



Encontro sobre a Melhoria da qualidade da informação sobre causas de morte no Brasil

1 a 6 de outubro de 2017 • Porto de Galinhas/PE



D4H CRVS INITIATIVE

Analysis of Causes of National Deaths for Action (ANACONDA)

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Assessing the quality of mortality data: Key demographic and epidemiological concepts underlying ANACONDA

The building blocks

- ANACONDA is built around a set of standard demographic and epidemiological concepts and classifications
- You need to be familiar with these in order to be better able to interpret the results
- **Age** and **sex** are the most important determinants of mortality risk and occurrence of disease and injury; hence we disaggregate by *age* and *sex* in all our data quality checks and analyses

What are the main data quality issues that ANACONDA checks?

- **Completeness of your dataset:** i.e. is your system able to record/register most, if not all, births and deaths that occur?
- How **complete** is child death registration?
- Is **age and sex of people who die being** recorded correctly?
- Are the **broad cause of death patterns plausible** given the age structure and overall health status of the population?
- What fraction of deaths are assigned an “**unusable**” code?
- What are the most common reasons for **unusable** causes in your data; how **severe** are they for mis-informing policy?
- How common are unusable (‘garbage’) causes among the leading causes of death?



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Key demographic concepts
underlying data quality
assessment

Concept of completeness of registration

Completeness of registration of vital events is the proportion of deaths (or births) that occur in a given year and are registered in your Civil Registration system in the year that they occur.

To calculate registration completeness, you need to know the

- number of events registered in a given year
- actual number of events that occurred in that year
- Many countries don't know the actual number of births and deaths, so registration systems are very incomplete; this has serious implications for using data from these systems to guide policy. **WHY?**

How can we measure completeness of registration of deaths in a population?

- Established indirect demographic techniques (e.g. Brass Growth-Balance, Bennet-Horiuchi, Preston-Coale, etc) known as 'Death Distribution Methods' have been used to estimate completeness.
- These methods are **complex**, highly dependent on (usually) **unrealistic demographic assumptions** about your population being '*closed*' (i.e. no migration) and '*stable*' (i.e. constant difference between birth and death rates); also **very unreliable** (+/- 15% accuracy, at best).
- This inaccuracy likely to be far too great to monitor progress with registration improvements, and to be able to use data confidently for policy and planning.

Interpreting the Crude Death Rate

- ANACONDA uses the observed level of the **Crude death rate (CDR)** as a one *proxy* indicator of death registration completeness, taking into account population age structure; the *lower* the CDR, *inter-alia*, the *higher* the degree of mortality under-registration in the population.
- **CDR** calculated as:
$$\frac{\text{Total resident deaths}}{\text{Total population}} \times 1,000$$
- ANACONDA calculates the CDR directly from your input data and assesses **likely completeness** by comparing your CDR to that estimated for the GBD Study for your country
- The trend in the CDR estimated by the GBD Study is also provided to assist with *interpretation of current observed CDR*; does it make sense in context of previous levels of the CDR?
- A CDR of less than about 5/1000 generally indicates incomplete death reporting. Only very few countries have recorded true CDRs <5/1000. **WHICH ONES? WHY?**

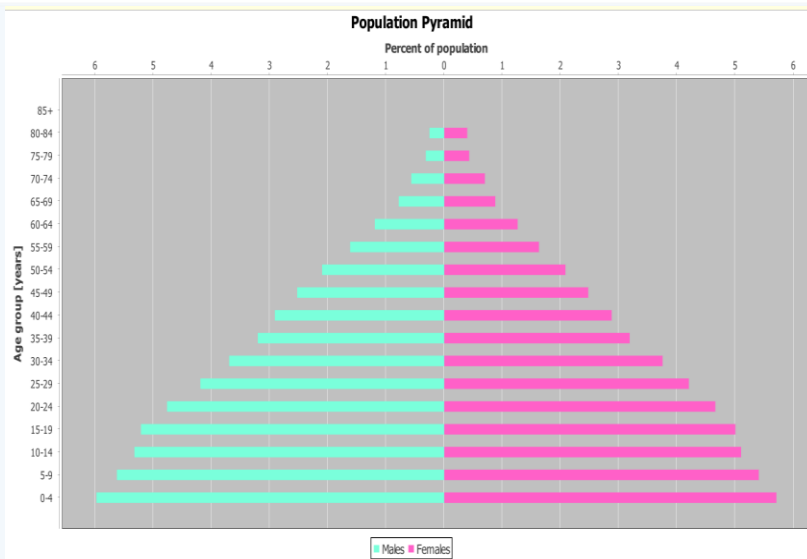
Understanding population age structure is key to understanding mortality

- Younger populations are characterised by high birth rates and few older people. They usually have high mortality, particularly for children
- Older populations are characterised by declining fertility rates, declining child and adult mortality rates, leading to a high proportion of the elderly
- These demographic observations are important since they help interpret the *plausibility* of the Crude Death Rate calculated from your data
- The progressive change from a ‘young’ to an ‘old’ population is known as “**demographic transition**”

Population pyramids give you an overview of the age structure (to interpret plausibility of the CDR)

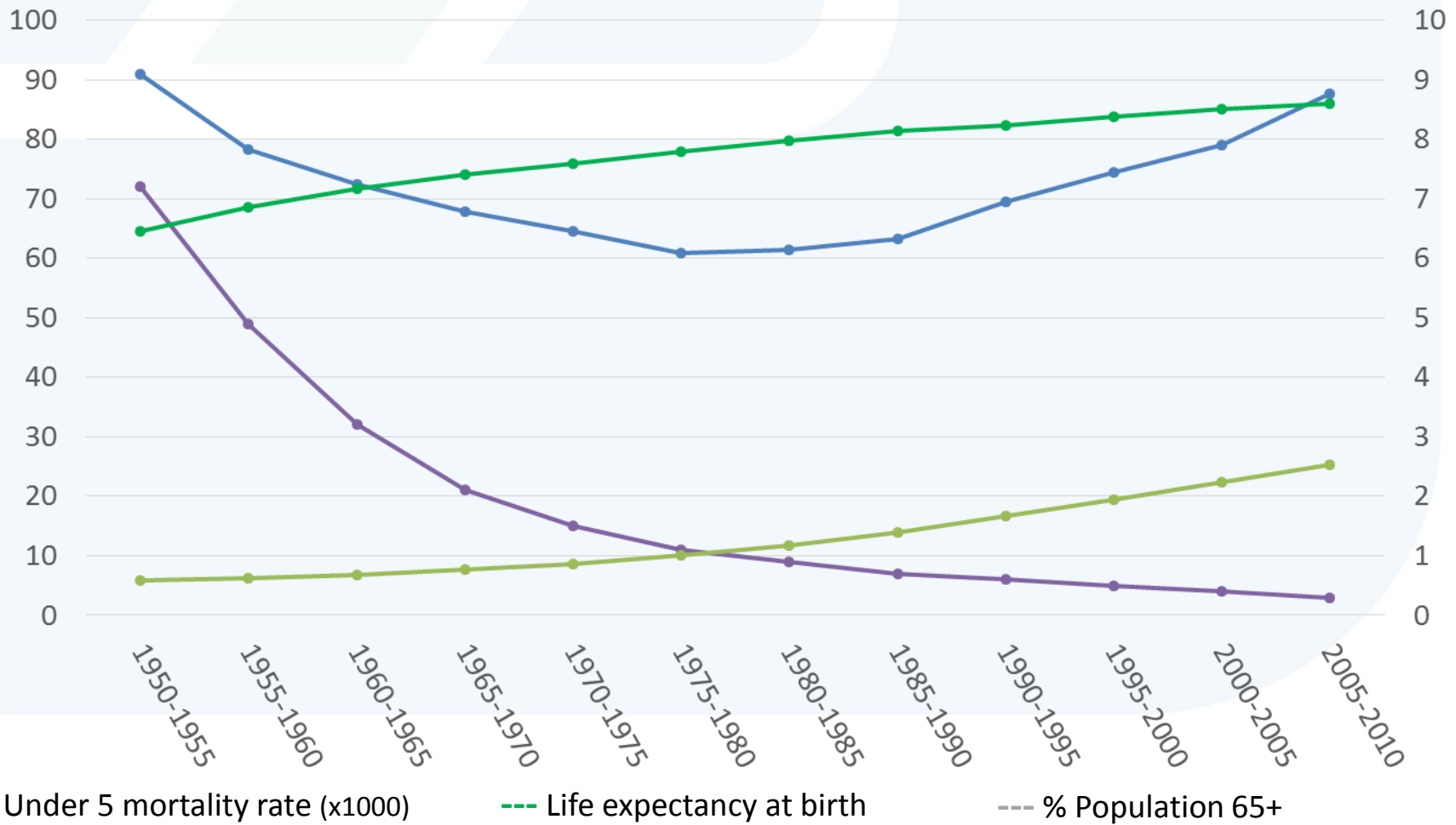
Very young population

Older population



Note: two populations (such as Japan and Sudan) with very different age structures and very different levels of mortality can have the same Crude Death Rate. **WHY?**

Empirical evidence about demographic transition: example of Japanese females, 1950-2010



Second way ANACONDA measures completeness of death registration

- CDR depends on i) **population age structure**, and ii) **overall level of mortality**, especially at young and old ages (ages when death rates comparatively high).

$$\begin{aligned} \text{Completeness} &= \frac{\text{Reg. CDR}}{\text{True CDR}} \\ &= \frac{\text{Reg. CDR}}{\text{Popn age structure} * \text{mortality level}} \end{aligned}$$

Reg. CDR is the **CDR** registered, or **observed** in your population

True CDR is the **actual CDR** in your population after adjusting for under-reporting of deaths, and is estimated using complex demographic methods

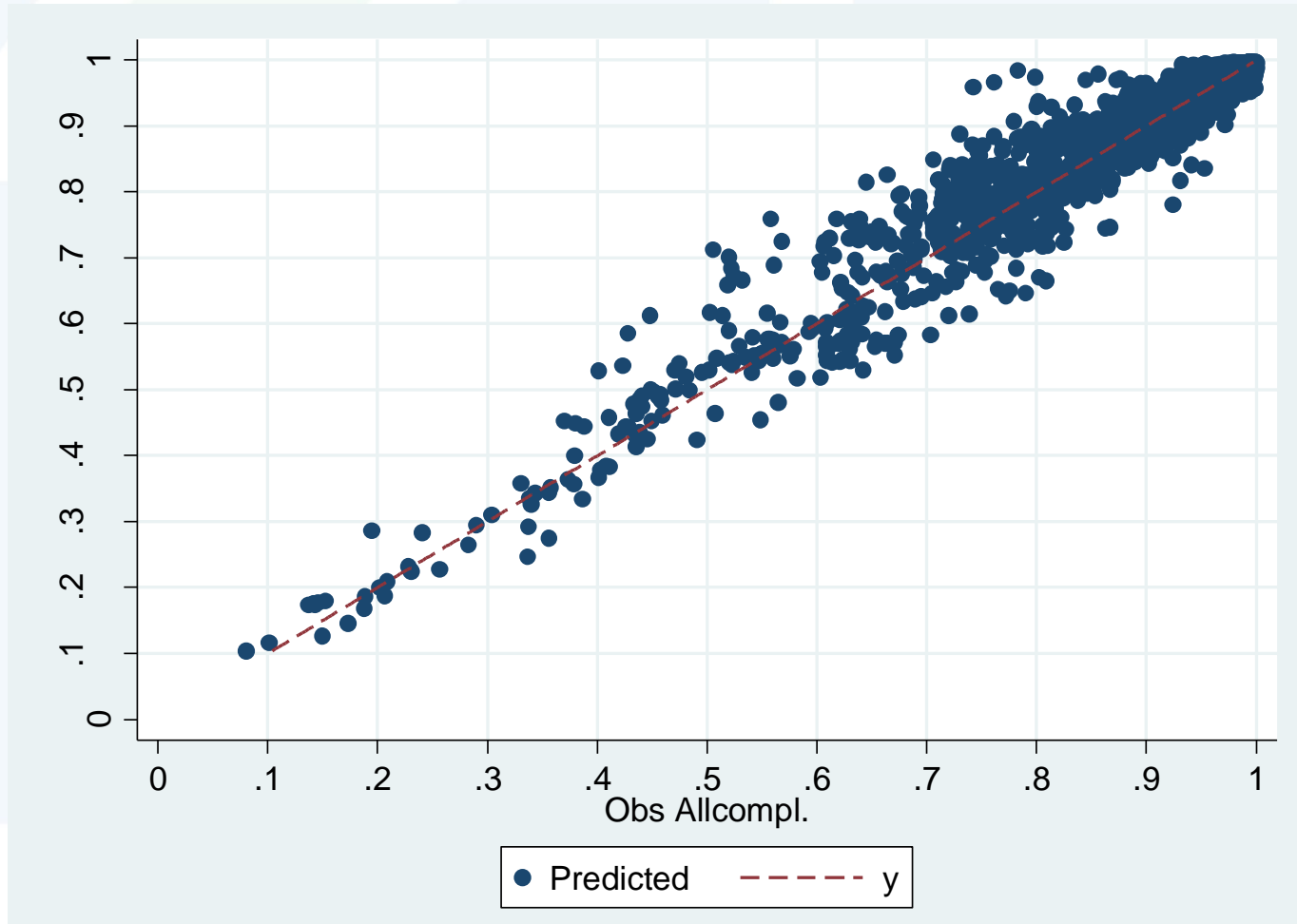
- We can *predict* the *completeness* of death registration using:
 - registered CDR
 - the two main determinants of true CDR (i.e. population age structure; and overall level of mortality, represented by 5q0)

Adair-Lopez completeness prediction Model

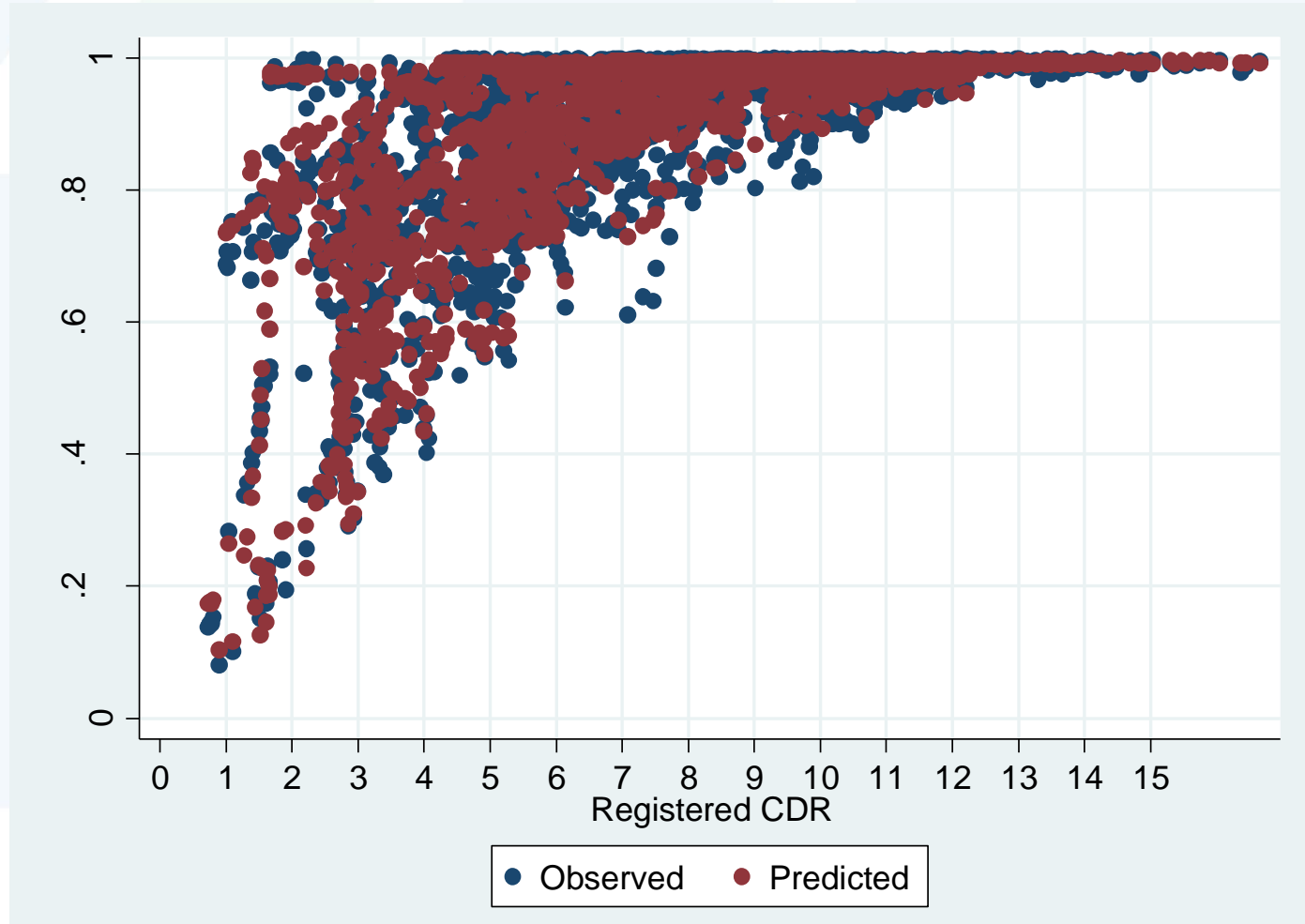
$$\text{logit}(\text{Completeness}) = (\text{RegCDR}^2 * -0.0187471) + (\text{RegCDR} * 0.6125569) + (65plus * -12.58245) + (\ln_5q_0 * -1.134923) + (\text{Compl}_5q_0 * 2.319505) + (\text{Year} * -0.0184299) + 31.40303 + \gamma$$

- R-squared of 0.85
- $\text{logit}(\text{Completeness}) = \ln\left(\frac{\text{Completeness}}{1-\text{Completeness}}\right)$
- *RegCDR* is the CDR calculated from the registration data
- *65plus* is the fraction (%) of the population aged 65+
- \ln_5q_0 is the natural log of the true under-five mortality rate (a measure of the overall mortality level in the population)
- Compl_5q_0 is the estimated proportion of under 5 deaths in the population that are registered.
- Year = cal. year of data; γ is country-level random effect.

How does the model perform? Predicted v observed completeness (observed compl. = Reg CDR/True CDR)



Predicted v observed completeness – at various levels of registered CDR



Advantages/application of model to predict completeness

- Prediction can be done entirely from input data/comparator data entered into ANACONDA; no additional external data
- Easily applied to estimate sub-national completeness of registration; option to input regional values of 5q0
- Sub-national estimates likely to vary substantially; better guide for targeting interventions to improve death registration

Model predicted completeness in Data for Health countries

Country/ city	Predicted	Observed (i.e. best estimate)
Bangladesh	9	5
Brazil	97	94
Shanghai	99	100
Colombia	85	83
Ecuador	80	81
Ghana	23	28
Mumbai	98	100
Myanmar	46	47
Peru	73	73
Philippines	82	87
Rwanda	6	5
Solomon Islands	52	59
Sri Lanka	98	100
Tanzania	8	12
Zambia	5	3

Example of sub-national application: Colombia departments

Department	Pred. compl.	Department	Pred. compl.
Amazonas	67	Guaviare	52
Antioquia	88	Huila	83
Arauca	82	La Guajira	22
Archipiélago de San Andrés y Providencia	89	Magdalena	81
Atlántico	95	Meta	97
Bogotá	92	Nariño	74
Bolívar	74	Norte de Santander	86
Boyacá	80	Putumayo	36
Caldas	97	Quindío	89
Caquetá	75	Risaralda	94
Casanare	79	Santander	94
Cauca	61	Sucre	90
Cesar	80	Tolima	77
Chocó	36	Valle del Cauca	94
Córdoba	87	Vaupés	29
Cundinamarca	81	Vichada	60
Guainía	66	National	85

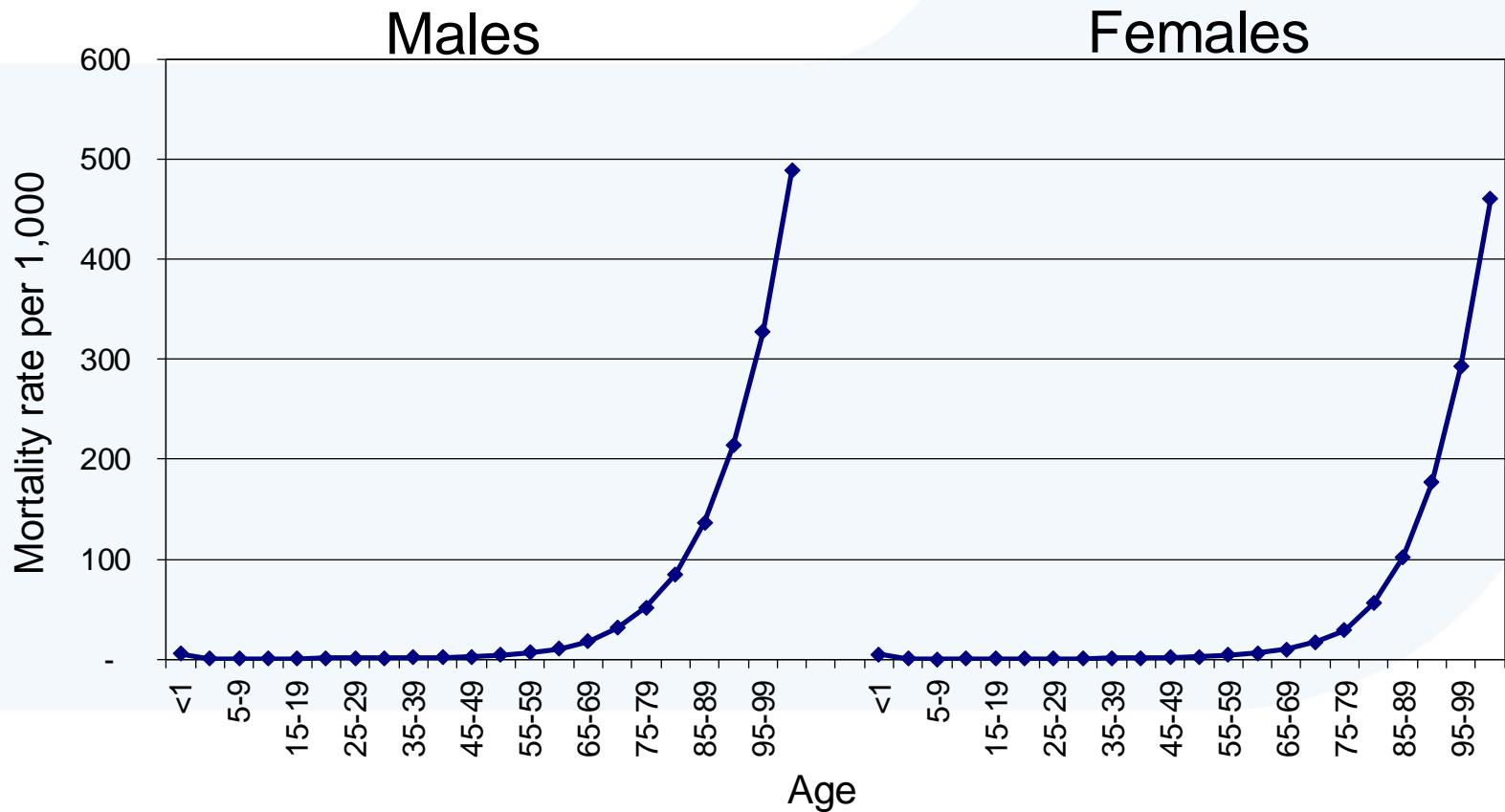
Conclusions: applicability of the method

- Main drivers of true CDR (population ageing, level of mortality represented by 5q0) can be used, with registered CDR and child mortality completeness, to predict completeness of registration
- All of these variables can be calculated directly from input data into ANACONDA; no need for external data inputs - huge advantage!
- Predicted completeness of registration usually with +/- 3-5% of true rate ($R^2 = .85$)
- Likely to be accurate enough to indicate where (in which populations) there is urgent need to rapidly improve death registration processes

What else affects data quality of registered deaths in a population?

- *Completeness of registration* by far the most important determinant of mortality data quality; need to check if female deaths less well counted
- But age misreporting of deaths also a key determinant of mortality data quality
- Why? Because the risk of dying is not the same for all age groups; need to accurately identify premature deaths in the data
- ANACONDA therefore checks how well you are reporting deaths at different ages

Spot the difference: Australian mortality rates by age and sex



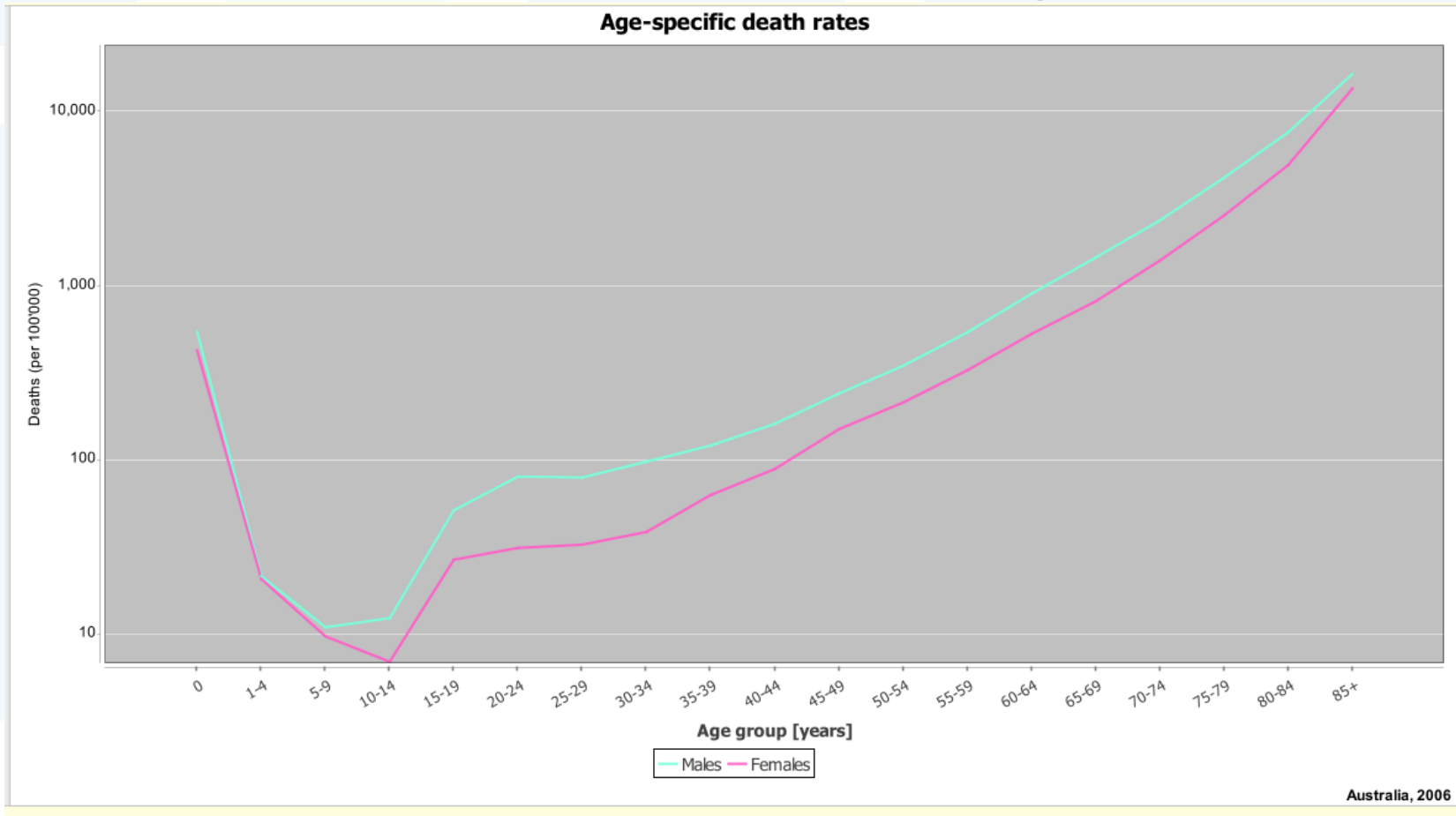
The risk of dying is not the same for all age groups as reflected in the *Age-Specific Death Rate (ASDR)*

- The ASDR is the number of deaths recorded for a specific age group in a given year, related to the total mid-year population in that age-group:

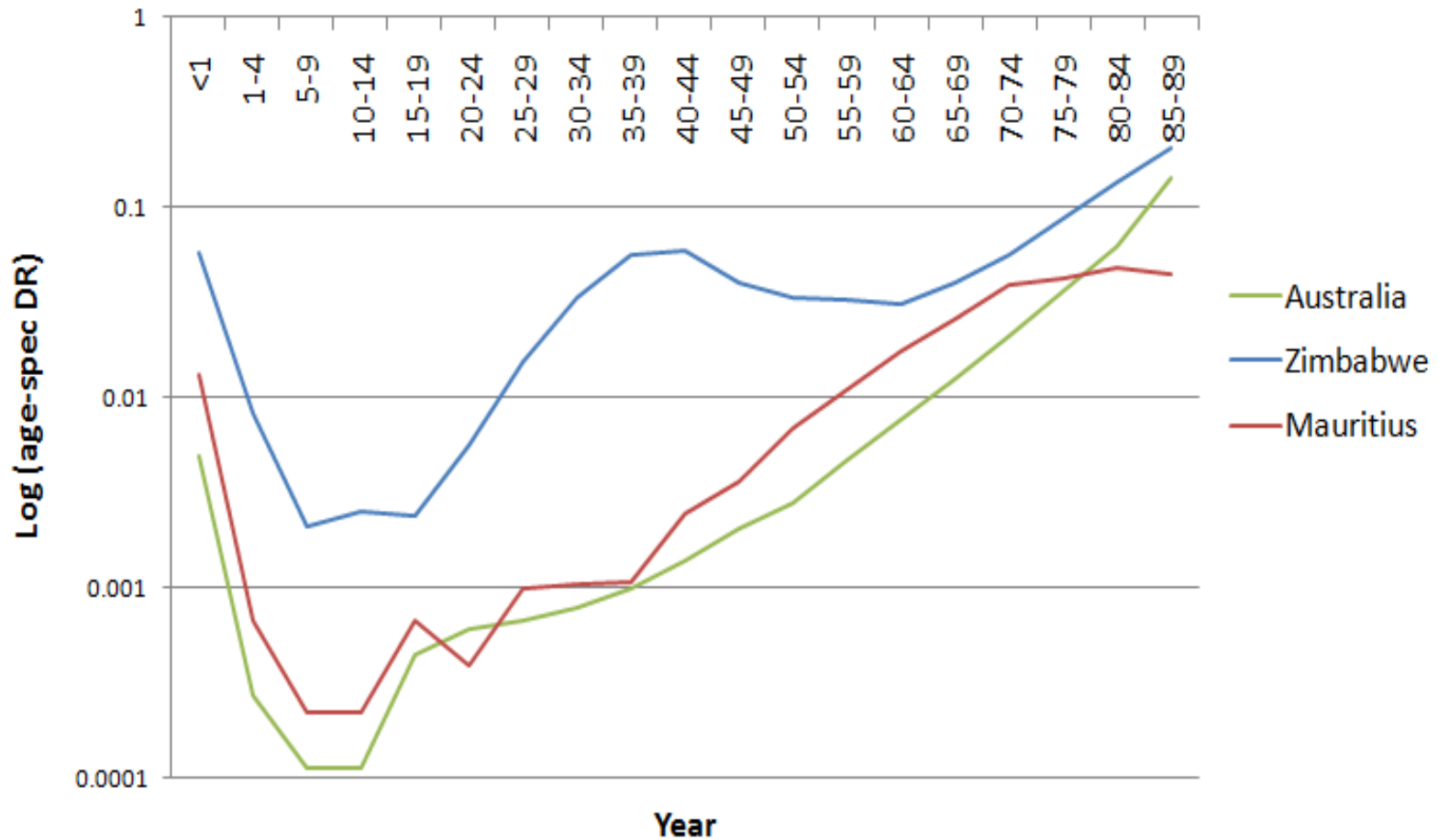
$$\frac{\text{Number of resident deaths in a specific age group}}{\text{Total population in the same age group}} \times 1,000$$

- ANACONDA calculates these mortality rates in standard 5-year age groups and allows you to check them against comparators for plausibility
- In the absence of high injury/HIV/maternal mortality, death rates rise exponentially with age beyond about age 35 (Gompertz' law (1825)).
- That is, $m(x) = \alpha \cdot \exp(\beta x)$, so $\ln[m(x)] = A + B \cdot x$, where A, B are constants. i.e. natural logarithm (ln) of the death rate [m(x)] is a linear function of age, i.e. is a straight line after about age 35
- We use this observation to compare the age and sex pattern of death rates in VR data with the comparator (much easier to see differences)

Linear increase in Natural log (ln) of the ASDR with age



Log plots of age-specific death rates, Zimbabwe 2006, Mauritius 2000, Australia 2005



At what ages does most under-counting of deaths occur? Study in Thailand (2005)

	Age group				
	0-4	5-49	50-74	75+	All ages
Undercount (%)	42.8	14.8	7.7	5.9	8.7

ANACONDA therefore focuses special attention on assessing completeness of death registration in this age group

Child mortality rate

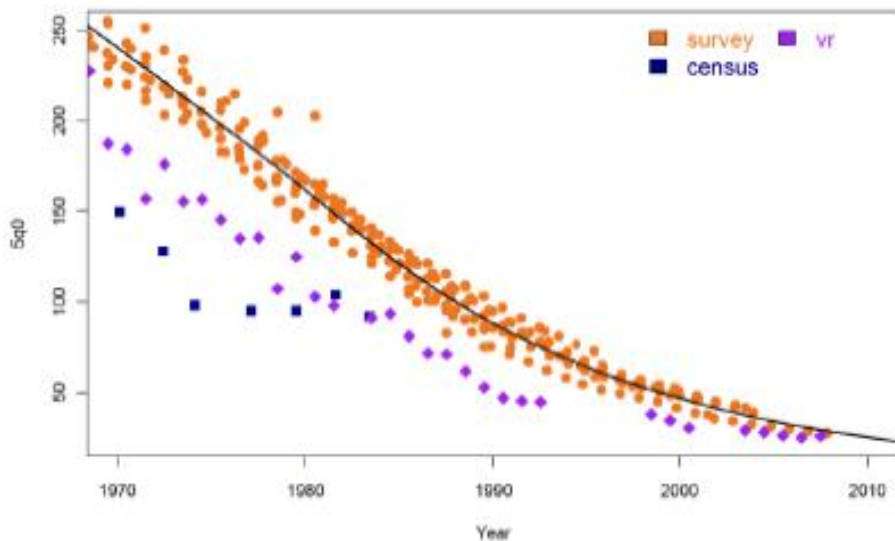
- Mortality among children under five years of age widely used health indicator; included in MDGs, SDGs.
- Enormous global health focus during past 5 decades to improve child survival; improved by 70-80% since 1970
- Because of this global focus, very large amount of data on levels of child mortality collected from censuses and surveys and used to indirectly measure probability of dying before age 5 (5q0), expressed as a risk per 1000 live births.
- These data likely to more accurately reflect level of child mortality than deaths reported in CRVS system. **WHY?**
- Can we use these widely available data on probability of dying before age 5 to estimate the completeness of registration of child deaths?
- To do so, ***need to convert death rates among children at different ages under 5 into the cumulative probability of dying before age 5 (5q0)***
- This requires calculation of a ***Life Table***; ANACONDA calculates a full (over all ages) Life Table and hence 5q0, directly from your input data
- This Life Table NOT to be used for any other mortality analysis. **WHY?**

Life table and life expectancy

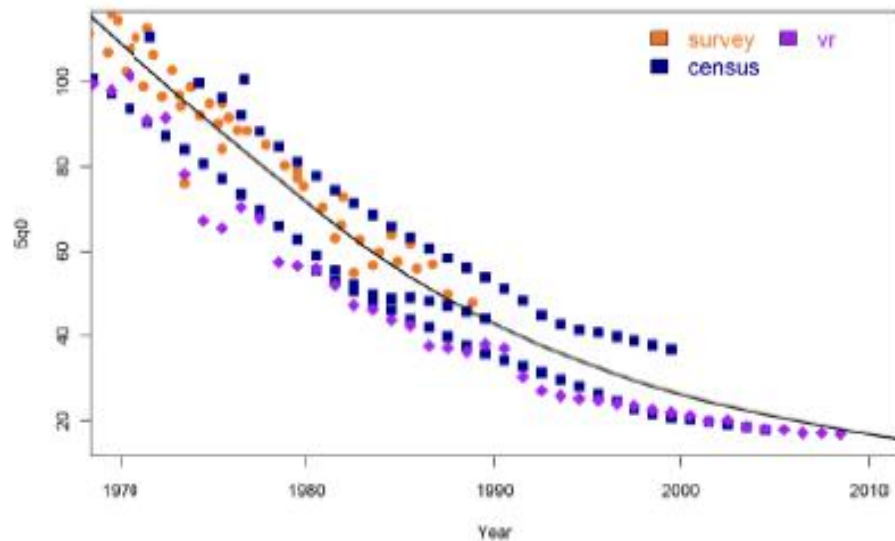
- A life table provides various measures of mortality that are of public health importance such as:
 - The probability of dying at any age
 - Life expectancy at birth
 - Life expectancy at any age
- Life expectancy is the average number of years that a person can expect to live assuming current ASDR continue forever
- Remember that the life table that ANACONDA calculates is only as reliable as your input data. If you seriously under-report deaths, the life table will be biased and **over-estimate** life expectancy

Observed (from vital registration (VR)) and estimated levels of the under-five mortality rate (5q0), selected countries, 1960-2000

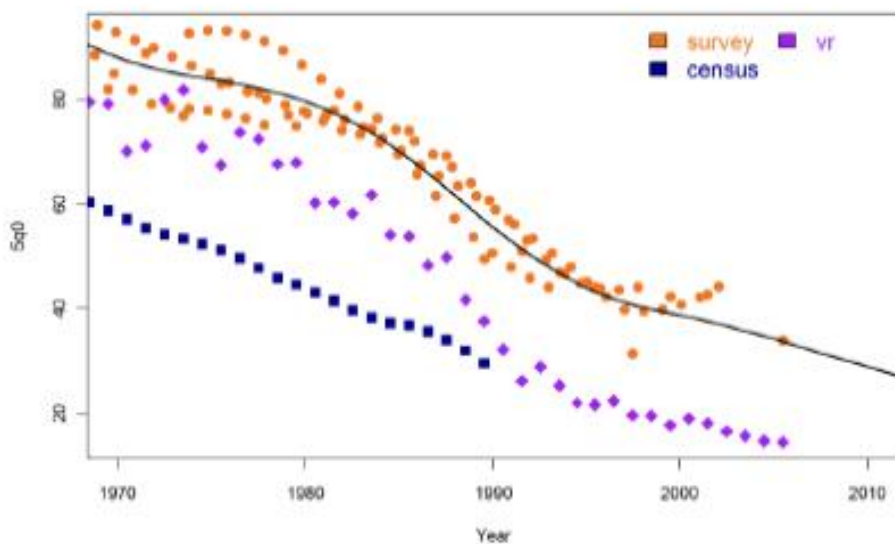
Child Mortality: Egypt



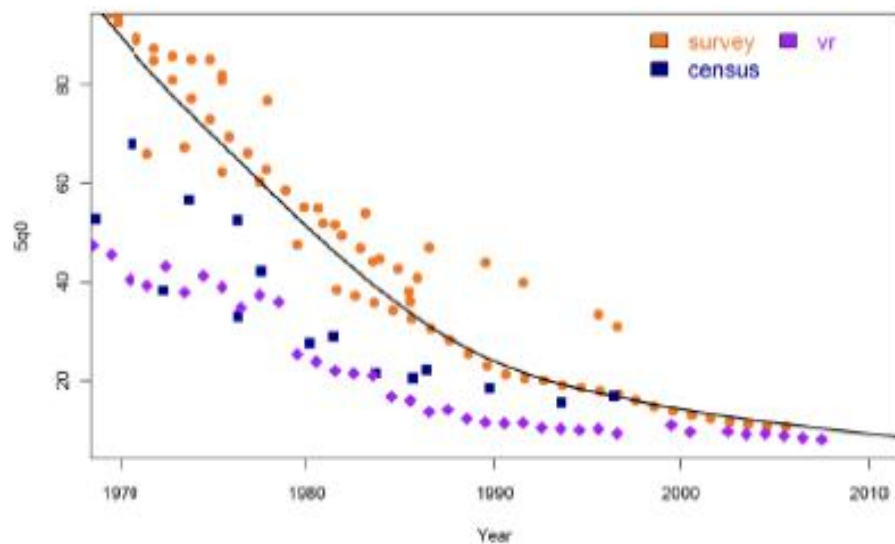
Child Mortality: Mexico



Child Mortality: Philippines



Child Mortality: Thailand



Child mortality comparator

- The ${}_5q_0$ comparator we use is from the IGME, an Inter-agency group that prepares mortality estimates for child deaths
- To estimate completeness of child death registration, calculate the ***relative difference*** between the two rates (i.e. input data (O), and comparator (E)). Calculated as $(E-O)/E \times 100\%$
- For example, if this = 50%, then half of all deaths among children under 5 are not being registered.
- **WHY?**



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Disease and Injury classification system




- The ***International Statistical Classification for Diseases and Related Health Problems*** (ICD) is the global standard for collecting cause of death data
- First developed around 1900; currently in its 10th Revision. Issued by WHO since 1948
- The ICD classification is divided into 21 Chapters, subdivided into homogenous blocks that consist of 3-character disease categories, e.g. I50, C48, etc
- ICD is used to translate diagnoses into alphanumeric codes that can be compiled into statistics
- Requires a three-stage process – ***certification*** of the cause of death by a physician, ***coding*** of the certificates by trained coders applying the rules of the ICD, and ***tabulation*** of the individual codes into cause of death tabulations or tables/graphs to inform policy.

ICD classification system for deaths

- Originally only used to classify COD – later expanded to cover morbidity and contacts with health services
- The “core” classification item for any disease or injury is the 3-character ICD code; over 3000 separate codes to describe causes of death
- For public health purposes, we aggregate these codes into Short or Tabulation Lists, usually containing between 50-300 categories

International form of medical certification of cause of death (WHO 2016)

Part 1- Sequence of events leading to death

Frame A: Medical data: Part 1 and 2				
1 Report disease or condition directly leading to death on line a Report chain of events in due to order (if applicable) State the underlying cause on the lowest used line			Cause of death	Time interval from onset to death
		a		
		b	Due to:	
		c	Due to:	
		d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)		<hr style="border-top: 1px dashed black;"/>		

Part 2- Other significant conditions leading to death

COD concepts

- The medical certificate must contain all those diseases or injuries which either resulted in or contributed to death (but not the symptoms or modes of dying)
- Line 1: the **immediate**/direct cause
- Line 2: the **intermediate** cause (if any)
- Last line: the **underlying** COD – **critical!!**
- Part 2: other significant contributory conditions

Underlying Cause of Death (UCOD)

- The disease or injury which **initiated the train of morbid events** leading directly to death;

OR

- The circumstances of the accident or violence which produced the fatal injury
- **Crucial to get the *underlying* cause of death correct to guide public health interventions**

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	Cause of death	Approximate interval between onset and death
<p>I Disease or condition directly leading to death*</p>	<p>(a) <u>Traumatic shock</u> due to (or as a consequence of)</p>	<p><u>1 hour</u></p>
<p>Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last</p>	<p>(b) <u>Multiple fractures</u> due to (or as a consequence of)</p>	<p><u>5 hours</u></p>
	<p>(c) <u>Pedestrian hit by truck</u> due to (or as a consequence of)</p>	<p><u>5 hours</u></p>
	<p>(d) _____</p>	<p>_____</p>
<p>II Other significant conditions contributing to the death, but not related to the disease or condition causing it</p>	<p>_____</p>	<p>_____</p>
<p><small>* This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.</small></p>		

Figure 7 A death certificate where **three** events leading to death are reported

Certifier's role in diagnosing the COD

- Doctors play a crucial role in the overall quality of cause of death data since only they are qualified to identify the disease or injury that initiated the sequence of morbid events which led to death
- Certifying the COD of their patients often seen as an administrative task; not a job they like
- Doctors often unaware of their public health responsibility
- Consequence: COD often poorly/incorrectly certified

What can we conclude from CoD data for hospital deaths? Example of misdiagnosis in Thailand

MEDICAL RECORDS DIAGNOSES

	HIV/AIDS (20)	Liver cancer (31)	Lung cancer (34)	Other cancers (46)	Diabetes (52)	Hypertensive diseases (66)	Ischaemic heart diseases (67)	Other heart diseases (68)	Cerebrovascular diseases (69)	Pneumonia (74)	COPD (76)	Liver diseases (80)	Other digestive diseases (81)	Genitourinary diseases (84)	Transport accidents (96)	All other causes	Total
Septicaemia (12)	44	2	3	3	53	6	8	3	55	38	16	27	19	47	2	144	470
Ill defined conditions (94)	16	6	7	5	27	16	75	36	25	14	39	10	14	13	9	135	447
Cerebrovascular diseases (69)			1		7	1	4	5	203					1	9	31	262
Ischaemic heart diseases (67)	1		2		26	5	138	9	3	2	3		3	6		16	214
Pneumonia (74)	40		3		9	1	4	2	25	44	21	7	1	10	3	37	207
All other external causes (103)					1	1	2	1	25	1					93	61	185
Genitourinary diseases (84)	1	1		1	37	24	2	3	3	1	1	5	2	58		17	156
Lung cancer (34)		1	85	6					1		4					5	102
Transport accidents (96)								1							91		92
Liver diseases (80)	2	2			1		2		2			63	2	1		11	86
HIV/AIDS (20)	79											1				3	83
Other cancers (46)	1	14	3	24						2				1		34	79
COPD (76)	1		2		2		3	3	2	3	54			2		5	77
Other digestive diseases (81)	3	1	2			2	1		2		1	16	17	1	1	27	74
Other respiratory diseases (77)	5		2	1	4	1	5		8	3	12	3		3	1	25	73
Other heart diseases (68)	1		1		1	4	15	14	4	1	4	1	1	5	1	18	71
Liver cancer (31)		58		2			1					3				4	68
Other infectious diseases (25)	18			1	3			1	5	1	1	1	1	3		17	52
Tuberculosis (5)	20				1						2					17	40
Other nervous system disorders (61)	10				2			1	4			1				10	28
Diabetes (52)				1	16		2		1	1				2	1	2	26
All other causes	14			8	9	8	5	3	18	1	1	9	4	6	2	336	424
Total	256	85	111	52	199	69	267	82	386	112	159	147	64	159	213	955	3316

The role of the coder

- ICD-10 has clear coding rules for processing cause of death information on the death certificate
- A *correctly* filled death certificate is easily coded by a trained mortality coder
- A *poorly* filled death certificate often results in a “garbage”/unusable COD; coders cannot work miracles!! Garbage in, garbage out!!
- Labelled as ‘unusable codes’ since they are of **none**, or **very limited** use for policymakers e.g. ‘heart failure’
- ANACONDA identifies these useless codes in the dataset and classifies them according to severity of their implications for policy, or by type of diagnostic error

Concept of 'Garbage codes' (unusable codes)

- The 1990 GBD study first identified 'garbage codes' and proposed rules to reallocate them to specific causes of death
- 'Garbage codes' defined them as 'deaths assigned to causes that *cannot or should not* be considered underlying causes of death, e.g.
 - Signs, symptoms and ill-defined conditions
 - Impossible UCOD
 - Intermediate and immediate causes
 - Insufficiently specified within ICD chapters

Using GBD broad cause groups to screen for gross errors in COD data/plausibility of epidemiological transition

Group I:

- Infections & Parasitic diseases (e.g. TB, pneumonia, diarrhoea, malaria, measles)
- Maternal/perinatal causes (e.g. maternal haemorrhage, birth trauma)
- Malnutrition

Group II:

- Non-communicable diseases (e.g. Cancer, diabetes, heart disease, stroke)
- Mental health conditions (e.g. Schizophrenia)

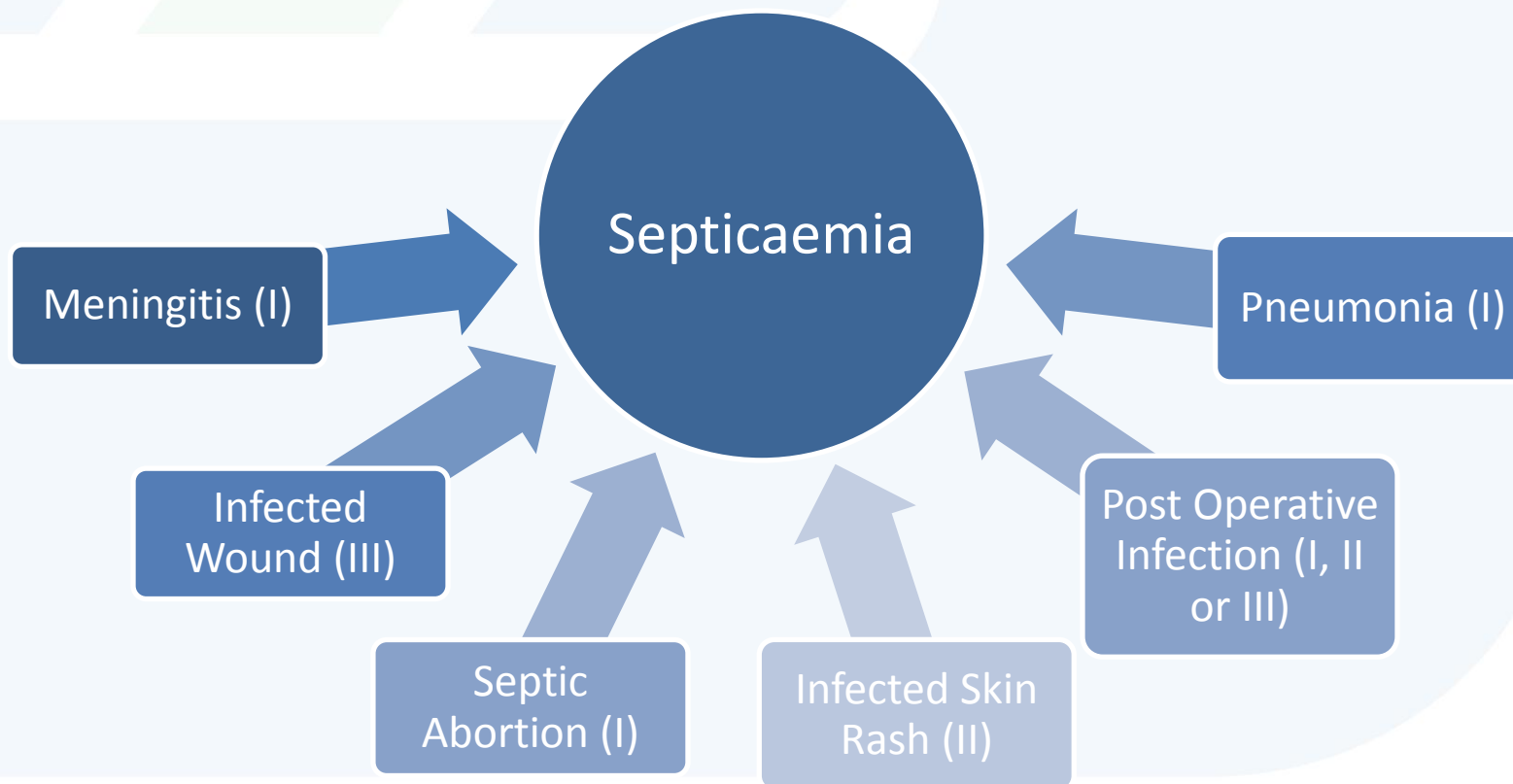
Group III:

- Injuries (e.g. Accidents, homicide, suicide) often referred to as “external diseases” or “non-natural” COD

Classification of Garbage Codes based on severity of impact for guiding policy

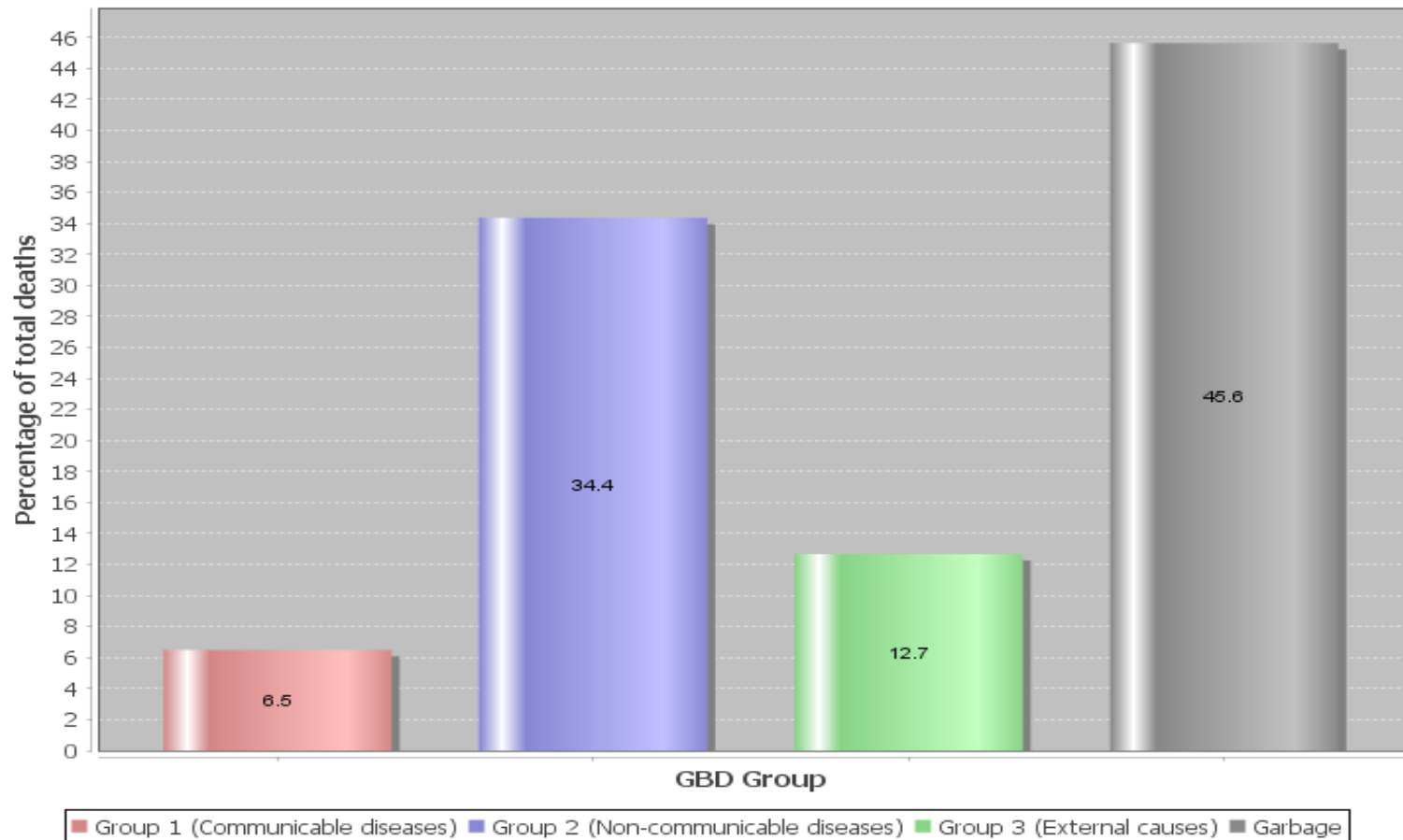
- *Level 1 (Very High)*: codes where the misdiagnosis has **serious** implications for public health policies
- *Level 2 (High)*: codes with **substantial** implications for guiding public health policy
- *Level 3 (Medium)*: codes with **important** implications for policymaking
- *Level 4 (Low)*: codes with **limited** implications for public health policies

What does it mean to die from 'septicaemia'?



Distribution of deaths by broad cause groups

Distribution of deaths by three GBD broad cause groups



Ratio of Group 2 to Group 1

Ratio of Group 2 to Group 1	Source	Reference year
9.1	Sri Lanka mortality data source: civil registration	2009
2.6	IHME estimates for GBD region: Southeast Asia	2010

Tabulation lists

- Once the death certificates have been coded and compiled by age and sex, they need to be tabulated in a useful way
- Based on the 3-character ICD codes, WHO has proposed 4 tabulation lists which condense the categories into manageable number of items
- ANACONDA uses one of these with 103 disease categories to tabulate and rank CoD data

Global Burden of Disease (GBD) List

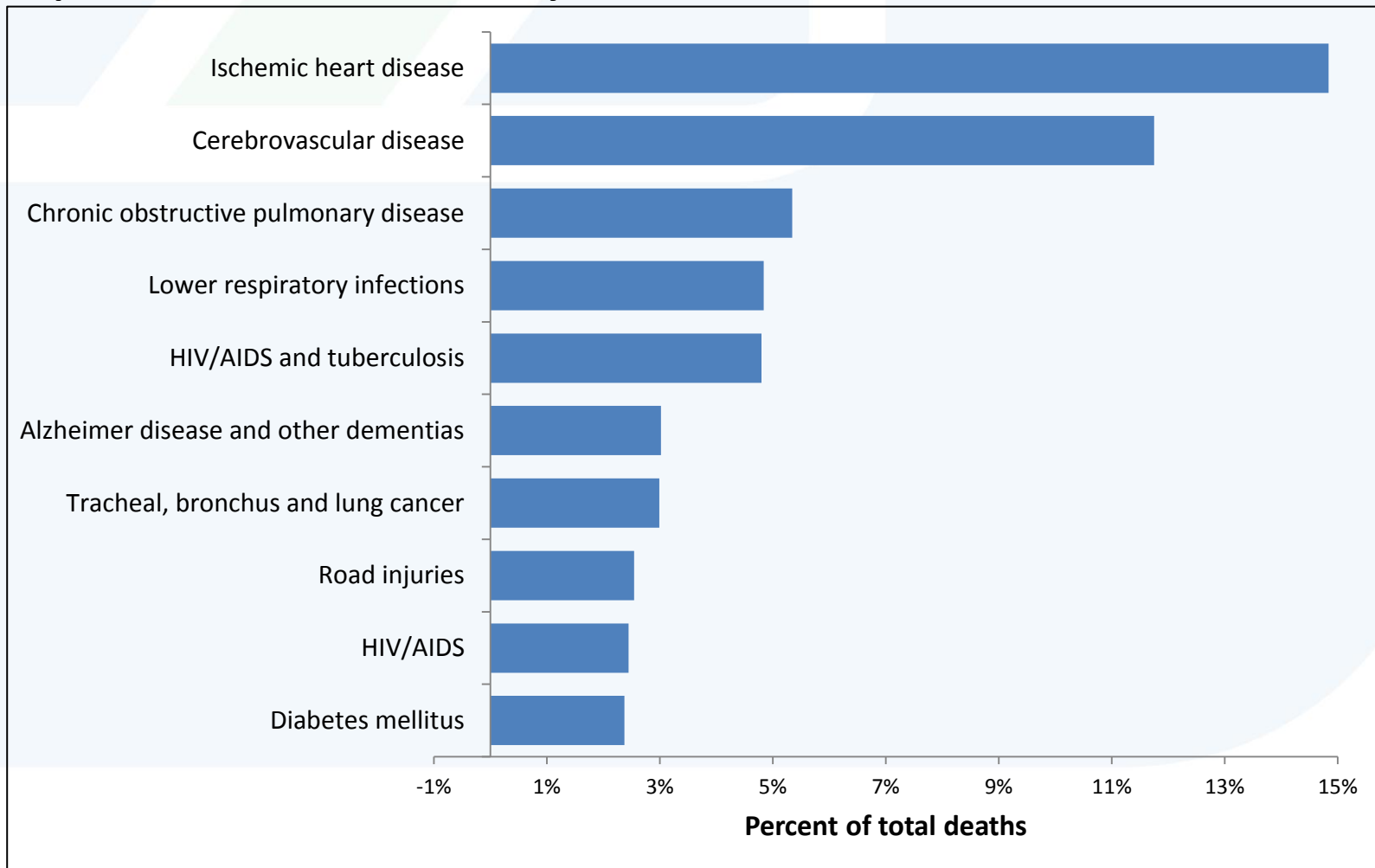
- Another standard tabulation used in ANACONDA comes from the GBD. GBD is a large, global collaborative study to estimate mortality and causes of death in 190 countries. First done in 1990, then 2000, 2012, 2013; annual updates since 2015
- GBD groups ICD causes of death into approx. 300 specific disease and injury categories considered to be of global public health importance
- GBD COD list is hierarchical: **3 broad groups** (I,II,III) subdivided into 21 major disease/injury groups (A (e.g. Neoplasms),B,C, D, etc), most of which are further disaggregated into sub-categories 01 (e.g. stomach cancer), 02, 03, etc

Concept of leading causes of death

- These and other CoD lists are used in all countries to rank leading causes of death to guide health policies
- Usually the 10 to 20 diseases/categories that cause the highest number of deaths are ranked
- ANACONDA automatically calculates the 20 leading causes for males and females based on 3 digit ICD
- These are the diseases causing most (premature) deaths that policy makers want to try and prevent – but how can they if ‘garbage codes’ dominate leading cause of death lists??

Leading Causes of Death

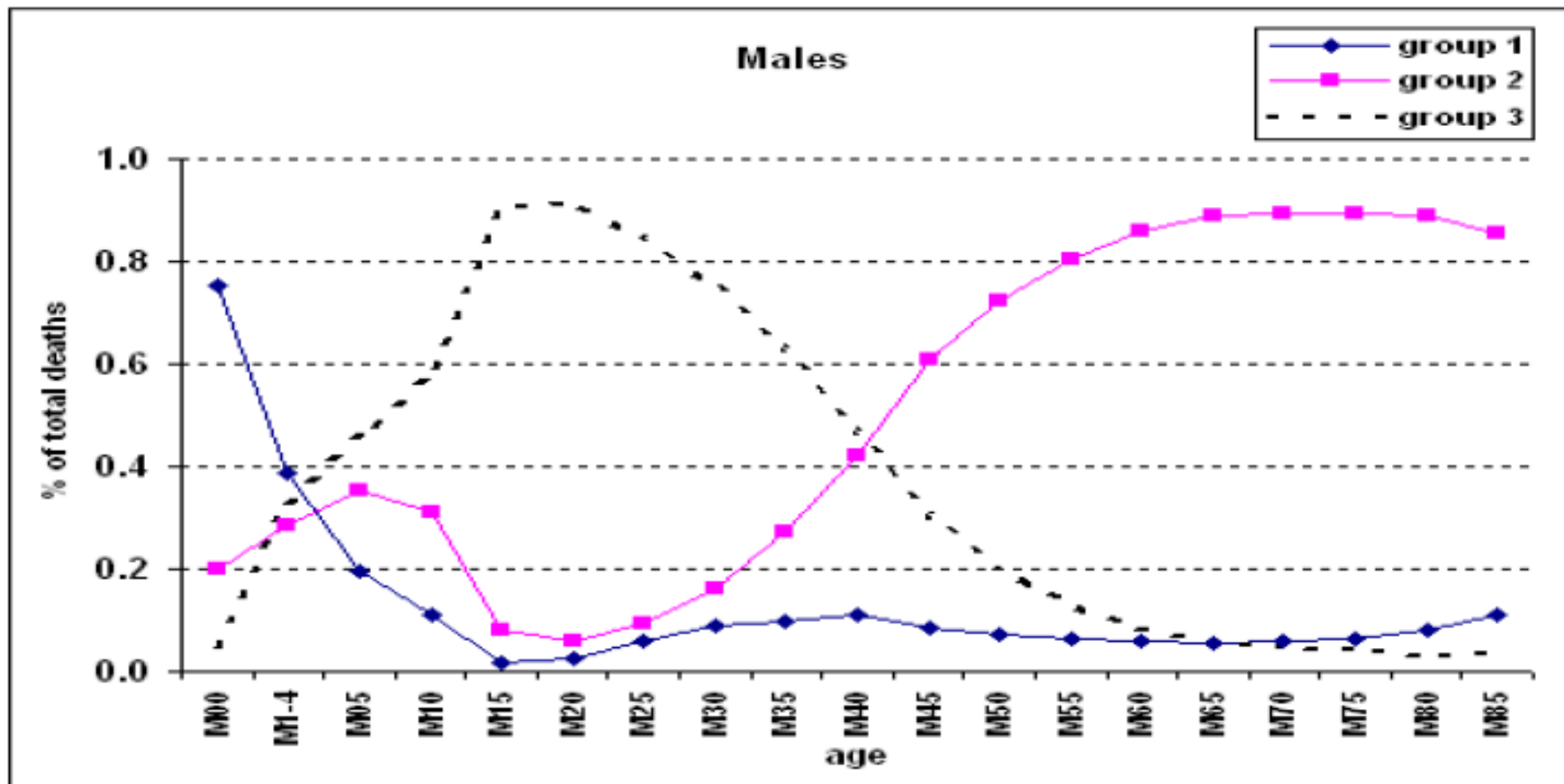
Top 10 Causes of Death Globally, 2013



Does my age pattern of causes of death look sensible?

- Causes of death should follow a well-established age pattern, e.g. *higher* infectious disease mortality at younger than older ages; *higher* NCD death rates among older adults; *higher* injury mortality among young adults
- True for each individual cause of death but checking age patterns of broad cause of death groups should identify any gross errors
- Male-female differences at broad cause group level provide additional check in plausibility; should be more male deaths at each age up to about 75, then more female deaths at the highest ages. **WHY?**

Typical age distribution of broad causes of death: 1-Comm. Dis., 2-NCDs, 3- Inj. Males



Summary index of vital statistics data quality: Vital Statistics Performance Index

- The overall policy utility of VS data can be assessed according five quality dimensions, plus timeliness of data
- Using a simulation environment, the relative weight of each has been empirically determined and they have been combined into a single metric, the ***Vital Statistics Performance Index (VSPI)***
- For ANACONDA, we utilized the 5 data quality measures but ***not*** the dimension related to timeliness of data, since not assessed using ANACONDA. Defined a new metric: VSPI(Q)
- VSPI and VSPI(Q) scores range from 0 (poorest performance) to 1 (best possible performance)
- VSPI measures objectively, comprehensively and usefully whether data from a VS system are ‘fit-for-purpose’.

How do we assess CRVS system performance using the VSPI (Q)

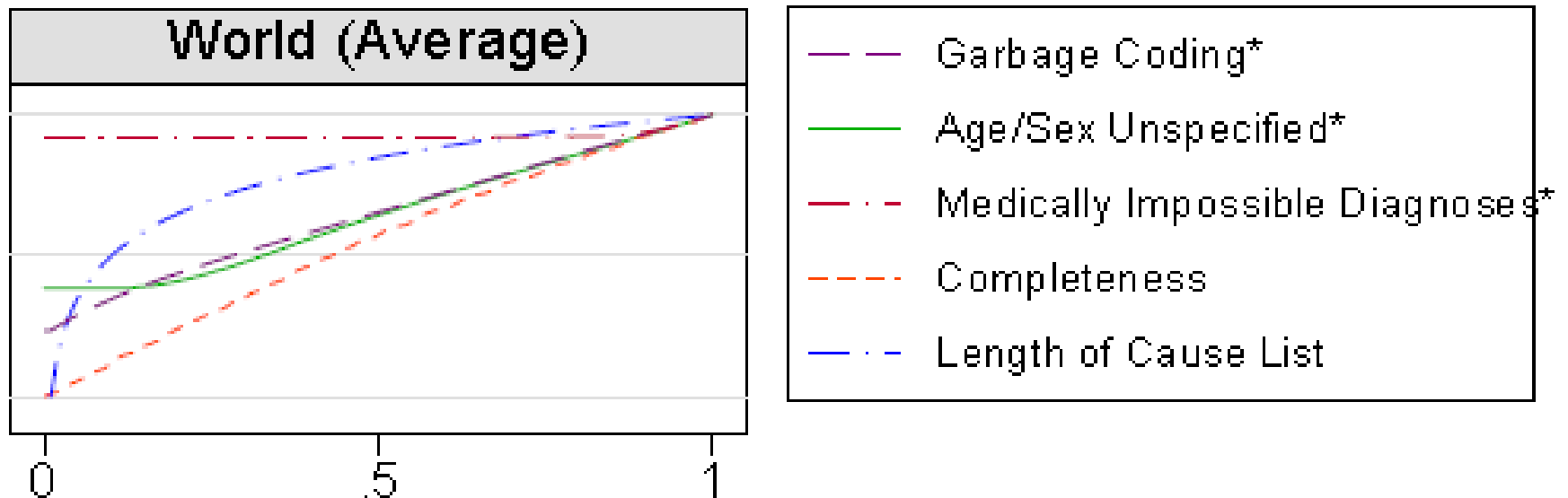
- Argue that most important value of VS for policy is providing accurate information on who dies of what, at what age.
- Hence assess CRVS performance by comparing CSMF Accuracy based on your VS data compared with some “gold standard” CSMF distribution for your country.
- *CSMF = % of deaths assigned to various causes (by age and sex). We measure the overall absolute difference between predicted (i.e. observed CSMFs) and “true” CSMFs as a fraction of the theoretically largest possible absolute difference between them:*

$$CSMF \text{ Accuracy} = 1 - \frac{\sum_{j=1}^k CSMF_j^{true} - CSMF_j^{pred}}{2[1 - \text{Minimum}(CSMF_j^{true})]}$$

- In terms of VS performance, $CSMF^{pred}$ is the CSMF directly observed from a given VS dataset, and $CSMF^{true}$ represents the hypothetically true CSMF for the same population for cause j out of a total number of k causes.
- To define $CSMF^{true}$ for our simulation, we utilized the CSMFs from GBD, estimated for seven broad epidemiologic regions, by year, sex and age.

VSPI Simulation

- Hypothetical sets of CSMFs were computed at progressively worse levels of a given dimension, from zero (e.g. no unspecified ages or sexes) to one (e.g. all deaths reported without age or sex) in increments of 0.01. At each simulated level, *CSMF Accuracy* was computed based on $CSMF^{pred}$ and $CSMF^{true}$. This procedure was repeated for each dimension separately.



The Vital Statistics Performance Index for Data Quality – VSPI(Q)

- VSPI(Q) measures quality of mortality data on 5 dimensions:
 - *completeness,*
 - *CoD accuracy (i.e. pattern and extent of garbage coding),*
 - *CoD detail available in tabulation lists,*
 - *missing information (age/sex of decedent)*
 - *biological plausibility of causes of death (e.g. male pregnancy. deaths)*
- The index (VSPI) was originally developed to assess the quality of the VS data used in the GBD and is rapidly becoming a global indicator to measure the performance and progress of vital statistics registration systems (see Mikkelsen et al, *Lancet* CRVS series, 2015)

Interpreting the VSPI(Q) in ANACONDA

- Provides detail about the relative contribution of each of the five dimensions to overall data quality of the CRVS system.
- A summary indicator will invariably obscure impact of specific problems on VS performance; hence important to examine scores for subcomponents to understand which improvement actions will have the biggest impact.
- ANACONDA shows the relative importance of each data quality component to the CRVS performance gap (compared with 100%) and highlights priority areas for improvement

Conclusions

- All else being equal, **completeness** of a VS system is the single most important aspect affecting performance (i.e. data quality)
- The two other most important factors affecting data quality are the use of abbreviated **cause of death lists** to report data, and widespread use of **garbage codes** to assign the underlying cause of death.
- Given the dominance of these three dimensions, national strategies to rapidly strengthen VS systems should focus on them (and any other dimensions identified by the VSPI).
- UoM working on a similar VSPI for births.
- Remember ANACONDA will help identify the pattern, extent and implications of errors/biases in your VR data, but will **not** fix' them
- UoM has developed a 'tool kit' to guide and evaluate CRVS intervention strategies (which should be based/prioritized according to ANACONDA).



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