MAJOR HEALTH-RELATED CHALLENGES OF MALARIA IN NEPAL

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Malaria

- Vector borne disease
- Severe and often life threatening
- In 2018, 228 million cases and 405,000 deaths worldwide (WHO, 2019)

Malaria in Nepal

- Nepal - a malaria endemic country
- Significant cause of morbidity and mortality in early 20th century.
- Mostly endemic in Terai
- Control interventions with DDT
- After control interventions, malaria decreased and migration in Terai.
- Renewed global interest
- Introduction of Long Lasting Insecticidal Nets (LLIN)
- Malaria decreasing again thereafter

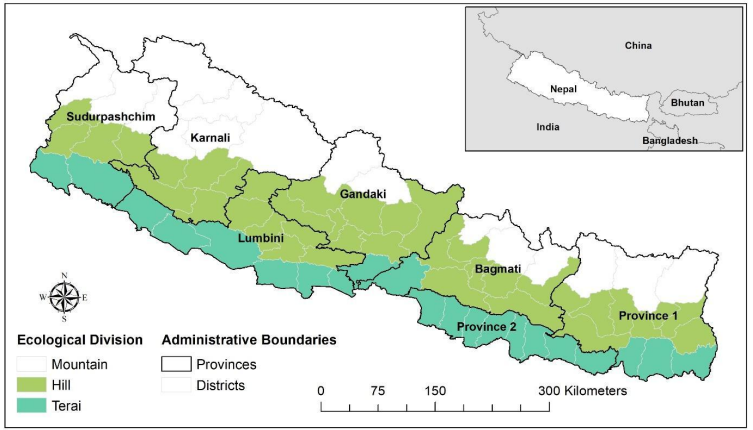
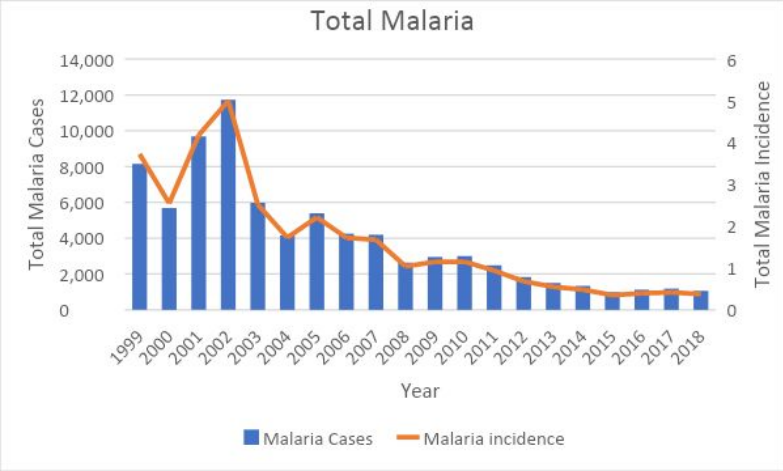
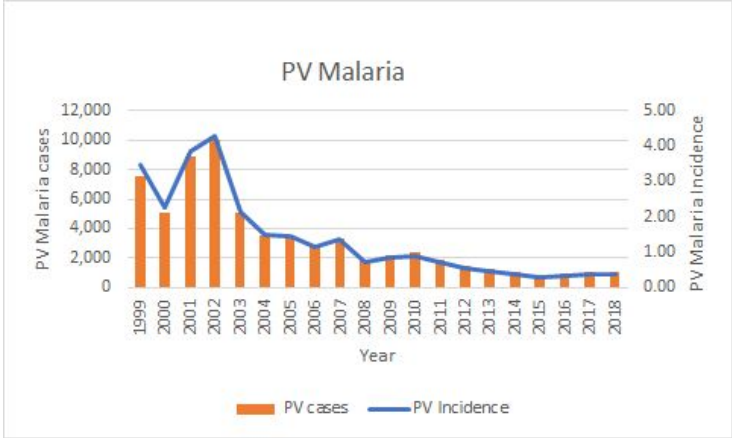
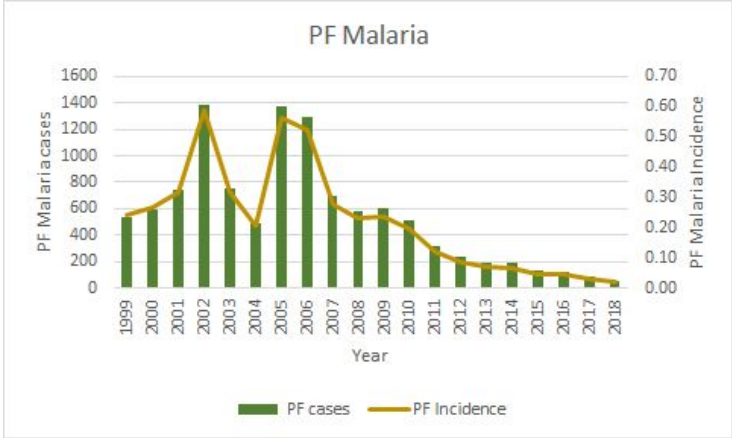


Figure: Major Ecological and Administrative Division of Nepal

Malaria Epidemiology in Nepal







- *Plasmodium vivax* and *Plasmodium falciparum*
- Total Malaria: 8149 (3.73) -1064 (0.38)
- PV Malaria: 7579 (3.47) - 1012 (0.36)
- PF Malaria: 529 (0.24)-53 (0.02)

Malaria and Migration

- Significant number of people migrate
- Migrate workers is crucial to national economy
- Popular destinations are India, Malaysia, and Gulf countries including Qatar, Saudi Arabia, United Arab Emirates
- India and Non-india

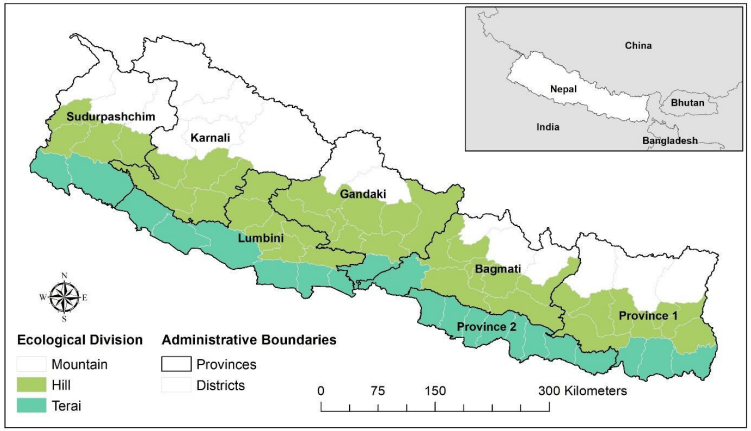
Table 1

International Migration and Remittance

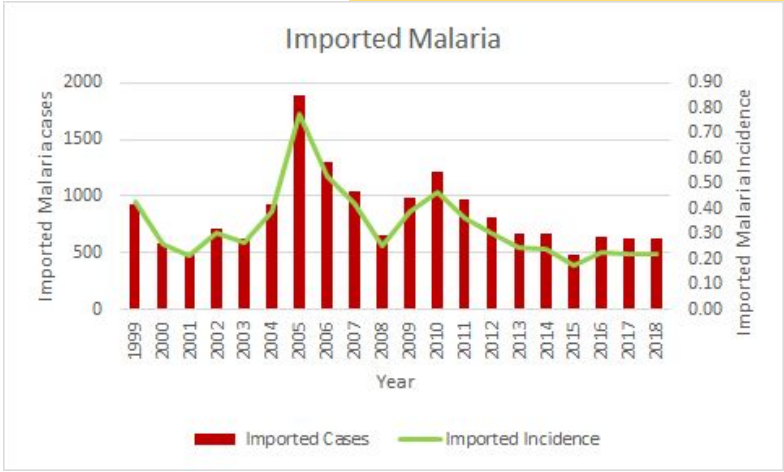
Year	Migration / Population			Remittance Income % GDP
	All	India	Non-India	
1961	3.49			
1981	2.68	2.48	0.19	
1991	3.56	3.17	0.37	1.5
2001	3.41	2.61	0.78	2.4
2011	7.43	2.8	4.63	22.4

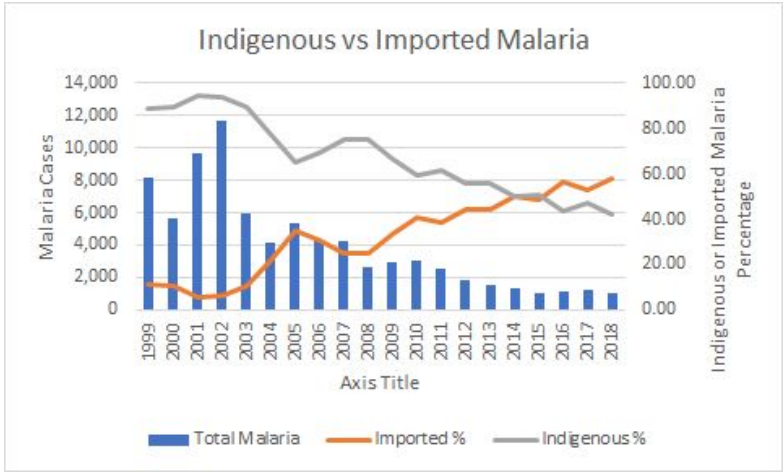
Note. From Shrestha, M. (2017). *Push and Pull: A Study of International Migration from Nepal.* The World Bank. https://doi.org/10.1596/1813-9450-7965

Malaria and Migration



- Imported Malaria: 928 (0.42) to 618 (0.22)





Health Systems and Delivery

Malaria health systems

- Diagnosis, treatment and drugs are free in all public health institutions
- Passive surveillance is predominant
- Monthly malaria cases reported from Sub-Health Post and Health Post
- District Health Office report to Epidemiology and Disease Control Division (EDCD) through Health Management Information System (HMIS)
- Weekly early warning reporting system (EWARS)
- Diagnosed by microscopy and Rapid Diagnostic Test (RDT)

Delivery of control interventions

- Indoor Residual Spraying (IRS)- primary vector control intervention in the 1950s
- Since, 2004, LLIN with support from Global Fund for AIDs, Tuberculosis and Malaria (GFATM)
- LLIN distributed in high malaria risk areas with the rate of 1 LLIN every 2 people in the household through mass distribution
- Also to pregnant women during Antenatal care visit
- IRS is sprayed during outbreak

Land Use Land cover and Malaria

- Land Use Land cover (LULC) influence malaria incidence and transmission
- LULC variables: forests, water bodies and agricultural practices such as rice cultivation
- Forests in Nepal

(Bhattarai et al., 2020)

LULC 2000		
Malaria incidence rate (MIR)	**Relationship**	**Significant LULC variable ($p<0.05$)**
2000	-	-
2001	Positive	Water bodies, Rice paddies
2002	Positive	Water bodies, Rice paddies
2003	Positive	Water bodies, Rice paddies
LULC 2010		
2010	Negative	Grassland
2011	Not significant	-
2012	Not significant	-
2013	Not significant	-

Climate Change and Malaria

- Climate change has mixed effects on malaria (IPCC 2007)
- 1°C increase in minimum temperature increased malaria incidence by 27% in a study in Dhangadi and Morang districts in Nepal (Dhimal et al., 2014)
- In Jhapa, malaria cases increased with a minimal increase in temperature and a considerable decrease in total rainfall (Bhandari et al., 2013)
- malaria hotspots have shifted to new VDCs (Village Development Committee) within the Morang district (Dhimal, *et al* 2014)
- malaria incidence increased in recent years, particularly in the hills and mountains of Nepal(Badu, 2012)

Health Behaviors

CONTROL EFFORTS

Improved coverage for early diagnosis and prompt treatment.

USE OF LLINs & ITNs

Between 2009-2013, almost 90% LLIN coverage achieved via the National Malaria Control Program.

REDUCING MALARIA BURDEN IN NEPAL

KNOWLEDGE & PRACTICE

Misperceptions and lack of knowledge about malaria are still widespread among vulnerable and high risk populations

BEHAVIOR CHANGE COMMUNICATION

Significant role in the adoption, adherence, and return on investment for control efforts.

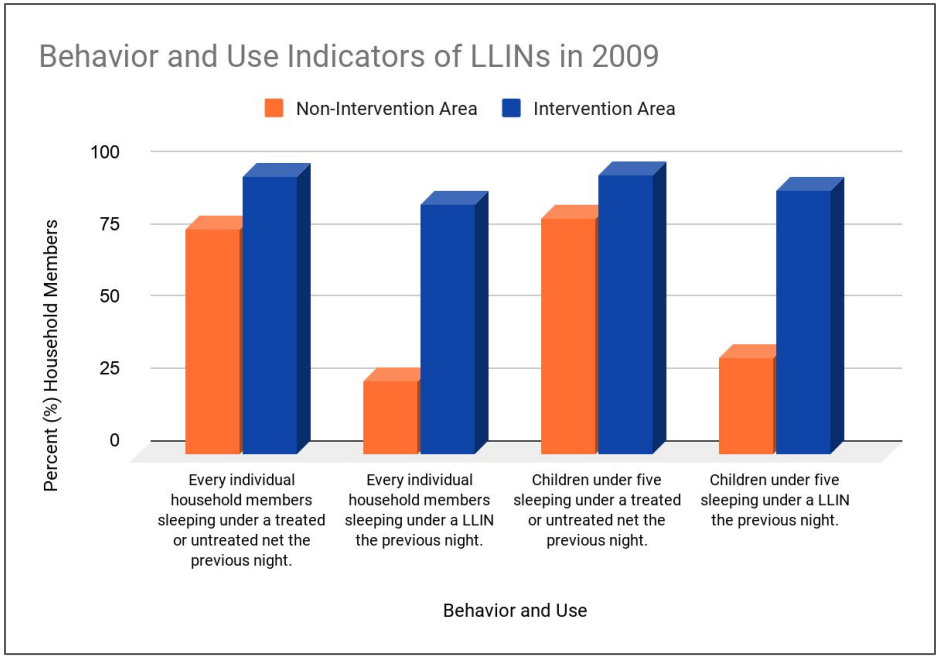
Health Behaviors

Table 2

Behavior and Use Indicators of LLINs in 2009

Behavior or Use	Non-Intervention Area *N=2375*	Intervention Area *N=1600*
	% (*n*)	% (*n*)
Every individual household member slept under a treated or untreated net the previous night.	78.9 (13306)	96 (9019)
Every individual household member slept under a LLIN the previous night.	25.2 (13306)	86.6 (9019)
Children under five sleeping under a treated or untreated net the previous night.	81.7 (1480)	96.7 (1008)
Children under five sleeping under a LLIN the previous night.	33.3 (1480)	91.5 (1008)

Note. P-value for all indicators shown $p < .001$. Data from PSI Research Division. (2009). *Nepal (2009): Malaria TRaC study evaluating LLIN use among general population and children under 5 years of age in 13 high-risk districts 1st round.* Population Services International.



Health Behaviors

MIGRANT AND MOBILE POPULATIONS (MMPs)

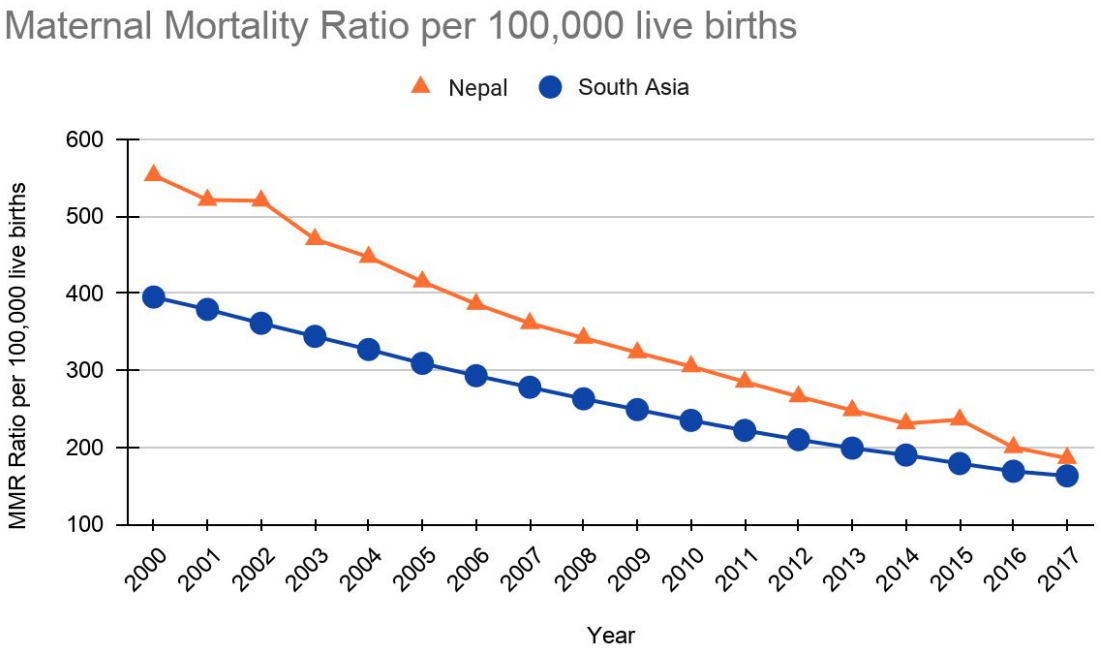
- LLIN usage was infrequent among adult male laborers in MMPs
- Imported cases are increasingly contributing to local malaria transmission
- 2016 cross-sectional study by Smith et al. (2019)
  - ***"Had not heard of malaria"*** ($p = 0.06$)
    - 68.8%, of MMPs social contacts
    - 53.8% of imported cases
  - "***No knowledge of malaria symptoms***" ($p < .0001$)
    - 48.3% of imported cases
    - 75.0% of MMPs social contacts
  - Adult male laborers self-reported infrequent usage during travel (20%)
    - Limited knowledge about obtaining bednets or absence during regular home distributions of bednets

Maternal & Reproductive Health

REDUCED MATERNAL MORTALITY RATIO

Since 2000, Nepal has reduced MMR from **553** to **186** per 100,000 in 2017

↓ 64%



Data Source. WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division. Trends in Maternal Mortality: 2000 to 2017. Geneva, World Health Organization, 2019

Maternal & Reproductive Health

SAFE MOTHERHOOD PROGRAM

- Reduce maternal mortality ratio (MMR).
- Improve M&N health outcomes
- Reduce M&N morbidity and mortality

1997

- Family planning services
- Regular antenatal care visits
- Develop & improve obstetrician infrastructure
- Increasing institutional delivery

FOUR ANC VISITS

2011-2016 (DHS surveys)
From **59.0%** to **73.7%** among Nepali women

↑ 14.7%

↑ 21%

INSTITUTIONAL DELIVERY

2011-2016
From **39.2%** to **60.2%** among Nepali women for their last child born

Maternal & Reproductive Health

MALARIA AND ANEMIA

- **Pregnant** women and women of **reproductive age** are at an **increased risk** due to reduced immunity.
- **Pregnant women** face a **double burden**; **placental sequestration** increases risk of maternal morbidities:
  - Microcytic anemia, congestive heart failure, folic acid deficiency, stillbirth, and premature delivery
- **Risk factors for women of reproductive age** include:
  - rural residence,
  - poor nutritional status,
  - little autonomy over decision-making in their health.

Gender & Women's Empowerment

MALARIA AND WOMEN'S AUTONOMY

- **Women's autonomy** is an indicator of:
  - Maternal and child health outcomes
  - Access to wealth
  - Social and material resources
- **Feminization of Nepal's agricultural workforce** has led to increased autonomy in economic and decision-making roles among Nepali women.
- **Increased autonomy** is important to make purchases (i.e., health services, travel to health facility) to improve health outcomes and quality of life

Gender & Women's Empowerment

MALARIA AND WOMEN'S AUTONOMY

- Acharya et al. (2010) - greater autonomy over healthcare decision-making among Nepali women
  - Increased with age
  - Higher in urban regions
  - Employed for an income
  - 3+ children
  - Higher education

Women's Autonomy in Decision-Making of Own Health Care

Characteristics	Own Health Care (%)
Age	
15-19	17.0
20-24	37.1
25-29	38.5
30-34	52.0
35-39	55.2
40-44	58.6
45-49	60.3
Employment (past 12 months)	
Not employed	43.5
Employed for cash	59.6
Employed for subsistence	41.4
Number of living children	
0	21.9
1-2	45.2
3-4	53.7
5+	55.0
Residence	
Urban	54.6
Rural	45.8
Education	
No education	47.4
Primary	44.7
Some Secondary	45.0
SLC and above/higher	55.8

Gender & Women's Empowerment

MALARIA, GENDER, & CONFLICT

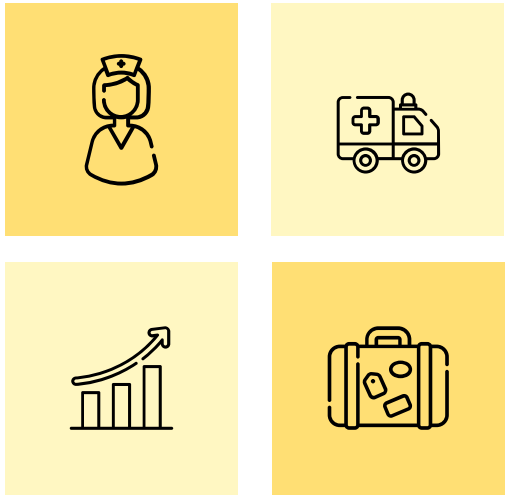
Maoist conflict.

- Observed increase in economic participation among Nepalese women.
- Infrastructure challenges increased barriers to access necessary health services, support, and other resources.
- Increased barriers for Nepali women in rural areas.
- ***Post-conflict.*** Resurgence of discriminatory gender practices and beliefs.
  - Citizenship registration necessary for various services and benefits

Demographic Transition & Malaria

Nepal's Demographic Transition Profile

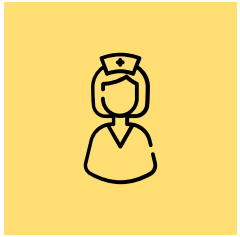
- Made significant improvements since the 1980s
- **Rapid decline** in crude birth and crude death rate
- Exponential **increase in population** growth rate
- Improved **life expectancy**
- **Unlike** the Western four-stage model
- Considered a **least developed country** (UN criteria)

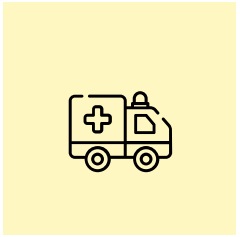


Demographic Transition & Malaria

CRUDE BIRTH RATE

1980-2018
From **41.7** to **19.8 per 1000**





CRUDE DEATH RATE

1980-2018
From **17.9** to **6.4 per 1000**

LIFE EXPECTANCY AT BIRTH

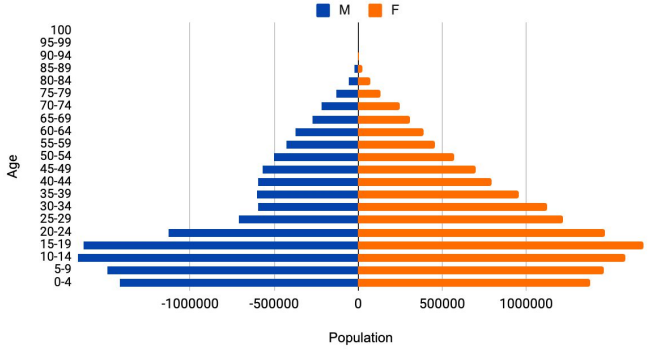
1980-2018
From **46.7** to **70.5 years**

NET MIGRATION

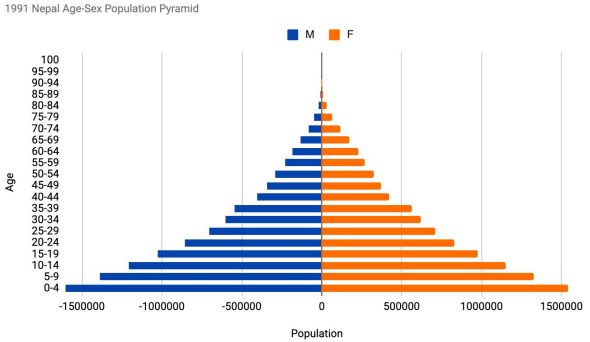
1980-2017
From **-101,147** to **-2 million**

Demographic Transition & Malaria

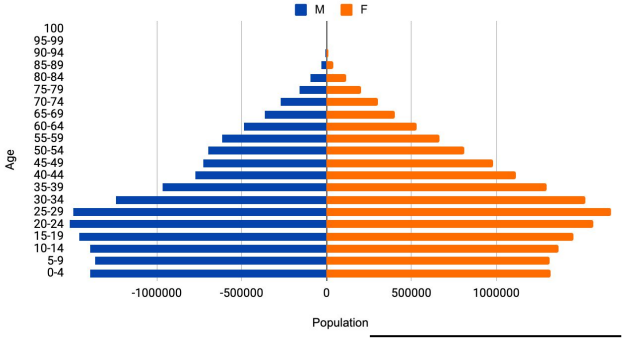
- **1980-90s** - renewed interest in malaria control
- **1991** - National Health Policy
- **1997** - Safe Motherhood Program
- **2004** - National Nutrition Policy
- **2012** - Health Communication Policy



2015



1991



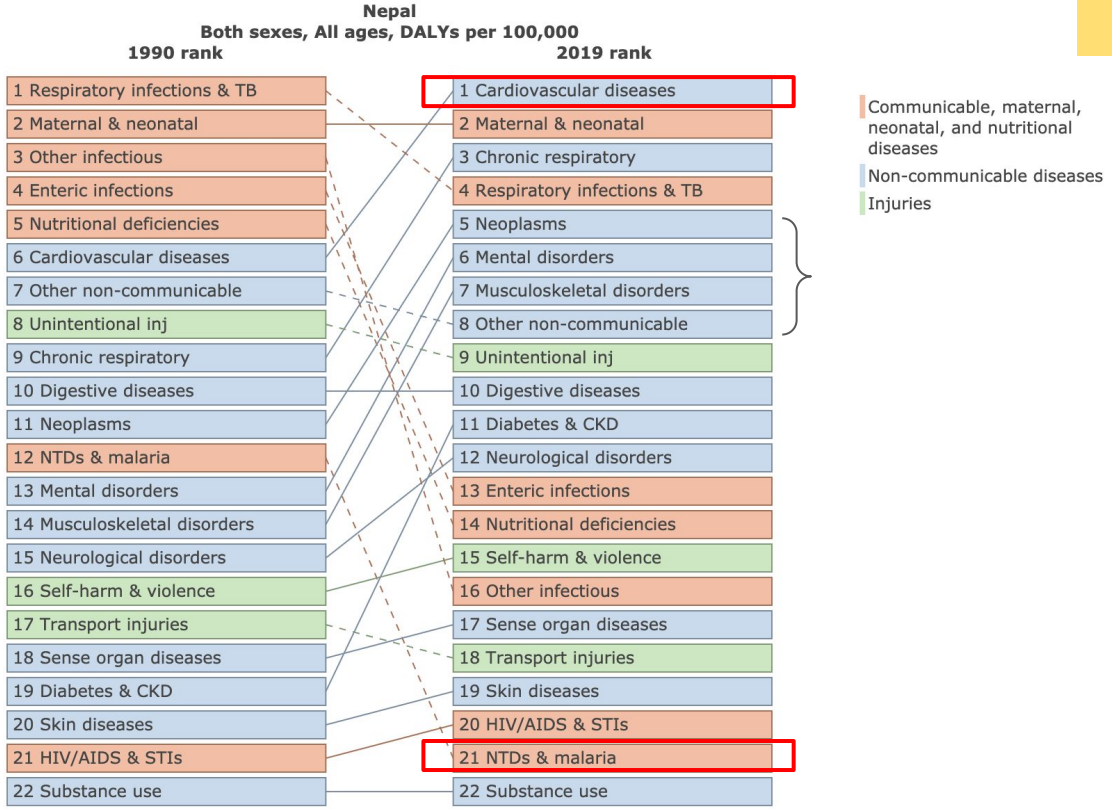
2025

Non-Communicable Diseases & Malaria

DALYs

Disability-Adjusted Life Years

- Cardiovascular disease (↑ **12.54%**), chronic respiratory (↑ **13.9%**), musculoskeletal disorders (↑ **45.08%**)
- Maternal and neonatal, same rank, but significant improvement, about **75% decrease**
- (2019) Malaria still among the major causes DALYs
- HIV/AIDS & STIs (↑ **16.32%**)



Source. Institute for Health Metrics and Evaluation (IHME). GBD Compare. Seattle, WA: IHME, University of Washington, 2015. Available from http://vizhub.healthdata.org/gbd-compare.

Non-Communicable Diseases & Malaria

YLLs

Years of Life Lost

- Since 1990, YLLs for malaria have decreased; from about **94k** to **61k YLLs** in 2010.
- In 2017, YLLs from malaria decreased to **59k.**
- YLLs for ischemic heart disease increased by 95%

Table 3

Years of Life Lost Among Major Causes of Death from NCDs and Malaria

Cause of Death	1990		2010		2017	
	% YLL	(n) YLL in thousands	% YLL	(n) YLL in thousands	% YLL [a]	(n) YLL in thousands [a]
Ischemic heart disease	1.2	142	3.8	277	11.34	663
COPD	2.4	287	3.5	249	5.51	322
Intracerebral hemorrhage	0.96[a]	562			2.7	158
Ischemic stroke	1	126	2.9	212		
Malaria	0.8	94			40.47 [b]	59 [b]

Note. From the IHME (2010) GBD profile report on Nepal.

[a] From the Ministry of Health (2019) Nepal Burden of Disease (NBoD) report.

[b] Derived from the Ministry of Health (2019) NBoD report. Malaria was aggregated with neglected tropical disease.

Double or triple burdens of existing infectious diseases and NCDs.

Thank You!

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