

PARTICIPANT GUIDE



NCD Burden of Disease

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Introduction to NCD Epidemiology. Atlanta, GA: Centers for Disease Control and Prevention (CDC), 2013.

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NCD Burden of Disease

LEARNING OBJECTIVES

At the end of the training, you will be able to:

- Calculate prevalence, incidence, and mortality
- Apply definitions of DALYs and QALYs.

ESTIMATED COMPLETION TIME

- 120 minutes (100 minutes interactive presentation; 20 minutes Skill Assessment)

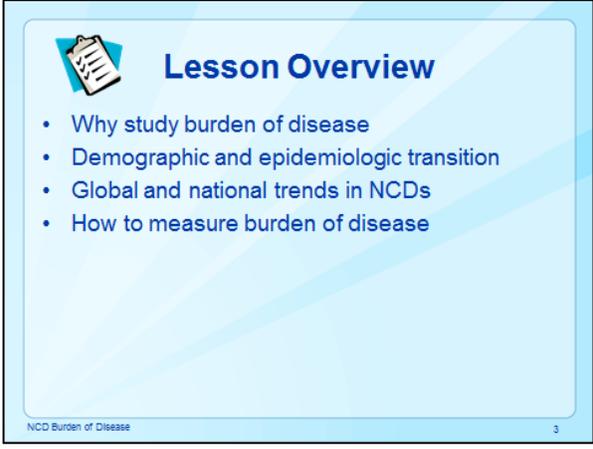
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- World Health Statistics 2008

MODULE CONTENT

Slide	Notes
 <p>Learning Objective</p> <p>At the end of the training, you will be able to: Calculate incidence, prevalence and mortality. Apply definitions of DALYs and QALYs.</p> <p><small>NCD Burden of Disease 2</small></p>	
 <p>Lesson Overview</p> <ul style="list-style-type: none">• Why study burden of disease• Demographic and epidemiologic transition• Global and national trends in NCDs• How to measure burden of disease <p><small>NCD Burden of Disease 3</small></p>	
 <p>WHY STUDY BURDEN OF DISEASE</p> <p><small>NCD Burden of Disease 4</small></p>	

Slide

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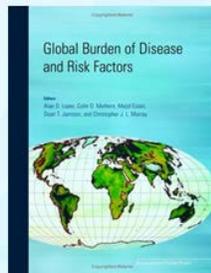
What is Burden Of Disease?

Considers health, social, political, environmental and economic factors to determine the cost that disease and disability exert upon the individual and society

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Why Study Burden of Disease?



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WHO Global Burden of Disease Study

- WHO assessment of the global burden of disease
- Features comparisons between deaths, diseases and injuries by region, age, sex and country income
- Provides projections of deaths and burden of disease by cause and region to the year 2030

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Key Point: The WHO GBD Study contains a lot of information that a country can find useful; this information can help prioritize where to direct money.

WHO Global Burden of Disease Study (cont.)

The study contains information on

- Causes of death in different parts of the world
- Leading causes of death by age sex and disease
- Numbers of people with various diseases and disabilities
- Number of people who become ill each year
- Causes of loss of health and the actual loss of years of good health

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10 Leading Causes of Death in the World

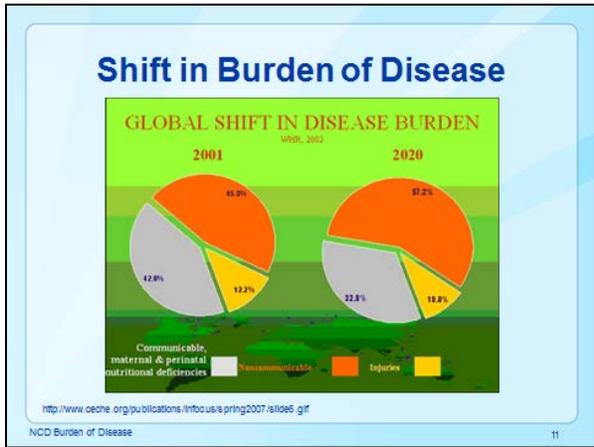
Cause of Death	Deaths in millions	% of deaths
Ischaemic heart disease	7.25	12.8%
Stroke and other cerebrovascular disease	6.15	10.8%
Lower respiratory infections	3.46	6.1%
Chronic obstructive pulmonary disease	3.28	5.8%
Diarrhoeal diseases	2.46	4.3%
HIV/AIDS	1.78	3.1%
Trachea, bronchus, lung cancers	1.39	2.4%
Tuberculosis	1.34	2.4%
Diabetes mellitus	1.26	2.2%
Road traffic accidents	1.21	2.1%

<http://www.who.int/mediacentre/factsheets/fs310/en/index.html>

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DEMOGRAPHIC AND EPIDEMIOLOGIC TRANSITION

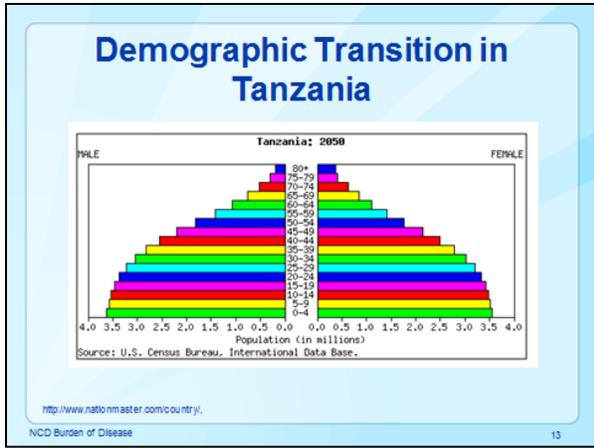
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Demographic Transition

A change in the population dynamics of a country as it moves from high fertility and mortality rates to low fertility and mortality rates

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Key Point: In order to determine burden of disease, you need to look at demographic transition in your country.

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Epidemiologic Transition

A transition from predominance of infectious diseases to chronic or degenerative diseases

- Globalization
- Urbanization
- Tobacco
- Obesity
- Increasing sedentary lifestyles and unhealthy diets

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GLOBAL AND NATIONAL TRENDS OF NCDs

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Global Trends in Cardiovascular Disease and Cancer

- Deaths from cardiovascular disease are predicted to rise from 17.1 million in 2004 to 23.4 million from 2030.
- Deaths from cancer are predicted to increase from 7.4 million in 2004 to 11.8 million in 2030.

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Key Point: As populations age in middle- and low-income countries over the next 25 years, the proportion of deaths due to NCDs is predicted to rise significantly.

Global Trends in Obesity

- In 2005, about 1.6 billion adults (age 15+) throughout the world were overweight (BMI>25); including 400 million who were obese (BMI>30).
- By 2015, WHO projects that approximately 2.3 billion adults will be overweight and 700 million obese.

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Global Trends in Traffic Accidents

- Deaths due to road traffic crashes are predicted to increase from 1.3 million in 2004 globally (ninth leading cause of death) to 2.4 million in 2030 (fifth leading cause of death).



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Global Trends in NCDs

Death trends (2006-2015)

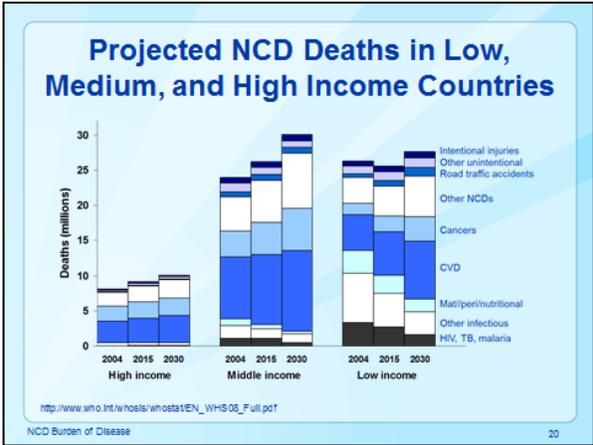
Geographical regions (WHO classification)	2005		2006-2015 (cumulative)		
	Total deaths (millions)	NCD deaths (millions)	NCD deaths (millions)	Trend: Death from infectious disease	Trend: Death from NCD
Africa	10.8	2.5	28	+8%	+27%
Americas	6.2	4.8	53	-9%	+17%
Eastern Mediterranean	4.3	2.2	25	-10%	+25%
Europe	9.8	8.5	88	+7%	+4%
South-East Asia	14.7	8.0	89	-18%	+21%
Western Pacific	12.4	9.7	105	+1	+20%
Total	58.2	35.7	388	-3%	+17%

WHO projects that over the next 10 years, the largest increase in deaths from cardiovascular disease, cancer, respiratory disease and diabetes will occur in developing countries.

(WHO Chronic Disease Report, 2005)

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NATIONAL TRENDS IN NCDs

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Future Impact of NCD Burden

The results of projections indicate that the already constrained health systems will face a double burden of disease, in which HIV/AIDS and other common infectious diseases will co-exist with the new NCDs.

- What is the social and economic impact of this double burden?

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MEASURES USED TO DESCRIBE BURDEN OF DISEASE

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Key Point: The number or actual count of persons affected by a chronic disease, condition, or risk factor is often used as the most fundamental measure of burden in a population. This measure is useful when assessing the need for health care or public health services as a direct measure of the burden on these systems.

Measures of Disease Occurrence

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Incidence

The development of new cases of a disease that occur during a specified period of time in previously disease-free or condition-free (“at risk”) individuals.

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Approaches to Considering Incidence

Two fundamental approaches to considering the incidence of disease or health condition:

1. Incidence Rate
2. Cumulative Incidence

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Incidence Rate

- Frequency with which new events occur in a population
- Typically reported as number of events per 100,000 persons per year:

$$\frac{\# \text{ of new cases of disease in a population in a defined time period}}{\text{average size of population during the time period}}$$

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Incidence Rate Calculation

Example: 110 women develop breast cancer in one year in a population of 342,000 women in country X:

$$110 \div 342,000 = 0.000322 \text{ (incidence)}$$

To calculate the incidence rate per 100,000 in this example:

$$0.000322 \times 100,000 = 32.2$$

- **Incidence rate of breast cancer for country X is 32 cases per 100,000 population of women per year**

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Cumulative Incidence Definition

PROPORTION of individuals who become diseased during a specified period of time
 Range: 0 to 1.0
 Also referred to as “incidence proportion”

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Cumulative Incidence (CI) Calculation

of new cases of disease during a given period
 Size of at-risk population at start of the defined time period

Example: During a 1-year period, 10 out of 100 “at risk” persons developed CVD (cardiovascular disease).

$$CI = \frac{10}{100} = 0.10 \text{ or } 10.0\%$$

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Key point: To accurately calculate cumulative incidence, we need to follow the entire population at risk for the specified time interval.

Example of Cumulative Incidence

Cumulative incidence of diabetes (%) in the Indian Diabetes Prevention Program (for people with IGT)

Time taken to develop diabetes (months)	Control group (%)	Metformin (MET) (%)	Lifestyle modification + metformin (%)	Lifestyle modification (LMO) (%)
0	0	0	0	0
6	10	8	7	6
12	20	15	14	12
18	28	22	21	18
24	38	28	27	24
30	45	32	31	28
36	50	35	34	32
42	55	38	37	38

Ramachandran, A., et al. Diabetologia 1996; 49:289-297

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Difference between Cumulative Incidence and Incidence Rate

Address Different Questions

- **Cumulative Incidence:** What is the *risk* that an individual will develop the disease over a given time interval?
- **Incidence Rate:** How quickly or frequently a disease occurs in a population?

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Practice 1

Calculate the incidence rate for Type 2 Diabetes in adults using the following information:

- Population of adults in country Y: 1,750,000
- # of new cases of Type 2 diabetes over the last 5 years: 525

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Prevalence

- The number of existing cases divided by the population count
- Measured at a point in time rather than over some interval
- Typically shown as a percentage
- Influenced by incidence and survival.
- Like incidence, can be used to describe disease in a population
- Unlike incidence, can be used to describe an attribute such as genetic marker, behavior or risk factor in a population (e.g., smoking, wearing a seatbelt)

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Example: Calculating Prevalence

In a large city, there are 275,000 women and 85,250 of these women are obese.

$85,250 \div 275,000 = .31$
 Prevalence: $.31 \times 100 = 31\%$

Approximately 31% of women in this large city are obese.

Category	Overweight (%)	Obese (%)
Rural Men	~2	~2
Urban Men	~8	~8
Rural Women	~5	~5
Urban Women	~15	~16

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Practice 2

1. In a small village of 1,143 adults, and 166 of them have hypertension. Calculate the prevalence of hypertension as a percentage.

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Mortality

- Number of deaths per population in a given time or place.
- Also known as “crude death rate”.
- Typically expressed in units of deaths per 100,000 individuals per year:

$$\frac{\text{total number of deaths over specified period} \times 100,000}{\text{number of total population over same period}}$$

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Mortality Rate Calculation

Example: 850 deaths per year in a population of 170,000

Mortality rate

- $(850/170,000) \times 100,000 = 500$ per 100,000 population

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Types of Mortality Rates

- **Crude mortality rate:** The total number of deaths per 100,000 people per year.
- **Maternal mortality rate:** The total number of maternal deaths per total number of live births per 100,000 per year.
- **Infant mortality rate:** The total number of infant (children below 1 year) deaths per 1000 live births
- **Child mortality rate:** The total number of child (more than 1 and less than 5 years) deaths per 1000 live births

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Practice 3

A region in Country C reported 1,256 smoking-related deaths last year. The population of the region is 78,605 people. Calculate the mortality rate due to smoking in that region.

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Additional Burden of Disease Measurements

- Years of life lost (YLL)
- Years of life with disability (YLD)
- Disability-adjusted life years (DALY)
- Quality-adjusted life years (QALY)

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Years of Life Lost (YLL)

- Measures the years of life lost due to premature mortality
- Based on the number of deaths and the standard life expectancy at age of death
- **Example:** Imagine that the life expectancy for an individual is 75 years, but that person dies at age 70. That death represents 5 Years of Life Lost (YLL).

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Years of Life with Disability (YLD)

Measures years of healthy life lost due to living in states of less than full health

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Overview of DALYs and QALYs

Summary measures of population health
 Estimated by combining morbidity and mortality

- Combined measures of quantity *and* quality of life

Answers two important questions:

1. What is the total impact of disease and injury in the population?
2. How do we compare the impacts of different diseases, risk factors, and interventions that affect different populations?

Helps inform decisions regarding resource allocation

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Disability-Adjusted Life Year (DALY)

- Represents the total number of years lost to illness, disability (health utility), or premature death within a given population
- Allows for comparison of impact of a program and/or diseases across population

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Example of DALYs

Region	YLL (per 1000)	YLD (per 1000)	Total DALY (per 1000)
High income	~10	~10	~20
Africa	~100	~100	~200
Americas	~50	~50	~100
Eastern Mediterranean	~100	~100	~200
Europe	~20	~20	~40
South-East Asia	~100	~100	~200
Western Pacific	~50	~50	~100

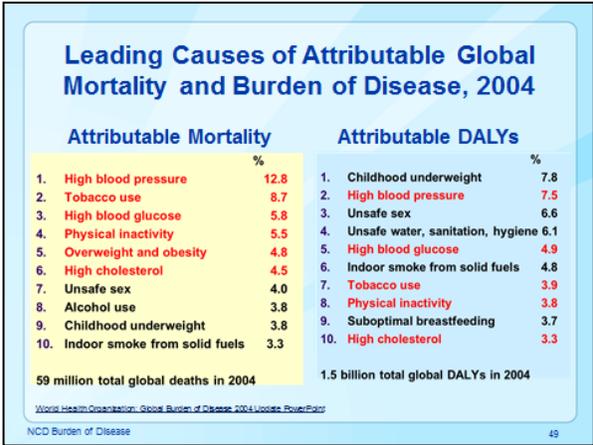
Source: World Health Organization
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World Health Organization
 Years of life lost (YLL), years lost due to disability (YLD) and disability-adjusted life years (DALYs) by WHO region, 2004

The contribution of premature death varied dramatically across regions, with YLL rates seven times higher in Africa than in high-income countries. In contrast the YLD rates were less varied, with Africa having 80% higher rates than high-income countries. South-East Asia and Africa together bore 54% of the total global burden of disease in 2004, although they account for only about 40% of the world's population. The Western Pacific Region has the "healthiest" low- and middle-income countries, with countries such as China now having life expectancies similar to those of many Latin American countries, and higher than those in some European countries.

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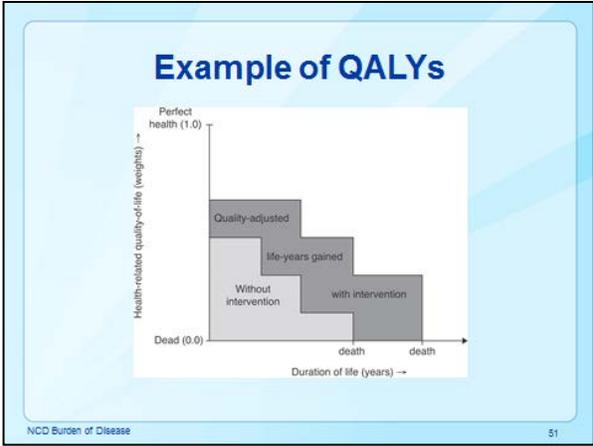
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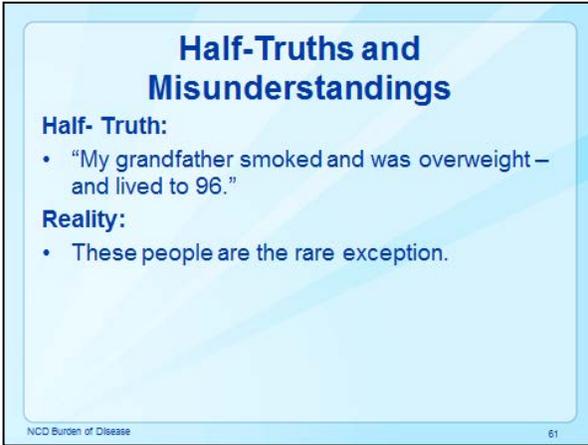


Quality-Adjusted Life Year (QALY)

- Gives us an idea of how many extra months or years of life of reasonable quality a person might gain as result of treatment
- Ratings: negative values below 0 (worst possible health) to 1 (best possible health)
- Makes it possible to summarize effects of an intervention that affects both morbidity and mortality

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Half-Truths and Misunderstandings

Half- Truth:

- “My grandfather smoked and was overweight – and lived to 96.”

Reality:

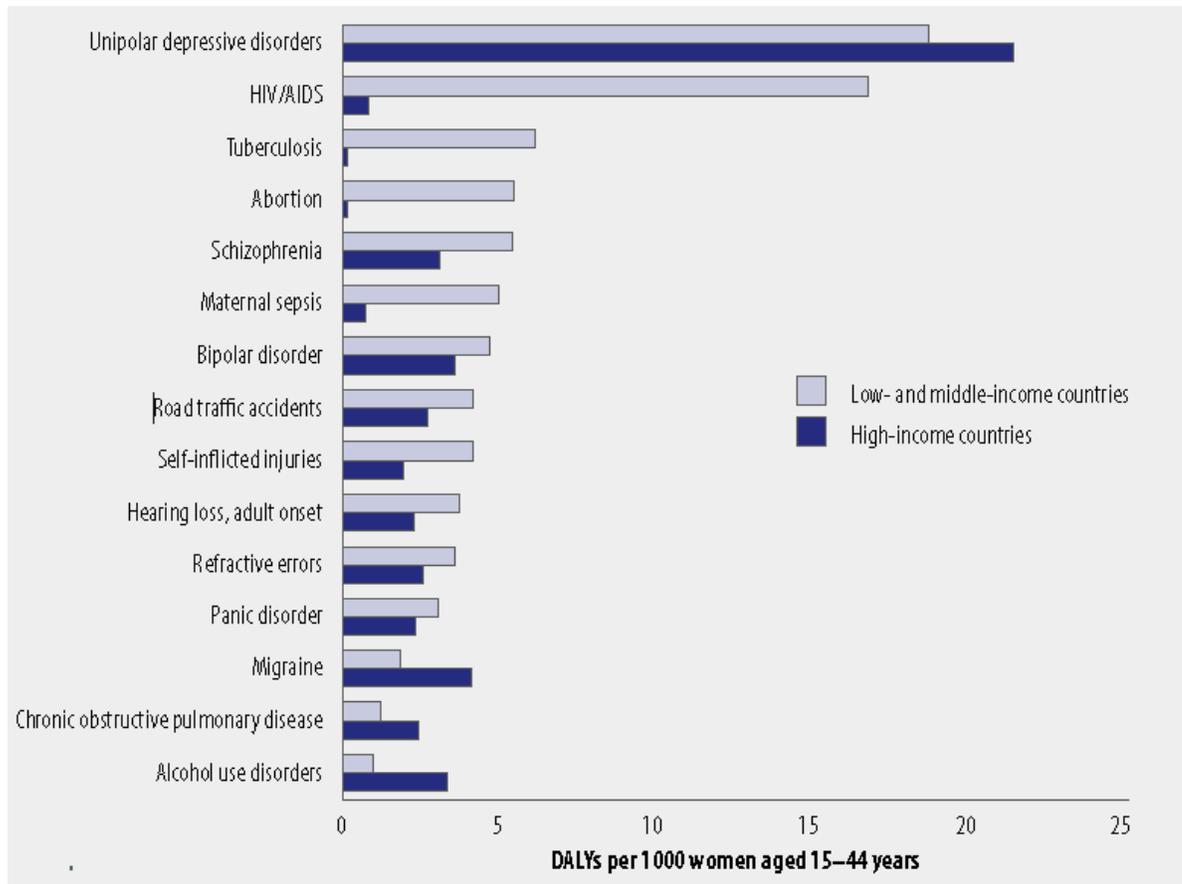
- These people are the rare exception.

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Part 2: DALYs and QALYs (10 minutes)

1. According to the WHO 2004 table below, what is the leading cause of disease burden for NCDs (including mental health) for women aged 15-44 years in low- and middle-income countries?

Figure: Leading causes of disease burden for women aged 15-44 years, high-income countries, and low- and middle-income countries, 2004



Reference: http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_part4.pdf

2. What does it mean when a disease has a higher DALY than other diseases? How can this information be useful?

(Continued on next Slide)

What does the graph below tell us about QALYs and how it changes depending on whether treatment is provided?

