Learn as if you were to live forever……

January 30, 2015
World Leprosy Eradication Day

Measurement of mortality

Learning Objectives

At the end of this session, the student should be able to:

1. Describe the International Death Certificate
2. Define mortality rate
3. Describe uses and limitations of mortality data
4. Describe in detail commonly used measurements of mortality

International Death Certificate

Medical Certification Of Cause Of Death Scheme (MCCD)

- Under the Birth & Death Act 1969 (RBD)
- Part of International classification of disease & Related health problems formulated by WHO (ICD 10)
- Provide Reliable & scientific information on mortality data
- The causes of deaths are classified as per ICD 10

Provision under the RBD act 1969

- Certification by Medical practitioner who has attended deceased during the last terminal illness.
- RGI instructed- 1999 State govt.
- – All private, Govt. hospital ,clinics…. Under the coverage

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)	. . . . .
	due to (or as a consequence of)	
Antecedent causes	(b)	. . . . .
Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	due to (or as a consequence of)	
	(c)	. . . . .
	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	. . . . .	. . . . .
	. . . . .	. . . . .

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

Form No.4

(See Rules 7)

MEDICAL CERTIFICATE OF CAUSE OF DEATH

(Hospital in-patients, not to be used for still births)

To be sent to Registrar along with Form No 2 (Death Report)

Name of deceased | For use of Statistical Office

Sex	**Age at death**			
1. Male 2. Female	If 1 yr or more, age in yrs	If < 1 yr, age in months	If < 1 month, age in Days	If < 1 day, age in hrs.

Cause of death		**Time interval between onset & death**	
I *Immediate cause* State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthenia, etc.	(a)…… due to (or as a consequences of)	……	……
Antecedent cause Morbid conditions, if any giving rise to the above cause, stating underlying conditions last	(b)…… due to (or as a consequences of)	……	……
II Other significant conditions contributing to the death but not related to the disease or conditions causing it	(c)…… due to (or as a consequences of)	……	……

Manner of Death How did the injury occur?

Natural/Accident/Suicide/Homicide/Pending Investigation

If deceased was a female, was pregnancy associated with the death? Yes/No

If yes, was she delivered? Yes/No

Name and signature of the Medical Attendant

Date of verification……

Death Certificate - Basis of mortality data

- International Death Certificate (IDC)
  - Uniform & Standardised for National & International comparability
- Often > 1 cause (related? / unrelated?)

- Part-I
  - Immediate cause
  - Underlying cause
- Part-II
  - Significant associated disease that contributed to the death but did not directly lead to it
- Emphasis on underlying cause – ESSENCE of IDC

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....

Cause of death		**Time interval between onset & death**	
I *Immediate cause* State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthenia, etc.	(a)..... due to (or as a consequences of)	.....	.....
Antecedent cause Morbid conditions, if any giving rise to the above cause, stating underlying conditions last	(b)..... due to (or as a consequences of)	.....	.....
II Other significant conditions contributing to the death but not related to the disease or conditions causing it	(c).....	.....	.....

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1. Male 2. Female	If 1 yr or more, age in yrs	If < 1 yr, age in months	If < 1 month, age in Days	If < 1 day, age in hrs.

Cause of death — **Time interval between onset & death**

I

Immediate cause (a)..... .....

due to (or as a consequences of)

State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthma

- 59 years old male was admitted to hospital died 2 days after shock & S/S of septicemia. along with patient had gangrene of left foot since 3 days. He had chronic bronchitis and DM since 5 years. Since five years patient was diagnosed pancreatic malignancy and operated for same 5 years back.

Form No.4

(See Rules 7)

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(Hospital in-patients, not to be used for still births)

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Name of deceased

Sex	Age at death			
1. Male	If 1 yr or more, age in yrs 59	If < 1 yr, age in months	If < 1 month, age in Days	If < 1 day, age in hrs.
2. Female				

Cause of death

Part I

•Immediate cause

State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthma

		Time interval between onset & death
a)	Septicaemic shock	2 days
	Due to (or as a consequence of)	

Form No.4

(See Rules 7)

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To be sent to Registrar along with Form No 2 (Death Report)

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1. Male	If 1 yr or more, age in yrs **59**	If < 1 yr, age in months	If < 1 month, age in Days	If < 1 day, age in hrs.
2. Female				

Cause of death		Time interval between onset & death
I		
•Immediate cause	**Septicaemic shock**	**2 days**
(a).....		.....
due to (or as a consequences of)		

State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthma

Time interval between onset & death

Antecedent cause

Morbid condition, if any giving rise to the above cause, stating underlying condition last

b) Gangrene of Lt. Foot ..... 3 days .....

Due to (or as a consequence of)

c) Diabetes Mallitus ..... 5 years .....

Due to (or as a consequence of)

d) Ca. Pancrease ..... 5 years .....

Due to (or as a consequence of)

Time interval between onset & death

Part II

Other significant condition contributing to the death but not related to the disease or conditions causing it

a) Chronic bronchitis ..... 5 years .....

Antecedent cause

Gangrene of Lt. Foot 3 days

(b) ..... due to (or as a consequences of) .....

Morbid condition, if any giving rise to the above cause, stating underlying condition last

C-Diabetes Mallitus 5 years

II

D- Ca. Pancrease 5 years

Other significant condition contributing to the death but not related to the disease or conditions causing it

Chronic bronchitis 5 years

Manner of death(How did injury occur?)

Natural/ accident/ Suicide/ Homicide/ Pending investigation

If deceased was female, was pregnancy associated with death? Yes/ No

If yes, was she delivered? Yes/ no

---

26 years old third para had Full term normal delivery at home. She was treated for anemia during her second trimester.

5 th day after delivery she developed high grade fever, severe abdomianl pain & was brought to the hospital. O/E she was diagnosed as sepicemic shock. 8 hrs after treatment she died.

Form No.4

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1. Male 2. Female	If 1 yr or more, age in yrs	If < 1 yr, age in months	If < 1 month, age in Days	If < 1 day, age in hrs.

Cause of death — **Time interval between onset & death**

I

•Immediate cause

(a)... ... ...

due to (or as a consequences of)

State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthma

Antecedent cause

(b)... ... ...
due to (or as a
consequences of)

Morbid condition, if any giving rise to the above cause, stating underlying condition last

II

Other significant condition contributing to the death but not related to the disease or conditions causing it

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Manner of death(How did injury occur?)

Natural/ accident/ Suicide/ Homicide/ Pending investigation

If deceased was female, was pregnancy associated with death? Yes/ No

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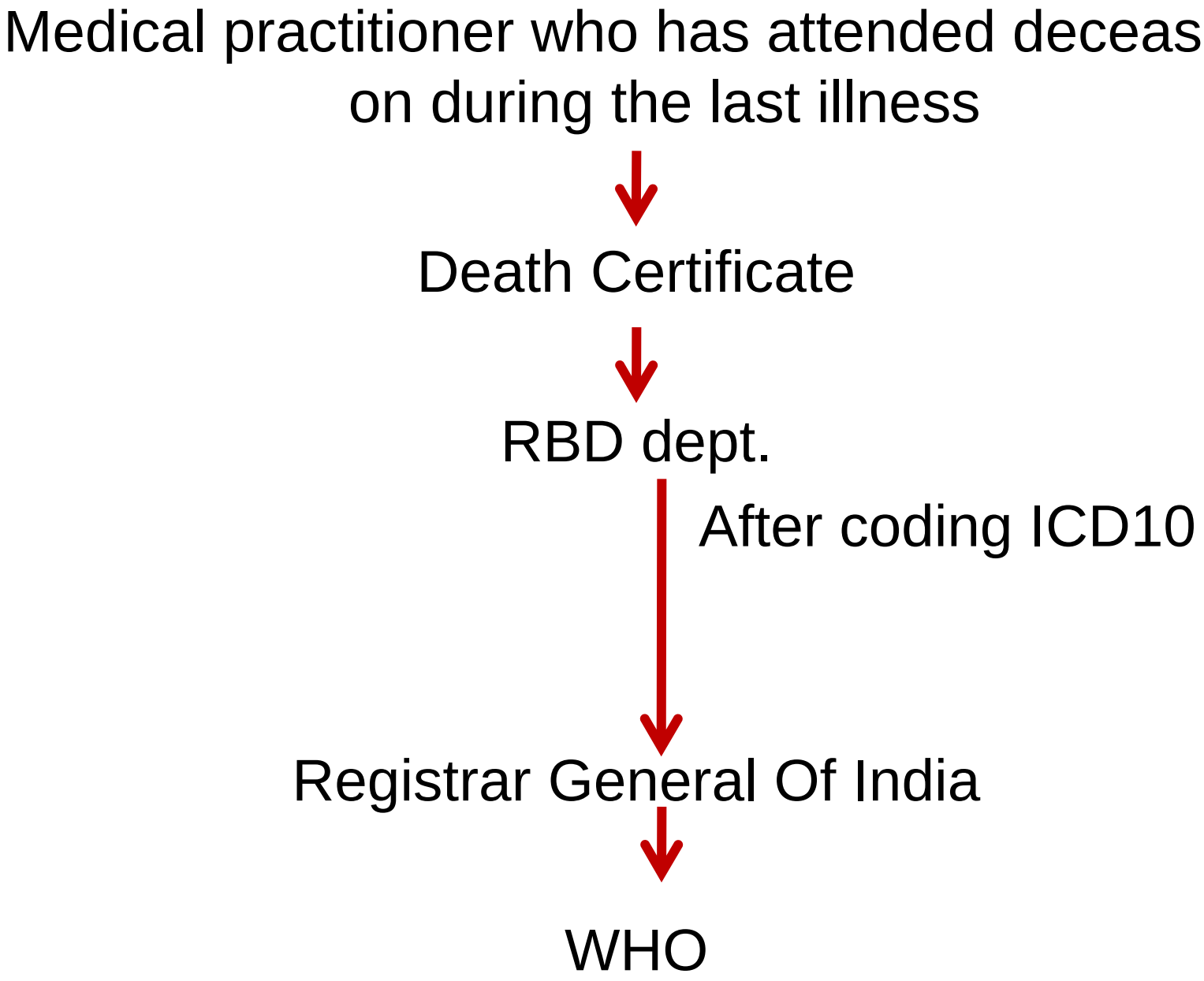

Medical practitioner who has attended deceased on during the last illness
Death Certificate
RBD dept.
After coding ICD10
Registrar General Of India
WHO

- Limitations Of Death Certificate
  - Incomplete reporting
  - Lack of accuracy
  - Lack of uniformity
  - Choosing a single cause
  - Changing (code-definition-nomenclature-concepts)
  - Disease with low fatality

Mortality Rates & Ratios

- Crude Death Rate
- Specific Death Rate
- Case Fatality Ratio
- Proportional Mortality ratio
- Survival Rate
- Adjusted \ Standardized Rate

Crude Death Rate

- Number of deaths (from all causes) per 1000 estimated mid-year population in one year in a given place

$$\text{CDR} = \frac{\text{Total no. of deaths (from all causes) during the year}}{\text{Estimated mid-year population in one year in a given place}} \times 1000$$

"It portrays an impression of mortality in a single figure"

Effect of factors that are summarized

- Population composition
- Age specific death rate

Pop.	CDR
A	15.2
B	9.9

Pop.	CDR	Age specific Death rate per 1000 pop.			
		0-5	6-45	45-65	>65
A	15.2	10.5	0.6	0.7	9.5
B	9.9	22.6	3.0	1.2	3.6

A)Developed countries

- High crude death rate
- Low age specific death rate

B)Developing countries

- Low crude death rate
- High age-specific death rate

Limitation of CDR

- It lacks comparability for communities with population that differ in population composition (Age, Sex etc.) (which require standardization)

Specific Death Rate

Specific Death Rate

- When death rates are refined to highlight the etiological factor
  - Cause/disease specific
    - TB, Accident etc
    - Month/season etc
  - Host
    - Age, Sex, , Caste, Religion, occupation, education, etc

SDR = $\dfrac{\text{Total no. of deaths (from all causes) in females}}{\text{Estimated mid-year population of females in one year in a given place}} \times 1000$

Ds.DR $\dfrac{\text{Total no. of deaths due to TB during the year}}{\text{Estimated mid-year population in one year in a given place}} \times 1000$

- Cause of death in HIV positive persons

  In India- 90% of HIV positive persons, cause of death is Tuberculosis.

  USA- Pneumonia & GI infections.

Specific Death Rate
USES

- It helps in identifying particular group/groups at risk
- Permits comparision between
  - Different causes in same population
  - Different groups in same population

Specific Death Rate Limitations

- Data – less reliable except in developed countries where satisfactory civil registration system operates
- Examples
  - Specific death rate due to tuberculosis
  - Specific death rate for males
  - Specific death rate for age-group 15-20 years
  - Monthly death rate etc

Mortality Ratio

- Maternal Mortality Rate
- Disease specific mortality ratio

Mortality Ratio

$$\frac{\text{Total no. of deaths due to Infectious diseases.}}{\text{Total no. of deaths due to Infectious diseases.}} = X:Y$$

Mortality Proportion

- Age/ disease specific Proportionate mortality

- Case Fatality Rate

Mortality Proportion

- Age/ disease specific Proportionate mortality

$$\frac{\text{Total no. of deaths due to Infectious diseases.}}{\text{Total no. of deaths}} \times 100$$

=50%

Mortality Proportion

- Age/ disease specific Proportionate mortality

$$\frac{\text{Total no. of deaths due to a Cancer}}{\text{Total no. deaths}} \times 100$$

Case Fatality Rate

$$\text{CFR} = \frac{\text{Total no. of deaths due to a particular disease}}{\text{Total no. of cases due to the same disease}} \times 100$$

Case Fatality Rate

- It represents the killing power of a disease
- It is typically used in acute infectious diseases & is closely related to virulence

- CFR of Tetanus - 90%

- Malaria P.Vivax- <1%

  P. falciparum- 60%

Case Fatality Rate

- Time interval – not specified
- Chronic ds. – onset→ death = long and variable period

Case Fatality Rate Limitations

- Time interval – not specified
- Chronic diseases – onset→ death = long and variable period

Proportional Mortality Rate

Example:

$$\frac{\text{No. of deaths from a specific disease in a year}}{\text{Total no of deaths (from all causes in that year)}} \times 100$$

Proportional Mortality Rate

- To know the relative importance of
  - Specific cause/disease
  - Specific age & sex group
- Especially when population data is not available, so, it does not indicate risk.

Proportional mortality rate is dependent on two data

1. Total deaths
2. Deaths due to disease/ in particular groups

- Both are variable (dependent), so, less reliable
- Cause of death varies according to age, sex etc, so may indicate preventable mortality

- Mid year population of a city during the year 2011 was 1 lac. There were 40,000 females, out of which 20,000 were belonging to age 15 to 45 years. Total no. of infants 2000. During the same year following events were reported.
- Total no. of death 1000.
- Infant death- 70
- Total no. of female deaths- 500 out of which 300 within age 15 to 45 years.
- Deaths due to Infectious diseases- 600.
- Out of total 500 malaria cases (P vivax-450, P.falciparum-50) 5 people died due to P. falciparum malaria.
- Find out possible Mortality rate, ratio & proportion.
-

Special Death Rate

- Denominator is different
- Not population or death but event, e.g.
  - Infant Mortality Rate (IMR)

    (No. of infant deaths in a year/ no. of live births in the year) x 1000
  - Maternal Mortality Rate (MMR)
  - Perinatal Mortality Rate

Survival Rate

- Describes proportion of survivors in a group at the end of a particular time period (esp. used in cancers)
- For describing prognosis in a quantitative term
- Yardstick for the assessment of standards of therapy/treatment
- Survival Rate = (total no. of patients alive after 5 yrs / total no. of patients) x 100.

Adjusted Or Standardized Rate

- CDR of village A- 12
- CDR of village B- 9

Village- A

- CDR -12

Age	Population
0-10	12,000
11-20	15,000
21-40	40,000
41-50	10,000
51-60	60,000

Village- B

- CDR-9

Age	Population
0-10	12,000
11-20	15,000
21-40	40,000
41-50	10,000
51-60	60,000

Village- A
- CDR -12

Age	Population
0-10	12,000
11-20	15,000
21-40	40,000
41-50	10,000
51-60	60,000

Village- B
- CDR-9

Age	Population
0-10	5,000
11-20	12,000
21-40	60,000
41-50	40,000
51-60	10,000

Standardized Rates

Rates are only comparable if the population upon which they are based are comparable

Problems in comparison

CDR
not comparable

Series of ASDR
(calculation difficult)

Standardized Rates

Rates are only comparable if the population upon which they are based are comparable

Problems in comparison

CDR
not comparable

Series of ASDR
(calculation difficult)

Standardized Rates

Rates are only comparable if the population upon which they are based are comparable

Problems in comparison

CDR … f ASDR
not com… …tion difficult)

SOLUTION

Age adjustment/ standardization

Age adjustment / standardization

- It removes the confounding effect of different age structure and yields a single standard / adjusted rate.

Standardization techniques:

Absolute age adjustment rate

Life table

Regression

Multivariate analysis

Standard population

- A standard population is defined as one for which the numbers in each age & sex group are known

CDR of a village - 9.87

CDR of Taluka – 9.9

Direct Standardization

CDR of a village - 9.87

When age & sex wise structure of study population is known			
Age	MYP	Death	ASDR (1000)
0-14	22000	22	**1.00**
15-44	44000	46	**1.05**
45-65	14000	722	**51.57**
Total	80000	790	**9.87**

Direct Standardization

When age & sex wise structure of study population is known			
Age	MYP	Death	ASDR (1000)
0-14	22000	22	**1.00**
15-44	44000	46	**1.05**
45-65	14000	722	**51.57**
	80000	790	9.87
Standard population			
Age	MYP	Death	ASDR (1000)
0-14	3,10,000	**1.00**	
15-44	4,30,000	**1.05**	
45-65	1,90,000	**51.57**	
	9,30,000		

Direct Standardization

When age & sex wise structure of study population is known			
Age	MYP	Death	ASDR (1000)
0-14	22000	22	**1.00**
15-44	44000	46	**1.05**
45-65	14000	722	**51.57**
	80000	790	**9.87**
Standard population			
Age	MYP	Death	ASDR (1000)
0-14	3,10,000	**1.00**	310
15-44	4,30,000	**1.05**	452
45-65	1,90,000	**51.57**	9798
	9,30,000	11.35	10560

Direct standardization

Study population

↓

ASDR

↓

Apply to standard population

↓

Expected deaths

↓

Standardised death rate

Indirect Standardization

- When age & sex wise structure of population is not known but ASDR of standard population is available

(Usually standard population – National Census)

Indirect Standardization

- Instead of a standard population, a set of age specific standard rate is selected
- Although less preferable, it is more commonly used

Indirect Standardization

Age	Coal worker MYP	Observed Death
25-34	300	
35-44	400	
45-54	200	
55-64	100	
	1000	**9**

Indirect Standardization

Age	National pop. Death Rate
25-34	3.0
35-44	5.0
45-54	8.0
55-64	25.0

Indirect Standardization

Age	National pop. Death Rate	Coal worker MYP	Expected Death
25-34	3.0	300	0.9
35-44	5.0	400	2.0
45-54	8.0	200	1.6
55-64	25.0	100	2.5
		1000	**7.0**

Indirect Standardization

Age	National pop. Death Rate	Coal worker MYP	Expected Death	Observed Death
25-34	3.0	300	0.9	
35-44	5.0	400	2.0	
45-54	8.0	200	1.6	
55-64	25.0	100	2.5	
		1000	**7.0**	**9.0**

Standardized Mortality Ratio (SMR)

SMR

= (Obs death / Exp. Death) x 100

= (9/7) x 100

= 129

(29% Excess mortality than expected)

- Two indirectly standardised rates strictly cannot be compared even if same standard set of rates is used because of different in age-sex distribution of the population, whose rates are being standardized.

- The Only valid comparision of an indirectly standardised rate is the population from which standardized rates were derived.

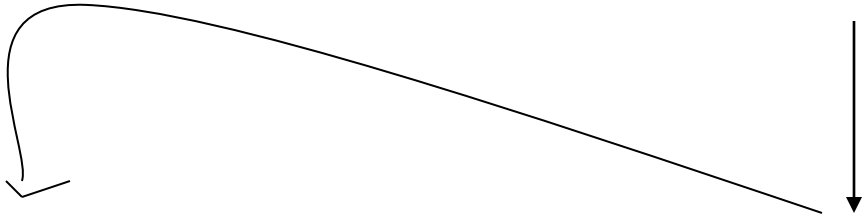
Visual comparision of Direct & Indirect Standardization

Standard Population

Study Population

Population

Direct



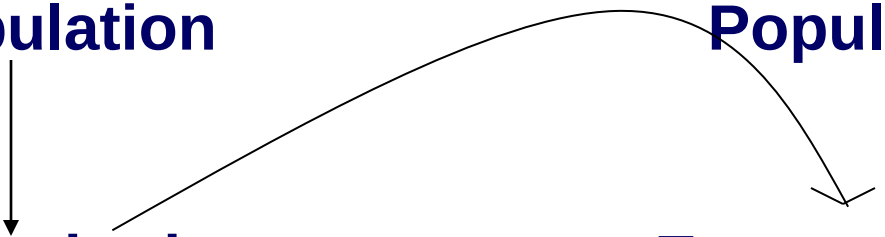
Standardized Death Rate

ASDR

Standard Population

Study Population

Indirect



Standard ASDR

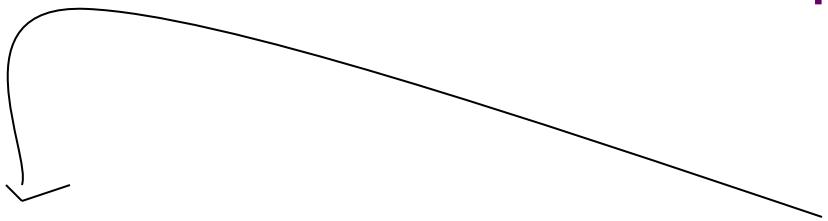
Expected Death SMR

1

Direct

Standard Population

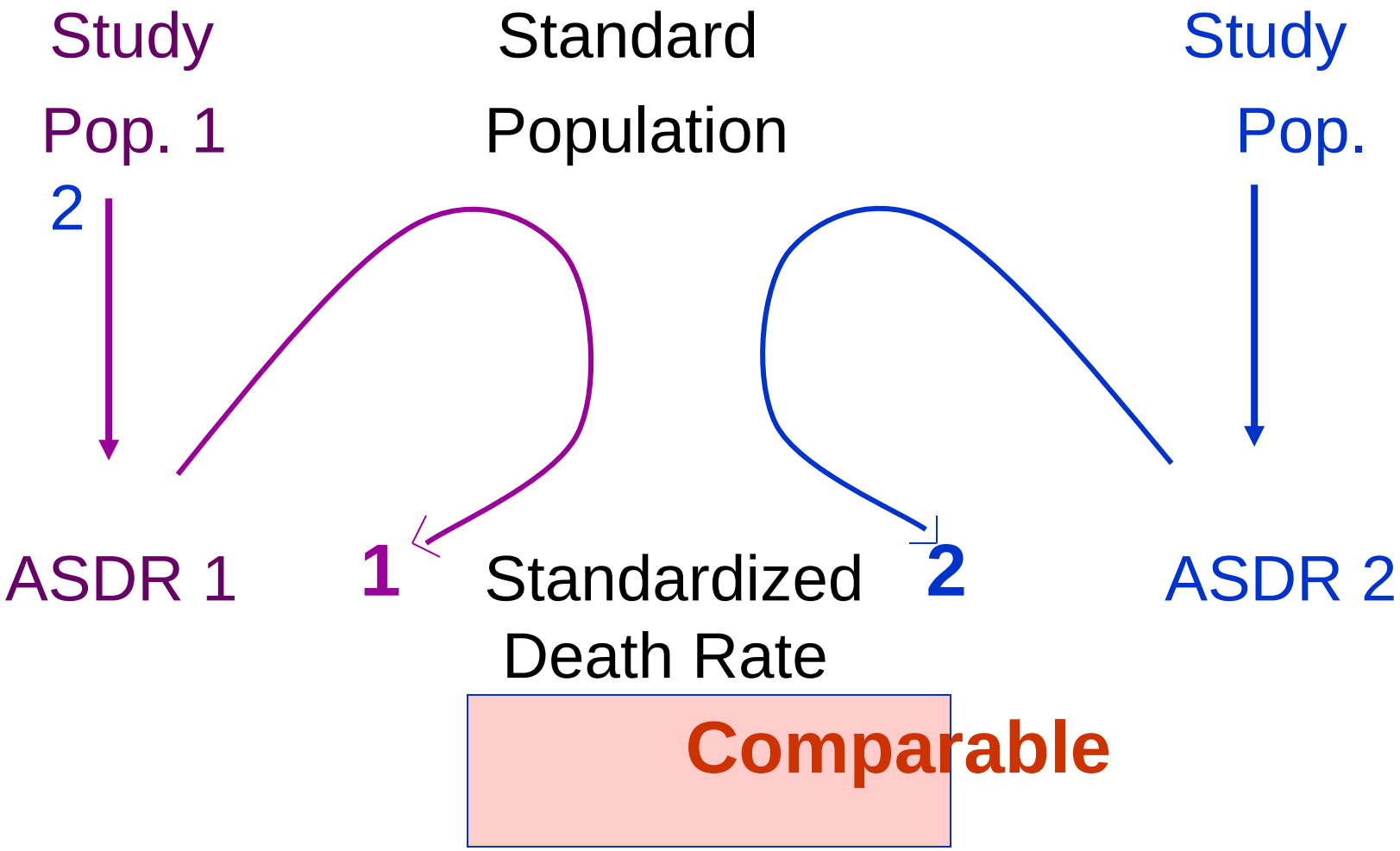
Study Population-

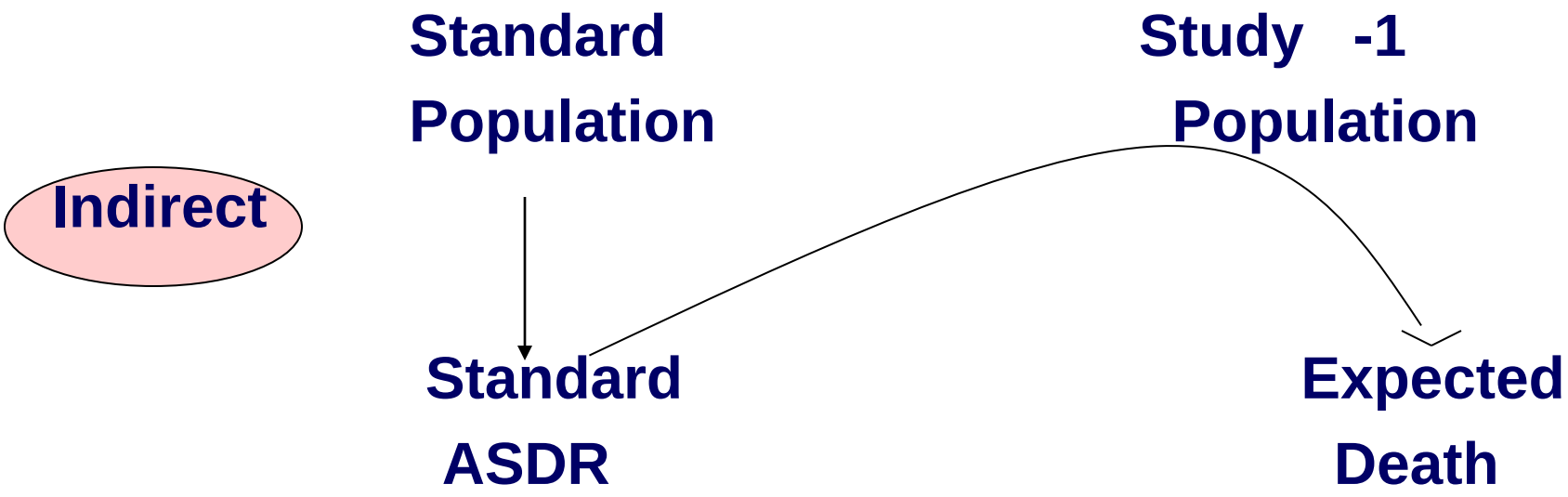


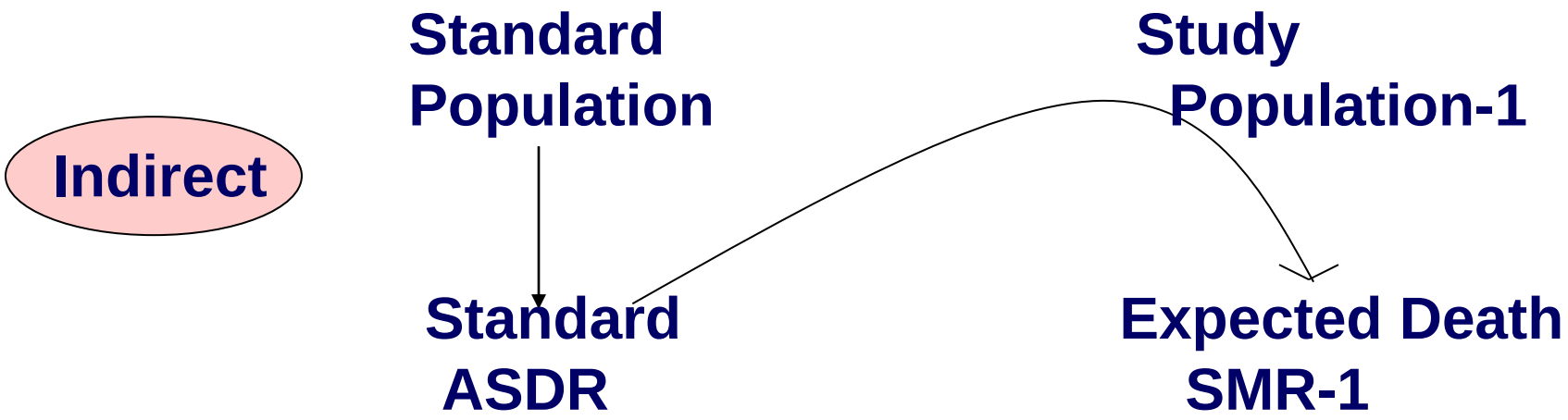
Standardized Death Rate-1

ASDR-1

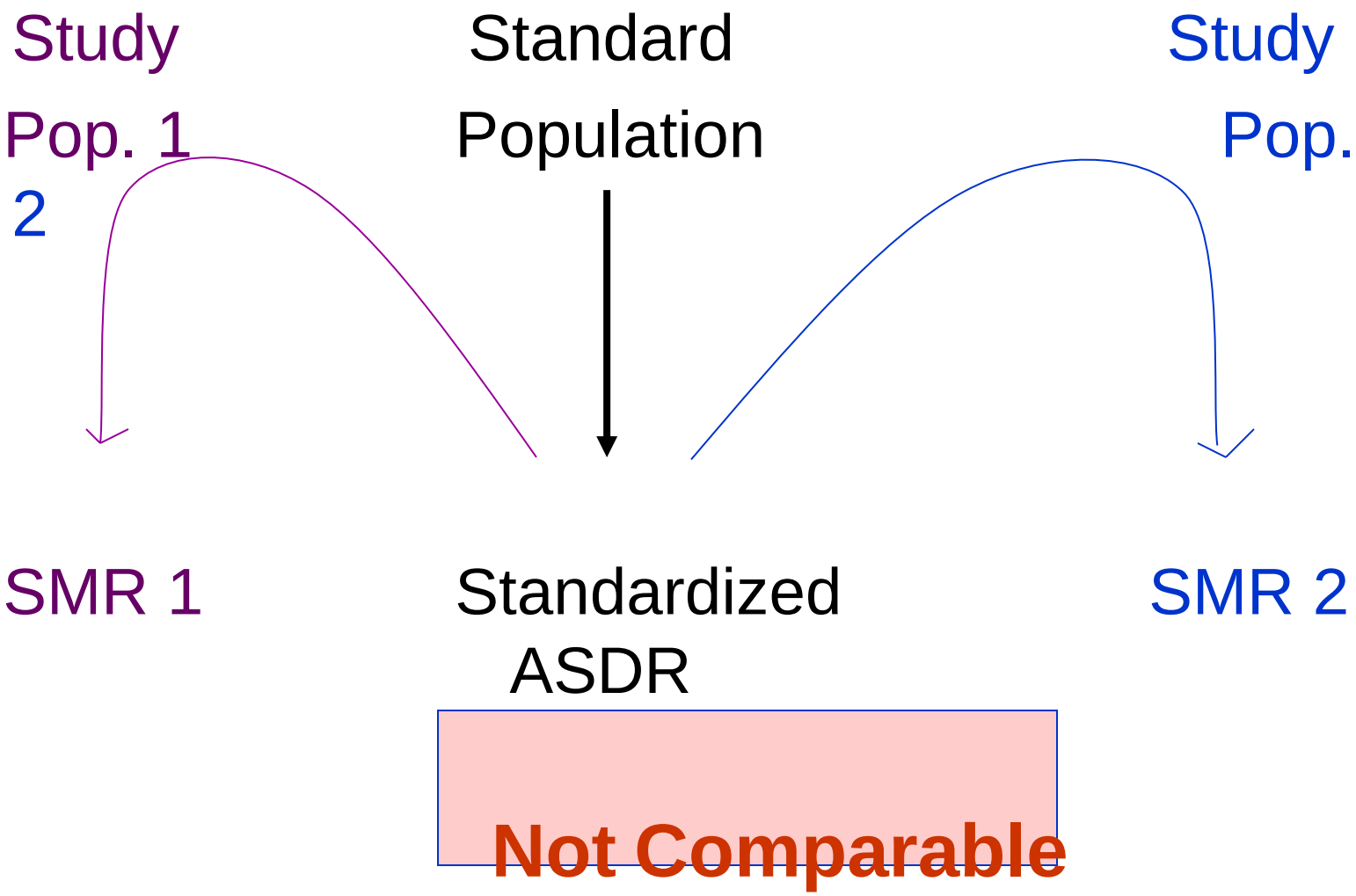
Direct Standardization




Standard
Population
Study -1
Population
Indirect
Standard
ASDR
Expected
Death


Indirect
Standard Population
Study Population-1
Standard ASDR
Expected Death SMR-1

Indirect Standardization



THANK YOU

Questions

- Crude Death Rate
- Indicators of mortality
- MCCD scheme
- ICD 10

- 27 years old male admitted with the H/o convulsions since 5 hrs. ,CSF examination- TB meningitis. Died after 3 days.
- Pt. was taking Rx for Pulmonary TB.
- Pt. was Pt. detected HIV +ve 5 yars back.
- Pt. was hypertensive

Part I

A] TB meningitis

B] Pulmonary TB

C] HIV

Part II (other significant condition)

Hypertension

A] Rate B] ratio C] Proportion

Q.1 927 females per 1000 males

Ans. B

Q.2 4 diabetics per 1000 Mid year population

Ans. A

Q.3 Infant population- 10%

Ans. C