04, P08, P35-P96	Other conditions arising during the perinatal period	> 4yr	5
C00-C97	**Malignant neoplasms**		
C00-C20	Mouth and oropharynx cancers	0-4yr	0
C15	Oesophagus cancer	0-4yr	0
C16	Stomach cancer	0-4yr	0
C18-C21	Colon and rectum cancers	0-4yr	0
C22	Liver cancer	0-4yr	3
C25	Pancreas cancer	0-4yr	0
C33-C34	Trachea, bronchus and lung cancers	0-4yr	3
C43-C44	Melanoma and other skin cancers	0-4yr	0
C50	Breast cancer	0-4yr	0
C53	Cervix uteri cancer	0-9yr	1
C54-C55	Corpus uteri cancer	0-9yr	1
C56	Ovary cancer	0-9yr	0
C61	Prostate cancer	0-9yr	0
C67	Bladder cancer	0-4yr	1
C81-C90, C96	Lymphomas and multiple myeloma	0-4yr	13
C91-C95	Leukaemia	0-4yr	0
I00-I99	**Cardiovascular diseases**		
I01-I09	Rheumatic heart disease	0-4yr	3
I10-I13	Hypertensive disease	0-4yr	1
I20-I25	Ischaemic heart disease	0-4yr	23
I60-I69	Cerebrovascular disease	0-4yr	59
I30-I33, I38, I40, I42	Inflammatory heart diseases	0-4yr	74
N40	Benign prostatic hypertrophy	0-34yr	0
X60-X84	Self-inflicted injuries	0-4yr	0

An attempt should be made to query and correct the death certificate for any deaths listed in this column that indicates an unlikely disease/age combination.

Steps 2-5

Focus on simple steps to assess the plausibility of the mortality levels.

The tool compiles and formats the raw data to enable the calculation of:

- crude death rates
- age-specific mortality rates
- life expectancy at birth
- child mortality

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 2: Crude death rates (CDR)

Enables users to:

- Calculate the CDR and use the country's population pyramid to helps in the interpretation of the CDR

$$\text{Crude death rate} = \frac{\text{Number of deaths in resident population in given year}}{\text{Size of the midyear resident population in that year}} \times 1000$$

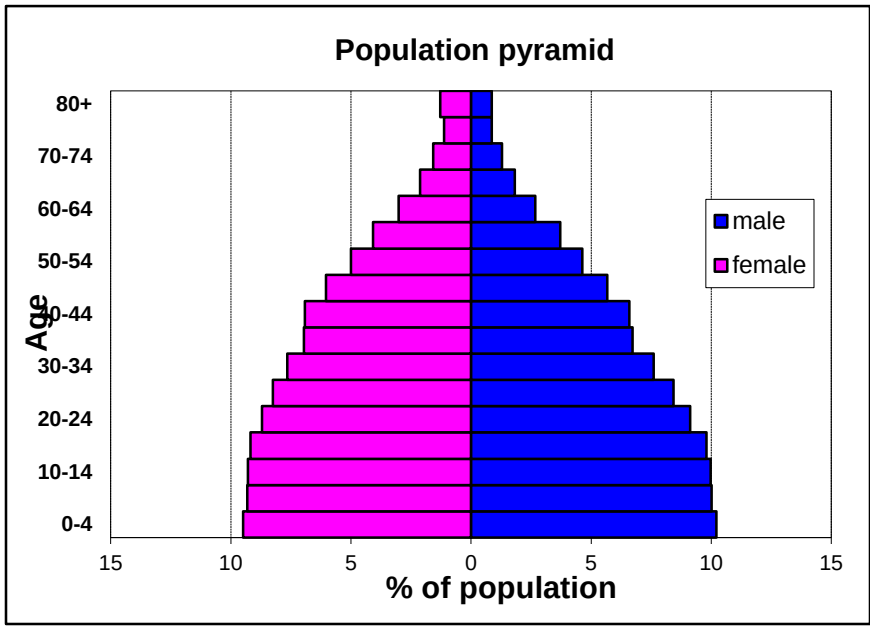
- Use the CDR as an approximate indicator of completeness of death registration
- Compare the CDR to the expected CRD based on life expectancy and population growth rates

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 2: Crude death rates

Population data to aid in interpretation of crude death rates:

Age-group (yrs)	No of deaths		Population	
	male	female	male	female
All ages	113 327	83 354	22 464 882	23 189 162
0	5 368	4 234	466 526	446 815
1-4	1 128	933	1 828 674	1 753 044
5-9	633	470	2 250 657	2 160 252
10-14	854	524	2 240 827	2 155 587
15-19	3 628	1 044	2 201 572	2 130 962
20-24	5 659	1 258	2 050 933	2 019 554
25-29	6 112	1 289	1 894 170	1 912 832
30-34	4 863	1 361	1 707 701	1 774 594
35-39	4 197	1 582	1 510 151	1 612 906
40-44	4 187	2 117	1 479 874	1 603 908
45-49	4 646	2 791	1 275 551	1 399 558
50-54	5 129	3 525	1 040 753	1 158 799
55-59	6 046	4 132	833 936	945 156
60-64	6 808	4 863	600 560	697 959
65-69	8 366	6 323	408 106	492 649
70-74	9 990	8 396	289 037	366 559
75-79	11 431	10 206	193 494	261 311
80+	24 281	28 307	192 360	296 717



CDR as approximate indicator of completeness of death registration:

≥ 90% is defined as "good" by UN standards.

Completeness of civil registration data is estimated by dividing the reported deaths by the UN estimates* => 78%

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

CDRs < 5.0 are suspiciously low and indicate under-reporting.

Step 2: Crude deaths rates

Observed					
Crude death rate per 1000 population	**Both sexes**	**4.3**	**Life expectancy at birth (years)**	**Both sexes**	**77.2**
	Males	***5.0***		Males	**73.6**
	Females	***3.6***		Females	**80.8**
% Annual rate of population growth (UN*)	**Both sexes**	**1.46**			
	Males	**1.43**			
	Females	**1.48**			

**UN source: United Nations, World Population Prospects the 2010 revision*

Compare the observed CDR to the expected CRD based on life expectancy and population growth rates

Expected crude death rates at different levels of life expectancy and population growth (based on Coale-Demeny West model)

Male	Annual rate of population growth (percent)									
Life expectancy at birth (years)	5	3	2.5	2	1.5	1	0.5	0	-0.5	-1
40	26.7	23.6	23.2	23.1	23.1	23.4	24.1	25.0	26.3	27.9
45	20.8	19.0	18.9	19.1	19.4	20.1	21.0	22.2	23.8	25.7
50	16.0	15.2	15.4	15.8	16.4	17.3	18.5	20.0	21.8	24.0
55	12.0	12.1	12.5	13.1	14.0	15.1	16.5	18.2	20.2	22.6
60	8.7	9.5	10.1	10.9	11.9	13.2	14.8	16.7	18.9	21.4
65	5.9	7.3	8.0	9.0	10.2	11.6	13.3	15.4	17.7	20.4
70	3.8	5.6	6.4	7.4	8.7	***10.2***	12.1	14.3	16.8	19.6
75	2.3	4.2	5.1	6.2	7.6	9.2	11.1	13.3	15.9	18.8

Female	Annual rate of population growth (percent)									
Life expectancy at birth (years)	5	3	2.5	2	1.5	1	0.5	0	-0.5	-1
40	27.4	24.1	23.6	23.4	23.6	24.1	24.1	25.0	26.2	27.8
45	21.6	19.5	19.3	19.4	19.6	20.2	21.1	22.2	23.7	25.6
50	16.8	15.7	15.8	16.1	16.7	17.5	18.6	20.0	21.8	23.9
55	12.7	12.5	12.9	13.4	14.2	15.2	16.5	18.2	20.2	22.5
60	9.4	9.9	10.4	11.1	12.1	13.3	14.8	16.7	18.8	21.3
65	6.6	7.7	8.4	9.2	10.3	11.7	13.4	14.8	16.7	19.5
70	4.3	5.8	6.6	7.6	8.8	10.4	12.2	14.3	16.7	19.5
75	2.6	4.4	5.2	6.3	7.6	9.2	11.1	13.3	15.9	18.8
80	1.5	3.4	4.2	5.3	6.7	***8.3***	10.2	12.5	15.1	18.1

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 3. Age and sex-specific death rates

Enables users to:

- Calculate the mortality rate specific to a population age group (usually a five-year grouping), known as the ***age-specific mortality rate*** (ASMR)

$$\text{ASMR} = \frac{\text{deaths in a specific age group in a population during a specified time period}}{\text{total mid-year population in the same age group, population and time period}} \times 100\,000$$

- Compare relative age patterns in ASMR for country to expected global patterns to identify potential under registration at certain ages

- Compare patterns in male:female ASMR ratio to countries with various infant mortality rates to identify issues with completeness of registration

- Look for deviations in expected patterns of the log ASMR to indicate under-reporting at certain ages or mis-reporting of correct age of death

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 3. Age and sex-specific death rates

Compare relative age patterns to expected patterns in ASMR: ***Deviations may indicate under-registration in certain age groups and/or missing age or sex information.***

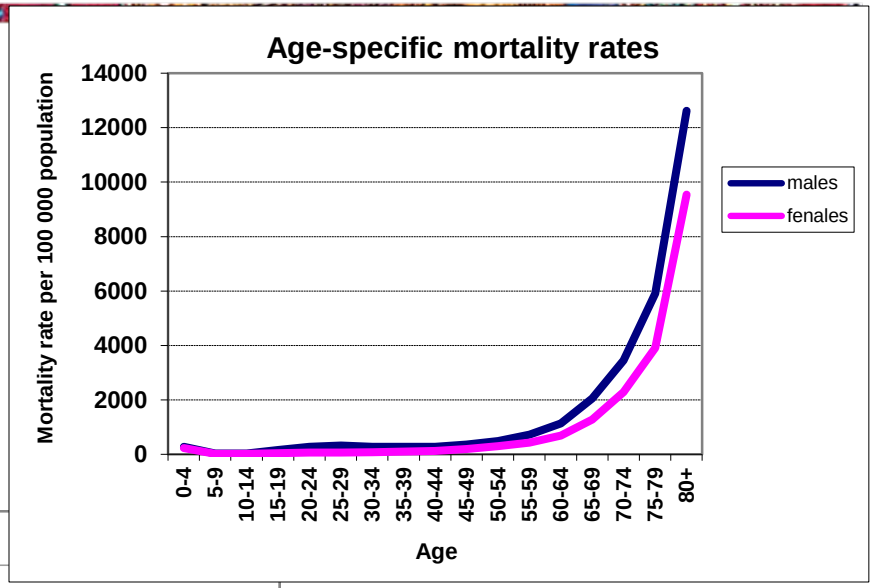
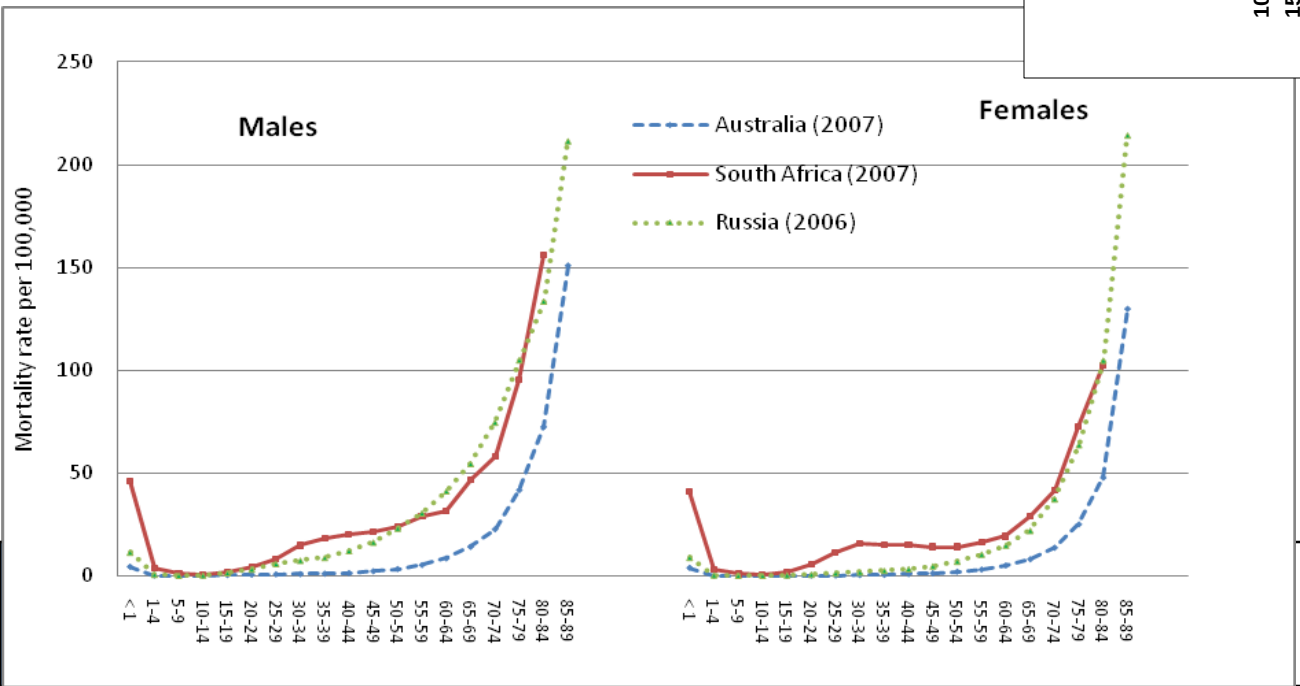


Figure 3: ASMR for Australia, Russia and South Africa, males and females, 2000 (ANACoD)

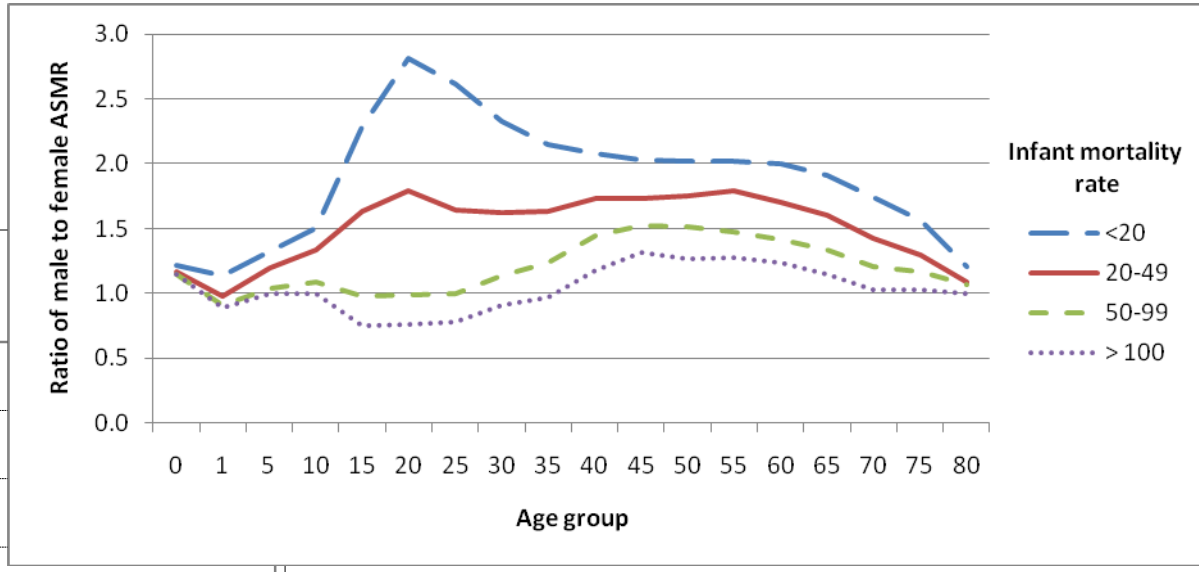


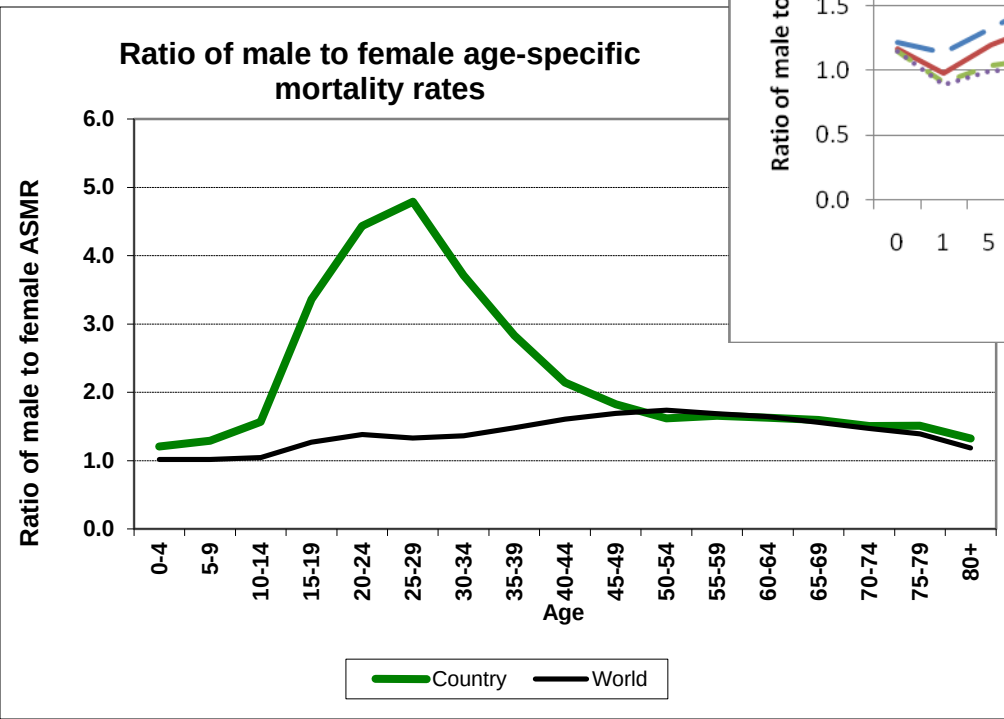
ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 3. Age and sex-specific death rates

Compare patterns in ratio of male:female ASMR: ***Deviations may indicate country abnormalities or under-registration.***

Figure 5: Ratio of male to female age-specific mortality rates at different levels of infant mortality *(expected patterns)*





IMR* = 16.0 per 1 000 live births

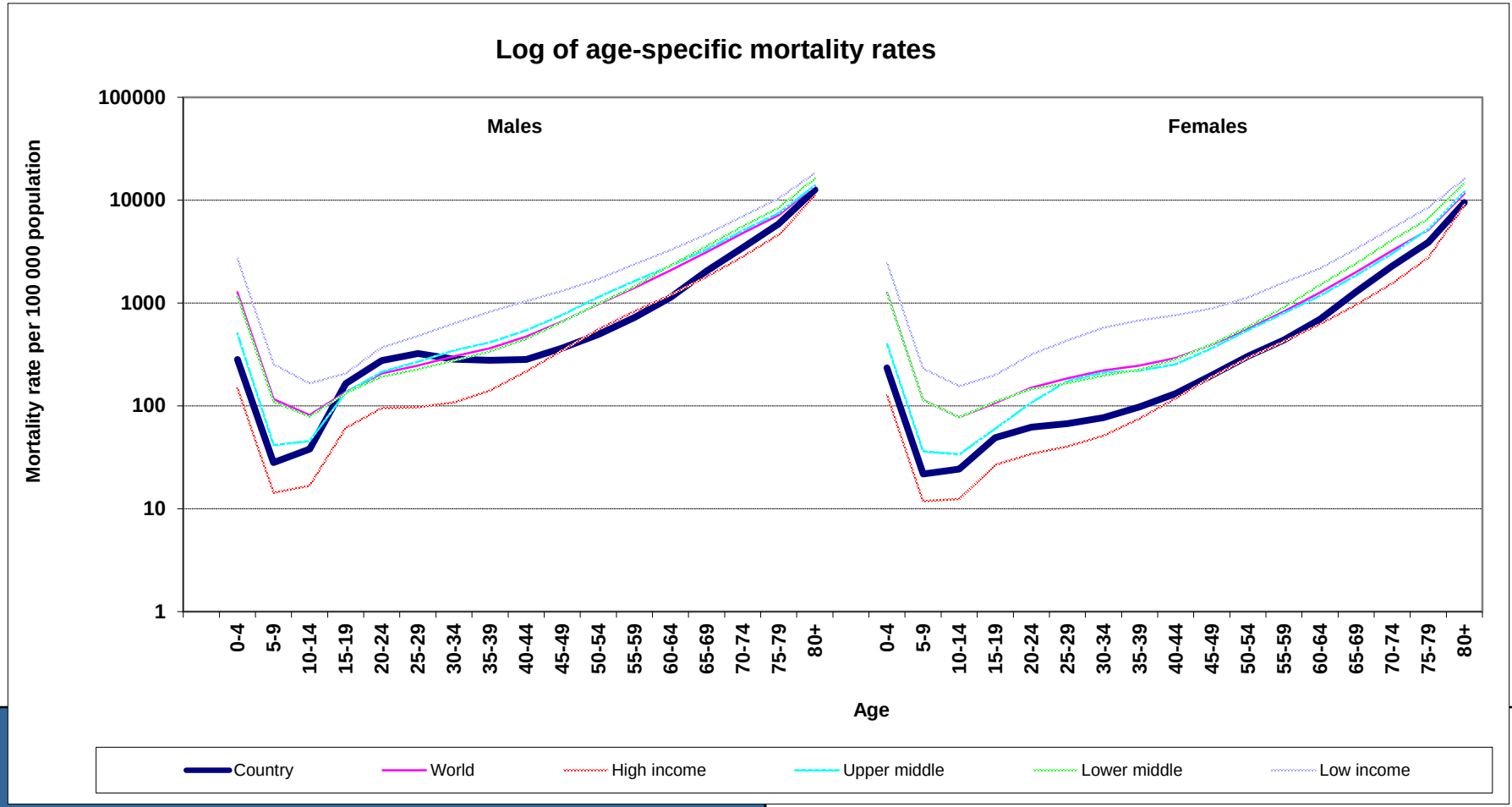
(WHO Global Health Observatory; 2010)

* From a source independent of the value from the data being assessed.

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 3. Age and sex-specific deaths rates

Look for deviations in the expected patterns of the log ASMR: ***Deviations may indicate systematic underreporting at a given age.***



ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 4: Review the age distribution of deaths

Enables users to:

- Examine the *age distribution* of reported deaths
- Compare the calculated distribution of deaths to expected distributions corresponding to:
  - Country income group (ANACoD guidance)
  - Country infant mortality rate (UQ Working Paper 13)

Step 4: Review the age distribution of deaths

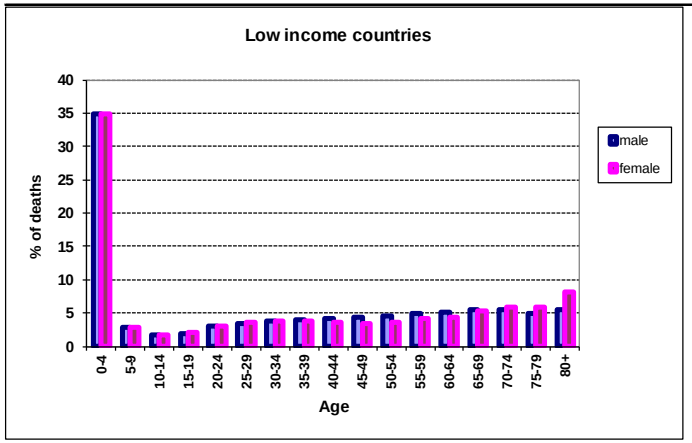
Look for expected patterns in age-specific mortality:

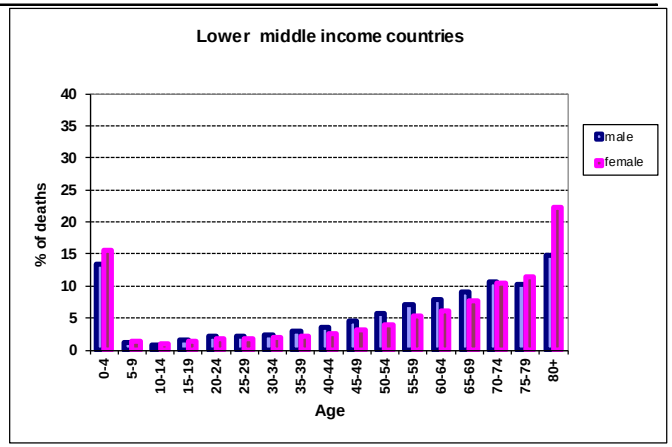
Deviations may indicate selective bias in age-specific death reporting.

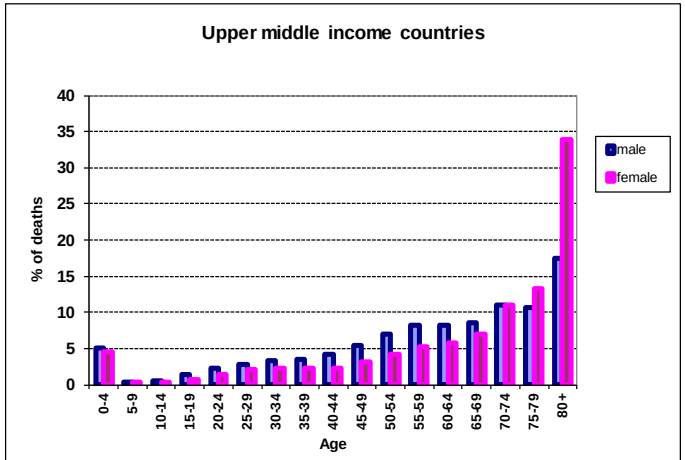
- **MALE >** female mortality, except in oldest age groups
  - In countries with *low income/high infant mortality*, female rates may be comparable to male rates.

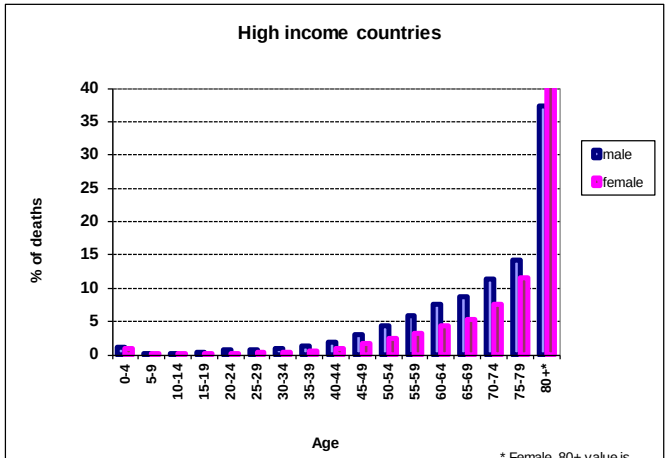
- Peak in overall mortality in:
  - 0-4 years
    (less so in countries with *high income/low infant mortality*)
  - Oldest age groups
    (less so in countries with *low income/high infant mortality*)

- Peak in male mortality between 15-44 years due to external causes





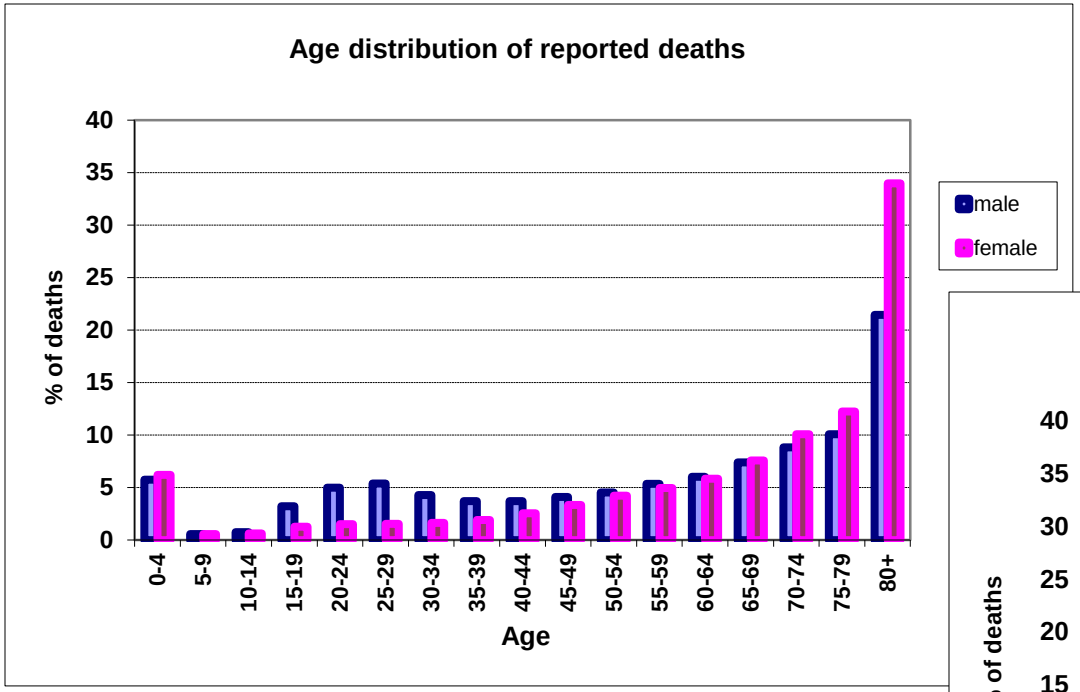


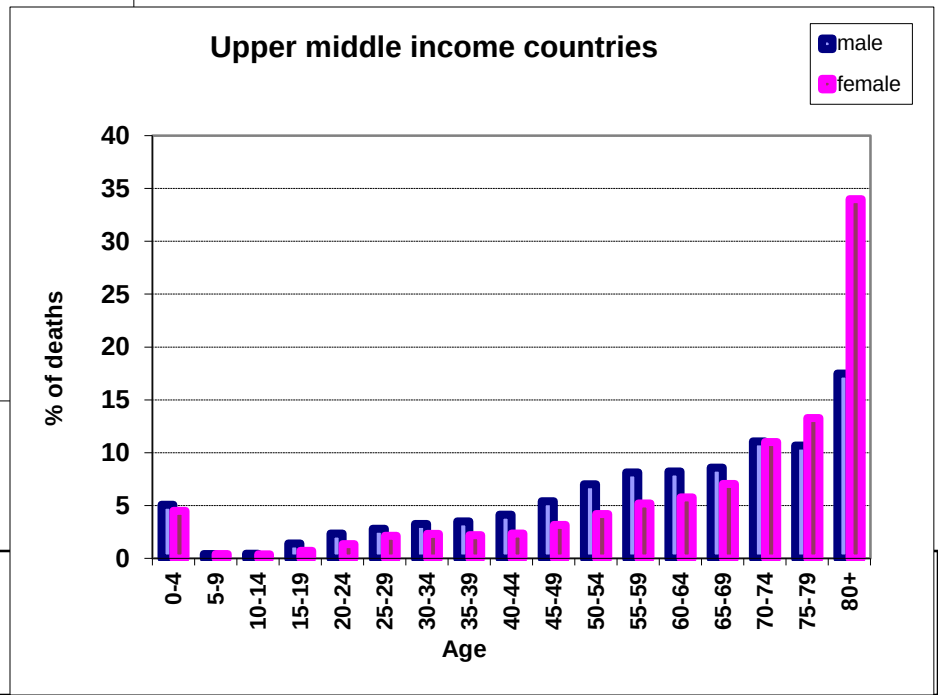


ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 4: Review the age distribution of deaths

Compare the calculated distribution of deaths to expected distributions corresponding to: country income group

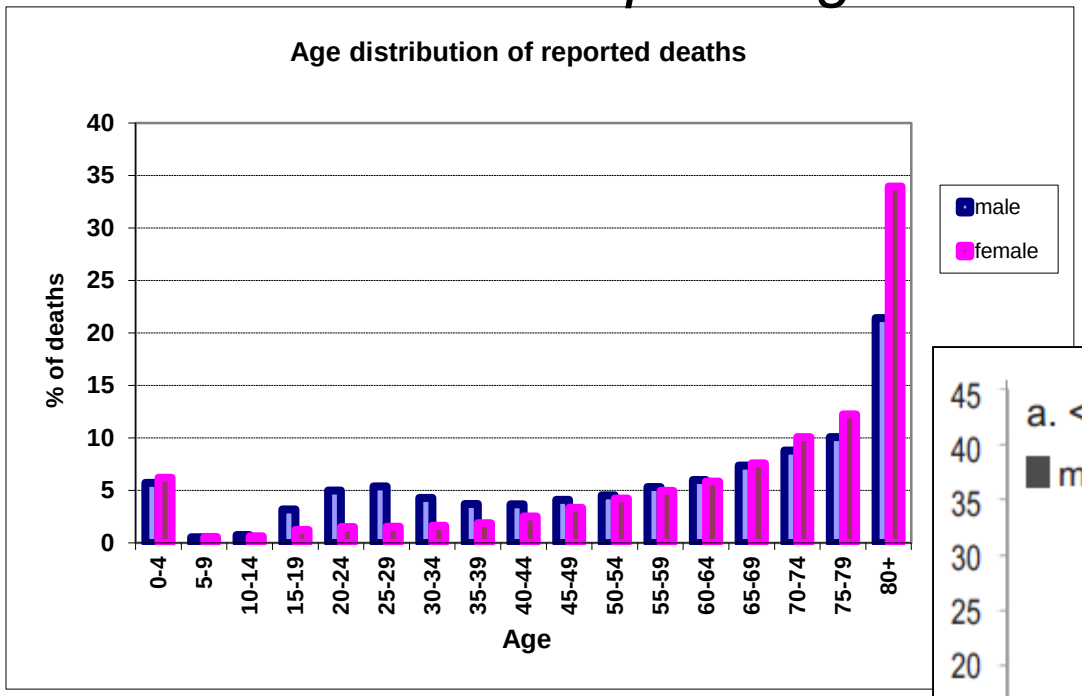


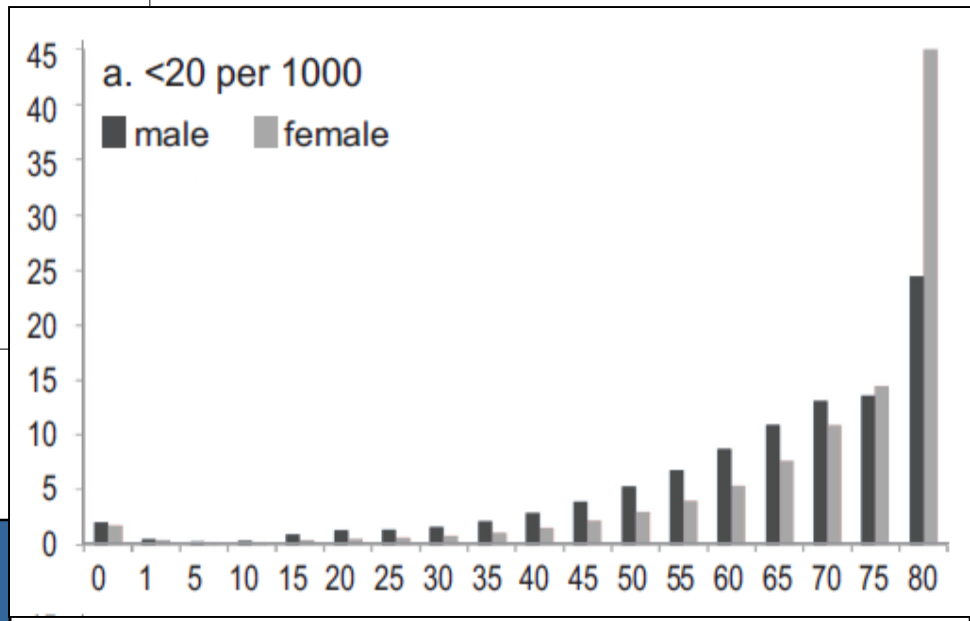


ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 4: Review the age distribution of deaths

Compare the calculated distribution of deaths to expected distributions corresponding to: infant mortality group





ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 5: Child mortality rates

Enables users to:

- Calculate & interpret indicators of under-five mortality
  - Infant mortality rate (ANACoD, UQWP13)

    Probability (per 1,000 live births) of a child born in a specified year dying before reaching the age of 1 if subject to current ASMRs
  - Under 5 mortality rate (ANACoD, UQWP13)

    Probability (1,000 live births) of a child born in a specified year dying before reaching the age of 5 if subject to current ASMRs
  - Neonatal mortality rate (UQWP13)
  - Post neonatal mortality rate (UQWP13)
- Use under-five mortality indicators from various sources to analyze the quality of mortality data

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Calculate indicators of under-five mortality:

Step 5: Child mortality rates

1. Child deaths by age and calculation of mortality indicators:
Data from Civil registration, 2009

x	n	Population	Deaths	$_nm_x$	$_nq_x$
0	1	913341	9601.941	0.0105	0.0104
1	4	3581718	2061.323	0.0006	0.0023

Infant mortality rate per 1000 live births	= 1000* $_1q_0$	==>**10.4**
Under-5 mortality rate per 1000 live births	= 1000*[1-(1-$_1q_0$)(1-$_4q_1$)]	==>**12.7**

x = beginning of the age interval

n = number of years in the interval

Population = from entered data; sum of male and female population in Step 2.

Deaths = from entered data; sum of male and femal deaths in Step 2.

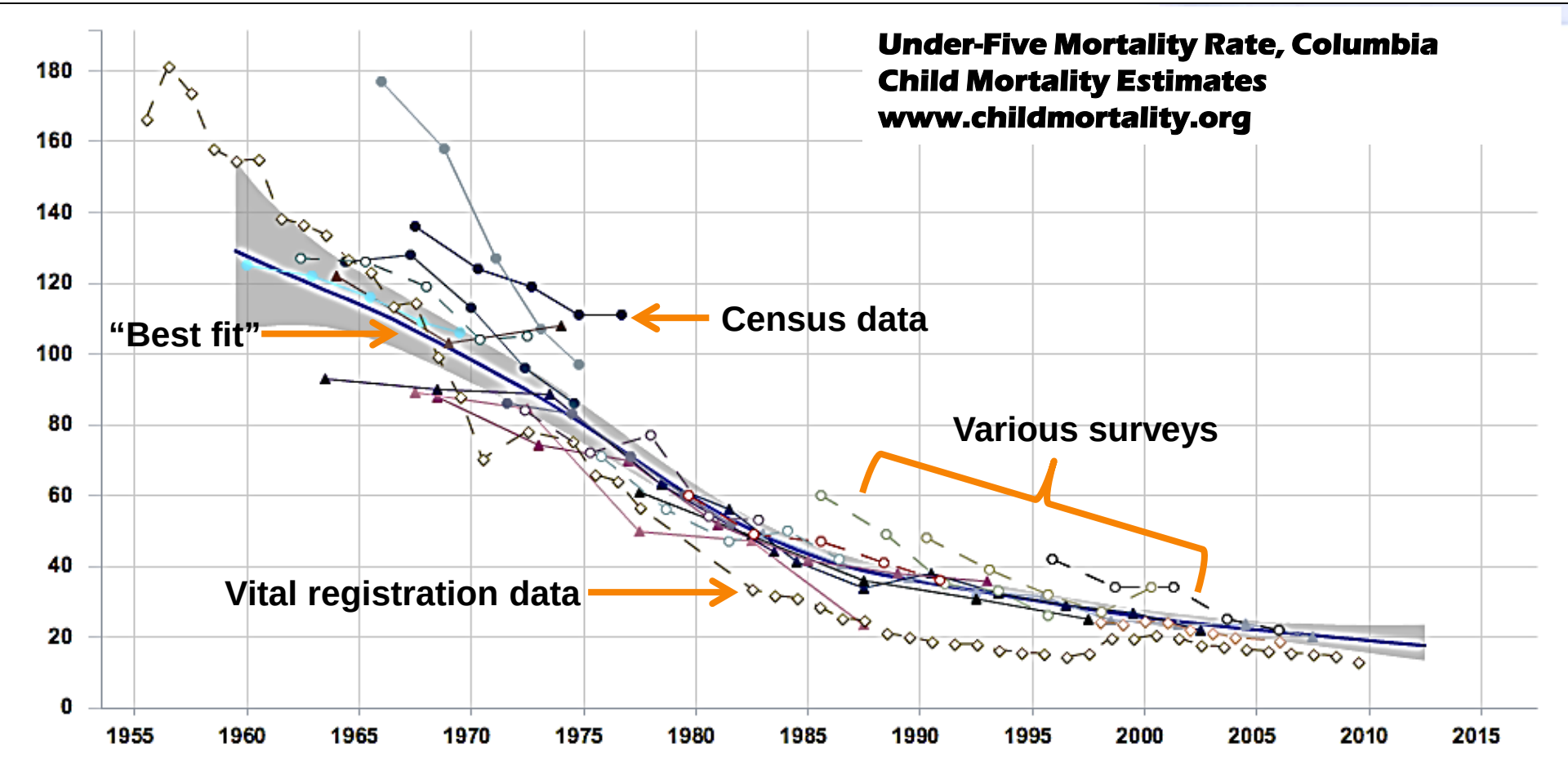
$_nm_x$ = mortality rate (ASMR) for age x to age n; Deaths/Population.

$_nq_x$ = probability of a child dying between age x and age n; automatically calculated (see ANACoD guidance for calculation details).

ANACoD - PART II: MORTALITY LEVELS ANALYSIS

Step 5: Child mortality rates

Use under-five mortality indicators from various sources to analyze the quality of mortality data: *Deviations from "best fit" line indicate over- or under- reporting.*



Steps 6-10

Focus on simple steps to assess the plausibility of data on causes of death

The objectives of steps 6-10 are to enable users to:

- Calculate broad patterns of causes of death
- Critically analyse and interpret cause of death data
- Assess the plausibility of the cause of death patterns emerging from the data

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 6: Distribution of death according to the Global Burden of Disease list

Enables users to:

- Calculate the percentage distribution of deaths by broad disease groups
- Compare distribution to what would be expected for the population (based on level of life expectancy)
- Identify potential problems in quality of data based on deviations from expected patterns

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 6: Distribution of death according to the Global Burden of Disease list

Global Burden of Disease cause list:

Group I: Communicable diseases, e.g.:

- TB, pneumonia, diarrhoea, malaria, measles
- Maternal and perinatal causes (e.g. maternal haemorrhage, birth trauma)
- Nutritional conditions (e.g. protein-energy malnutrition)

Group II: Non-communicable diseases, e.g.:

- Cancer, diabetes, heart disease, stroke

Group III: External causes of mortality , e.g.:

- Accidents, homicide, suicide

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 6: Distribution of death according to the Global Burden of Disease list

Compare distribution to what would be expected for the population (based on life expectancy): ***Deviations suggest potential problems with the certification and/or coding of causes of deaths.***

Calculating proportions of groups 1, 2 and 3 after redistribution of deaths from unknown sex and ill-defined diseases	
…	
Proportions to total deaths	
grp1	0.11
grp2	0.71
grp3	0.18
	1.00
New totals after all the above adjustments	**196681**

Colombia life expectancy, 2011: 78 years
(WHO Global Health Observatory)

Table 2: Expected distribution of causes of death according to life expectancy by broad groups

Life Expectancy	55 years	60 years	65 years	70 years
Group I causes of death (communicable)	22%	16%	13%	11%
Group II causes of death (non-communicable)	65%	70%	74%	78%
Group III causes of death (external)	13%	14%	13%	11%

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 7: Age pattern of broad groups of causes of death (Distribution of major causes of death)

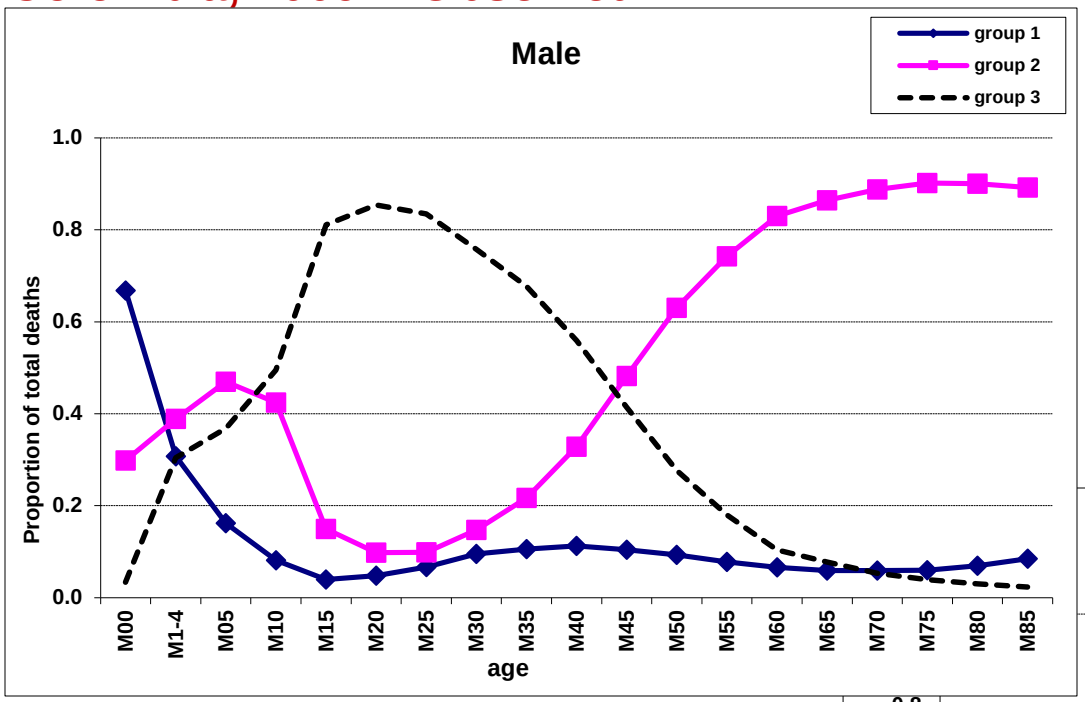
Enables users to:

- Observe age-pattern of deaths from broad causes
- Check if pattern is consistent with expected patterns of countries from same income level
- Identify potential problems associated with:
  - Poor medical certification of cause of death
  - Poor coding practices
  - Age-misreporting of deaths
  - Bias in reporting certain infectious diseases

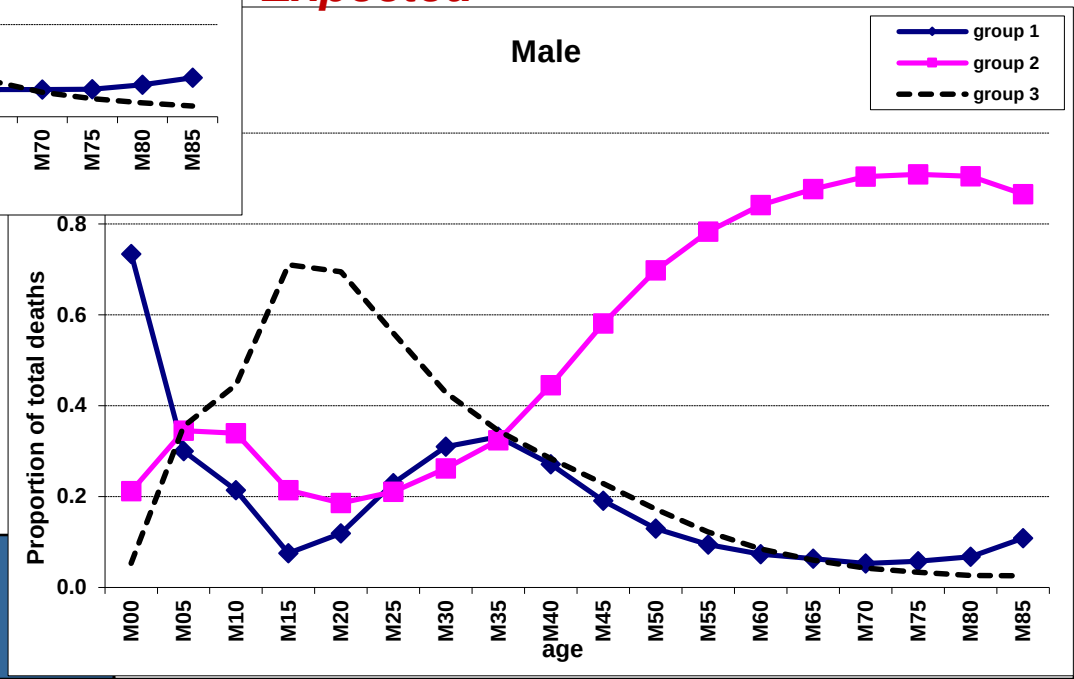
ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 7: Age pattern of broad groups of causes of death (Distribution of major causes of death)

Colombia, 2009 -- *Observed*



Upper middle income countries -- *Expected*

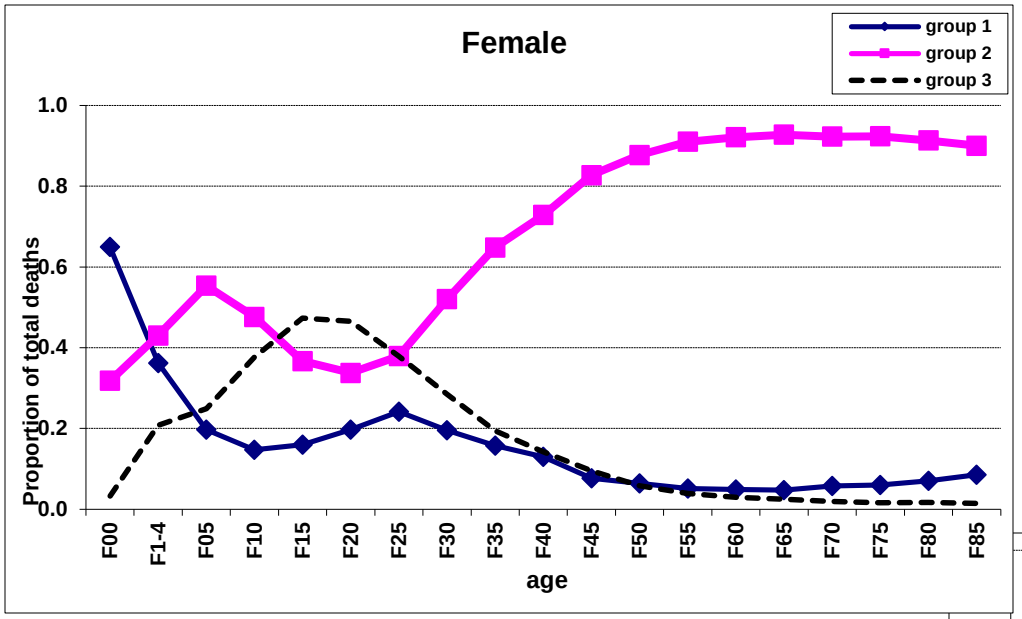


Group 1: Communicable
Group 2: Non-communicable
Group 3: External

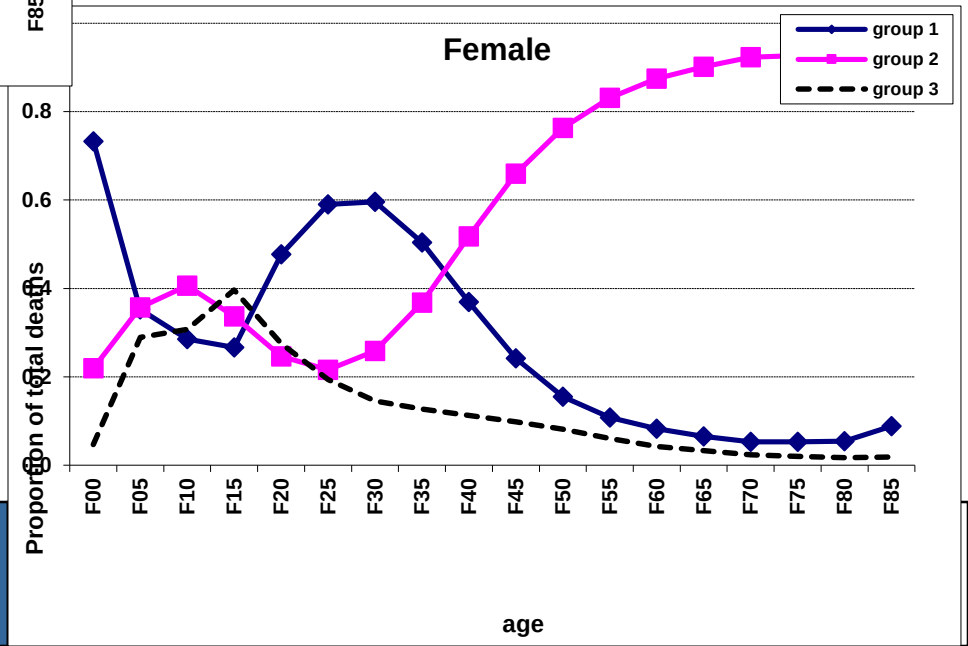
ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 7: Age pattern of broad groups of causes of death (Distribution of major causes of death)

Colombia, 2009 -- *Observed*



Upper middle income countries -- *Expected*



Group 1: Communicable
Group 2: Non-communicable
Group 3: External

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 8: Leading causes of death

Enables users to:

- Determine the distribution of leading causes of death for the country
- Compare observed distribution to distributions expected in other countries of similar income level
- Identify deviations that would be indicative of potential biases in certification and coding practices

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 8: Leading causes of death

Compare distribution of leading causes:

Deviations may indicate biases in certification or coding practices

20 leading causes of death, all ages

	Both sexes	Nos	%total
1	Ischaemic heart disease	27,597	*14.0*
2	Homicide	19,680	*10.0*
3	Cerebrovascular disease	13,870	*7.1*
4	Chronic obstructive pulmonary dis.	10,265	*5.2*
5	Other cardiovascular diseases	8,674	*4.4*
6	Other digestive diseases	7,111	*3.6*
7	Diabetes mellitus	6,469	*3.3*
8	Lower respiratory infections	6,442	*3.3*
9	Other malignant neoplasms	6,441	*3.3*
10	Road traffic accidents	6,377	*3.2*
11	Hypertensive disease	5,664	*2.9*
12	Stomach cancer	4,450	*2.3*
13	Ill-defined diseases (ICD10 R00-99)	4,289	*2.2*
14	Trachea, bronchus and lung cancers	3,898	*2.0*
15	Nephritis and nephrosis	3,199	*1.6*
16	Other respiratory diseases	2,732	*1.4*
17	Colon and rectum cancers	2,575	*1.3*
18	Prostate cancer	2,419	*1.2*
19	HIV	2,340	*1.2*
20	Self-inflicted injuries	2,259	*1.1*

Upper middle income countries

	Both sexes	Nos (000)	%total
1	Ischaemic heart disease	1,508	*19.1*
2	Cerebrovascular disease	1,035	*13.1*
3	Other cardiovascular diseases	419	*5.3*
4	HIV	377	*4.8*
5	Lower respiratory infections	295	*3.7*
6	Diabetes mellitus	248	*3.2*
7	Hypertensive disease	224	*2.8*
8	Road traffic accidents	196	*2.5*
9	Chronic obstructive pulm. dis	189	*2.4*
10	Other malignant neoplasms	189	*2.4*
11	Other digestive diseases	183	*2.3*
12	Other unintentional injuries	178	*2.3*
13	Trachea, bronchus ,lung can.	175	*2.2*
14	Homicide	171	*2.2*
15	Cirrhosis of the liver	146	*1.8*
16	Stomach cancer	122	*1.5*
17	Other respiratory diseases	117	*1.5*
18	Colon and rectum cancers	113	*1.4*
19	Other infectious diseases	108	*1.4*
20	Inflammatory heart diseases	104	*1.3*

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 9: Ratio of non-communicable to communicable causes of death

Enables users to:

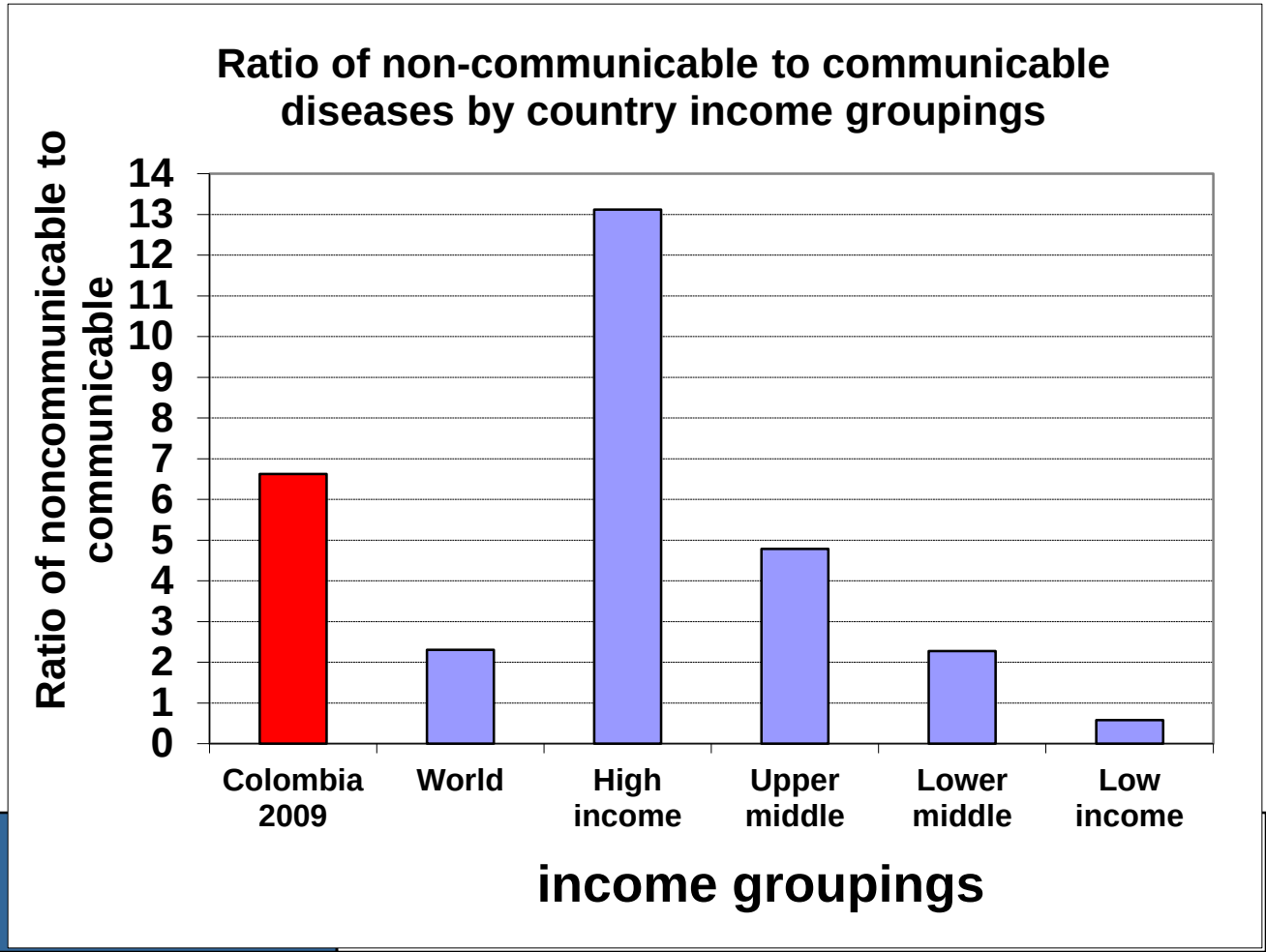
- Calculate the ratio of deaths from non-communicable diseases to communicable diseases for the country
- Compare the country ratio to the world and 4 income groupings
- Identify deviations that are suggestive of errors in cause of death data

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 9: Ratio of non-communicable to communicable causes of death

Compare ratio for country to similar income group:

Deviations indicate potential errors in cause of death data



ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 10: Ill-defined causes of death

Enables users to:

- Calculate the proportion of deaths attributed to ill-defined causes of death
- Evaluate the proportion of ill-defined causes of death against recommended levels
- Identify target areas for remedial action to reduce usage of ill-defined causes of death

Ill-defined causes are: 'symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified.' They arise from:

- **Deaths classified as ill-defined (Chapter XVIII of ICD-10)**
- **Deaths classified to any one of the following vague or unspecific Dx:**

- A40-A41 Streptococcal and other septicaemia
- C76, C80, C97 Ill-defined cancer sites
- D65 Disseminated intravascular coagulation [defibrination syndrome]
- E86 Volume depletion
- I10 Essential (primary) hypertension
- I269 Pulmonary embolism without mention of acute cor pulmonale
- I46 Cardiac arrest
- I472 Ventricular tachycardia
- I490 Ventricular fibrillation and flutter
- I50 Heart failure
- I514 Myocarditis, unspecified
- I515 Myocardial degeneration
- I516 Cardiovascular disease, unspecified
- I519 Heart disease, unspecified
- I709 Generalized and unspecified atherosclerosis
- I99 Other and unspecified disorders of circulatory system
- J81 Pulmonary oedema
- J96 Respiratory failure, not elsewhere classified
- K72 Hepatic failure, not elsewhere classified
- N17 Acute renal failure
- N18 Chronic renal failure
- N19 Unspecified renal failure
- P285 Respiratory failure of newborn
- Y10-Y34, Y872 External cause of death not specified as accidentally or purposely inflicted

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 10: Ill-defined causes of death

% ill-defined should ideally be:

≤ 10% for deaths at ages 65 years and over

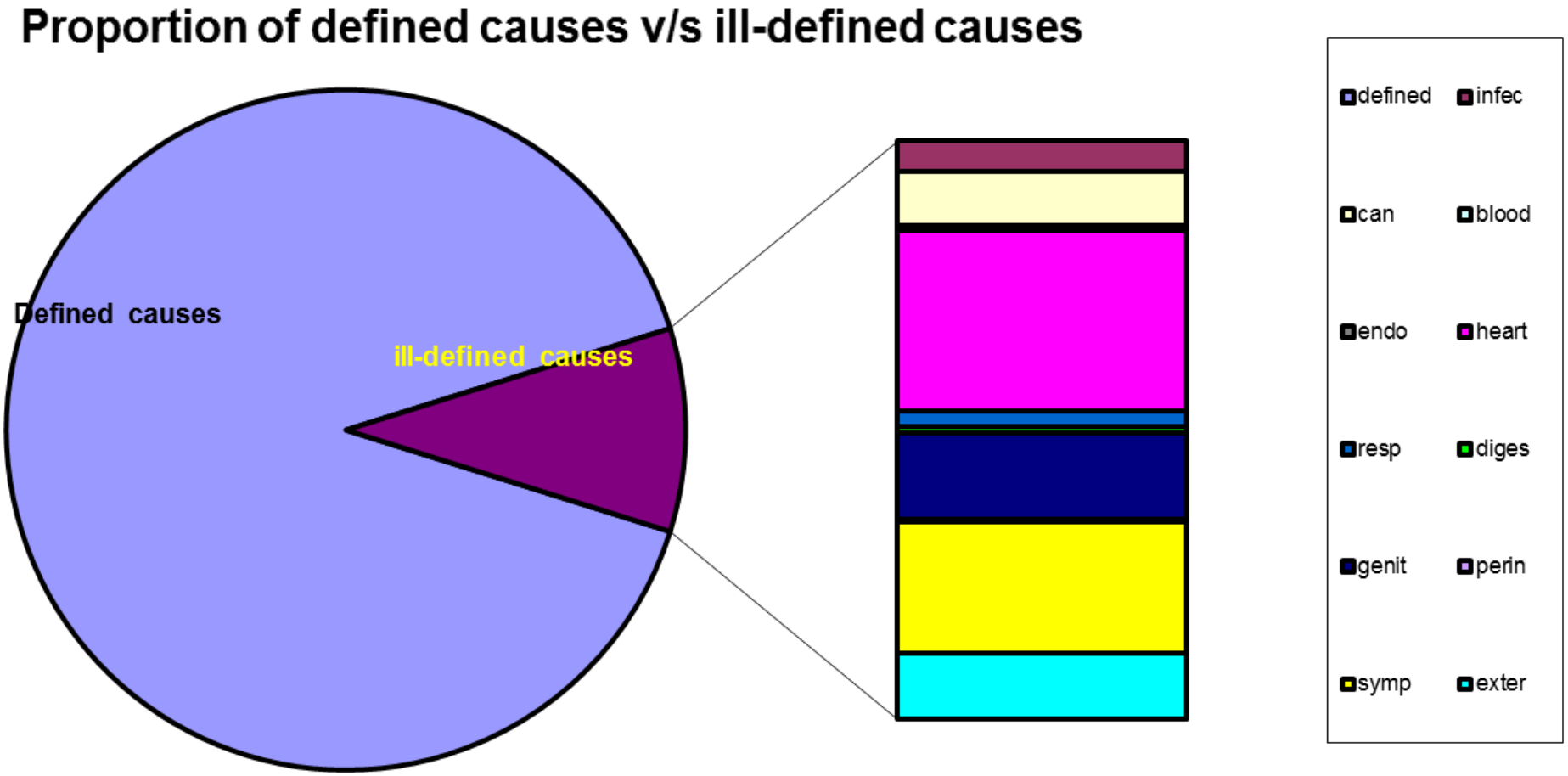
< 5% for deaths at ages below 65 years

	Both	Male	Female	Male			
	All ages			0	1-4	5-9	…
All causes	**196681**	**113327**	**83354**	5333	1121	629	…
Ill-defined causes by ICD-10 chapter:							
I. Infectious and parasitic diseases	1024	502	522	56	16	5	5
II. Neoplasms	1773	843	930	2	7	5	4
III. …	74	37	37	13	4	1	1
Total of ill-defined	**18989**	**10395**	**8594**	415	145	80	69
as % of All causes	***9.7%***	***9.2%***	***10.3%***	*7.8%*	*12.9%*	*12.7%*	***…***

ANACoD - PART III: CAUSES OF DEATH ANALYSIS

Step 10: Ill-defined causes of death

Specific causes among ill-defined causes can be used to target improvement efforts.



ANACoD Wrap up

- The “Summary” sheet provides a summary report of findings

With ANACoD, the user is able to:

- Derive the mortality profile of the country/area analysed
- Develop a critical view on the quality of mortality data
- Understand further cause-of-death statistics

Limitations of ANACoD include:

- Partial data are not adjusted for incompleteness by the tool
- The tool cannot improve the quality of poor data, but it can provide insights on medical certification or coding problems
- Currently only data coded to ICD-10 three or four characters can be analysed

References

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- (WHOSIS) WHO Statistical Information Systems. Indicator definitions and metadata, 2008. Age-standardized mortality rates by cause.

Activity

Comparison of Vital Event Definitions:

- In small groups, discuss the degree to which the vital event definitions used in your country match those used by WHO. If differences exist, discuss:
  - Philosophies behind them
  - Whether or not those differences affect the registration system or interpretation of vital statistics
- Share with the class.

Activity

Data Quality Review:

- In small groups, review and compare various reports for the aspects of data quality:
  - Accuracy
  - Timeliness
  - Comparability
  - Relevance
  - Accessibility

- Discuss observations with class.

Overall Review

1. Good statistical systems are efficient, credible, and (*subjective / objective*).
2. The quality of vital statistics data is judged based on (*reliability / accuracy*), timeliness, comparability, relevance, & accessibility.
3. (*Direct / Indirect*) assessment of coverage error includes comparing the total number of vital events registered and reported to the statistical agency for a given period with the number registered and reported in a previous, similar period.
4. (*Direct / Indirect*) assessment of coverage error includes regularly querying and monitoring statistical returns from local registrars.
5. Production time is the mean time from (*beginning / end*) of reference period to publication.