Establishing the global governance to End-TB in the Korean Peninsula

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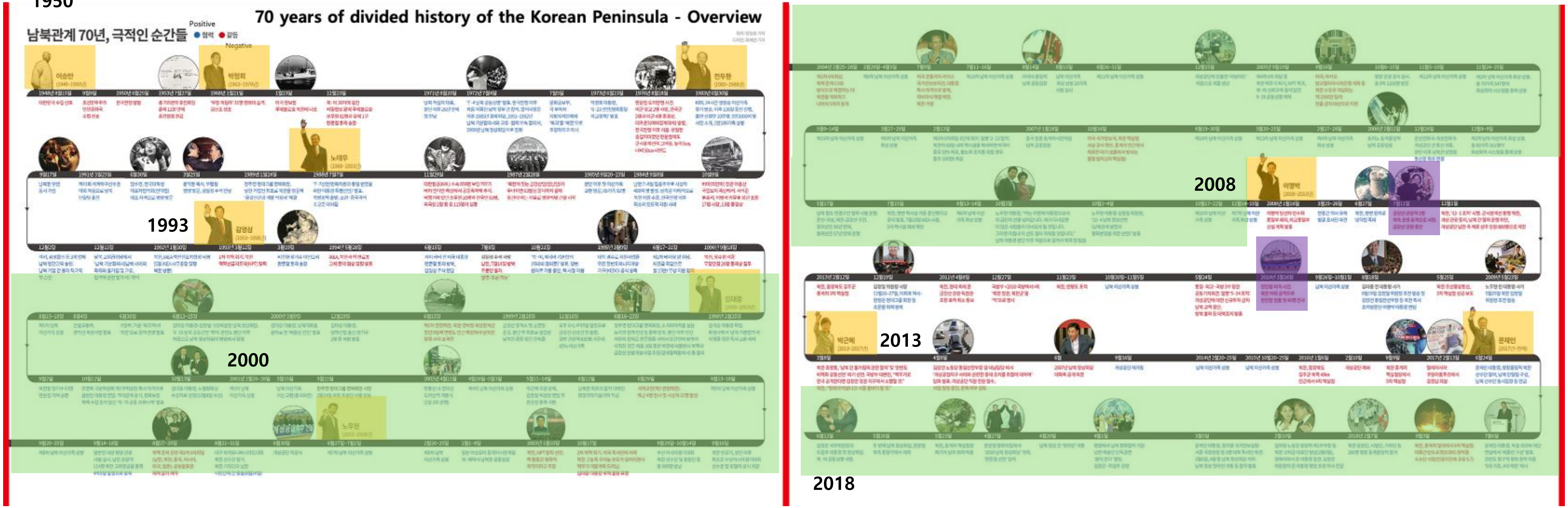
November 7th, 2024

Image sourced from: https://ccej.or.kr/posts/w9tdXR

Turbulent political climate in the Peninsula: rollercoaster ride of the hopes and despair of unified Korea

● Positive Outlook ● Negative Outlook


1950
남북관계 70년, 극적인 순간들
Positive
Negative
70 years of divided history of the Korean Peninsula - Overview
1993
2000
2008
2013
2018

🟨 South Korean Presidency 🟩 Periods of exchange & on-ground support (2001 – 2018) 🟪 Conflicts resulting in S. Korean casualties

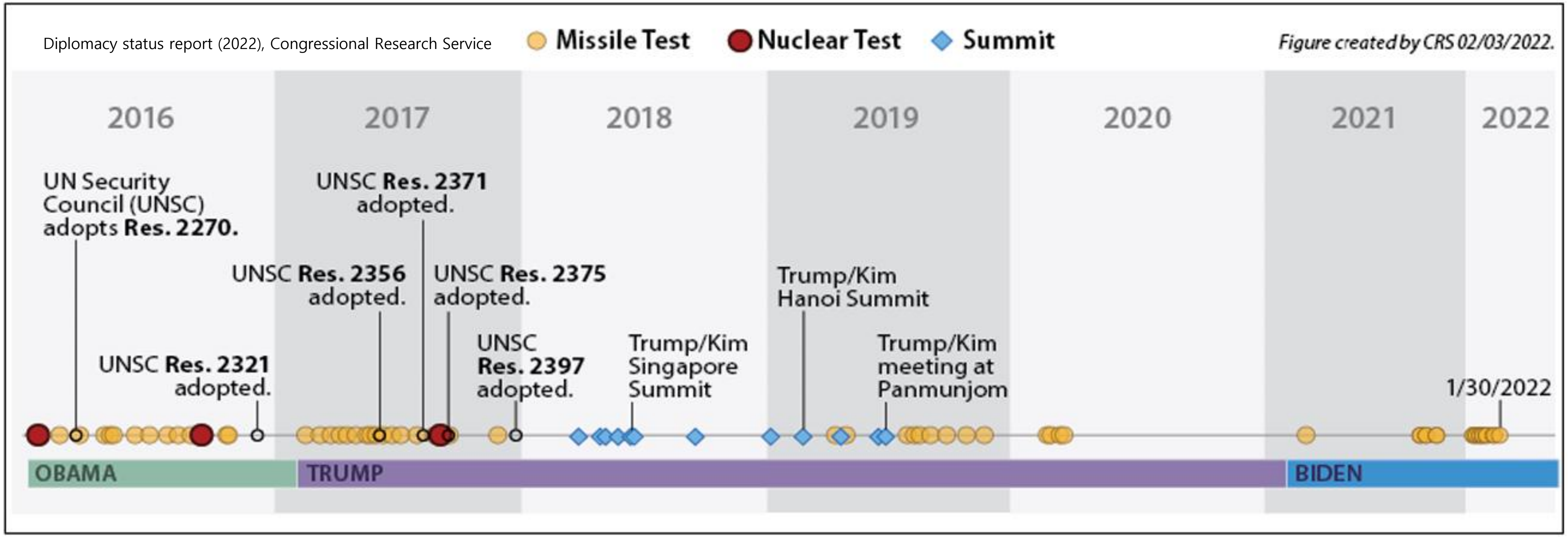
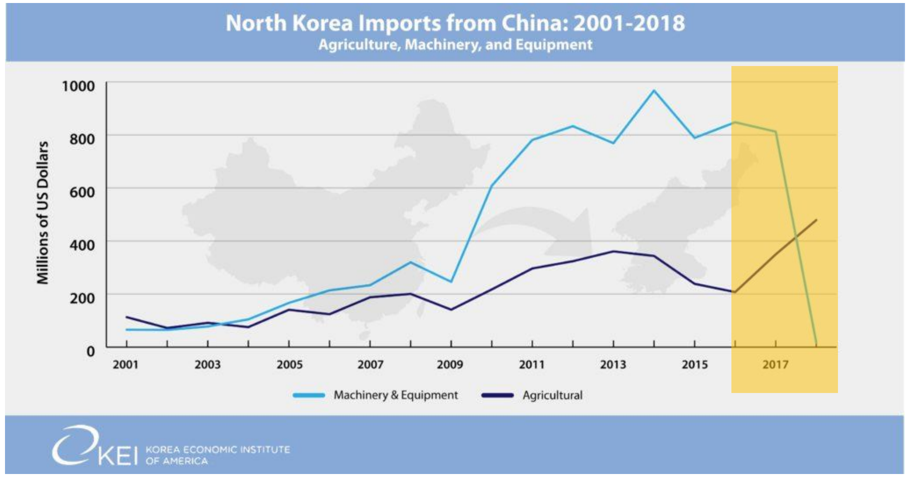
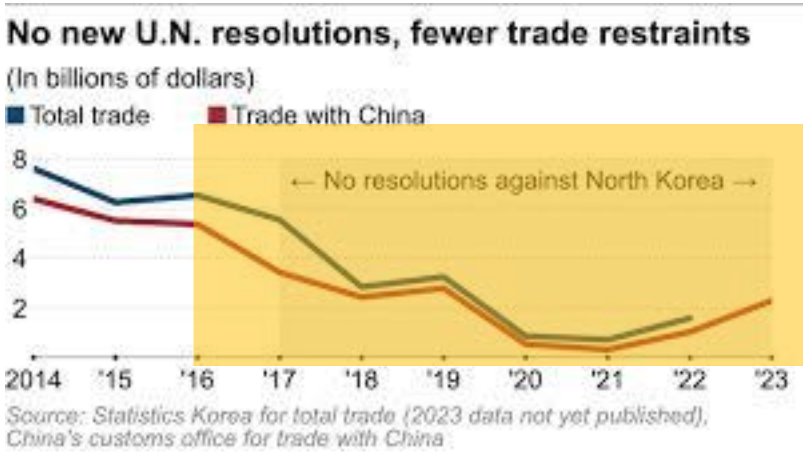

Diplomacy status report (2022), Congressional Research Service

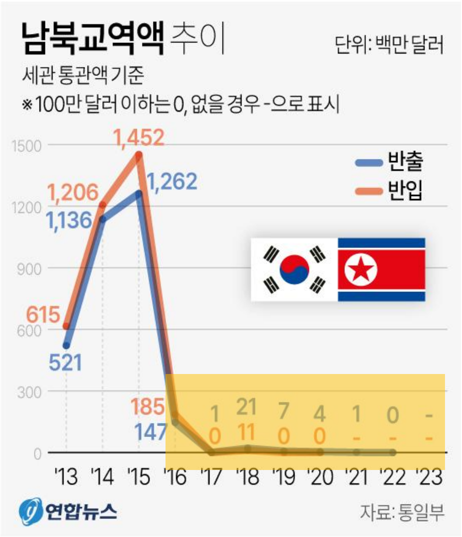
Figure created by CRS 02/03/2022.

UN Sanctions, Missile & Nuclear Tests, Trade w/ N. Korea in the recent decade





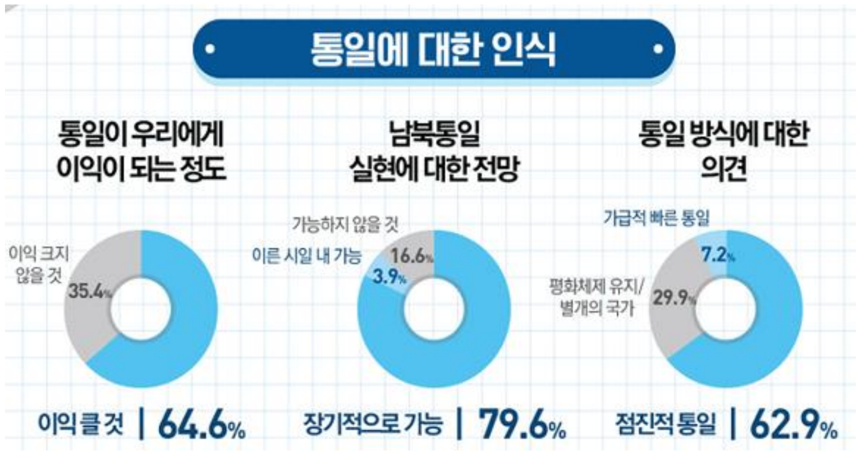
Source: Statistics Korea for total trade (2023 data not yet published), China's customs office for trade with China



자료: 통일부

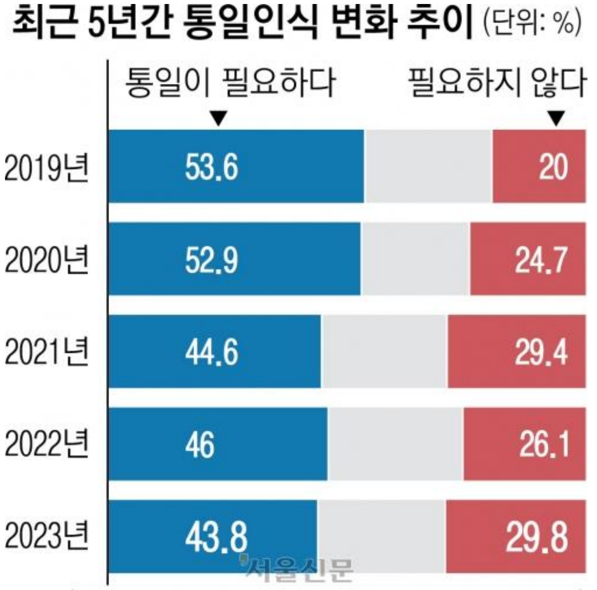
원형민 기자 20240531

S. Korean expectations in reunification 2018



https://www.korea.kr/news/estNewsView.do?newsId=148852818&cateId=subjec#top50

S. Korean expectations in reunification since 2019

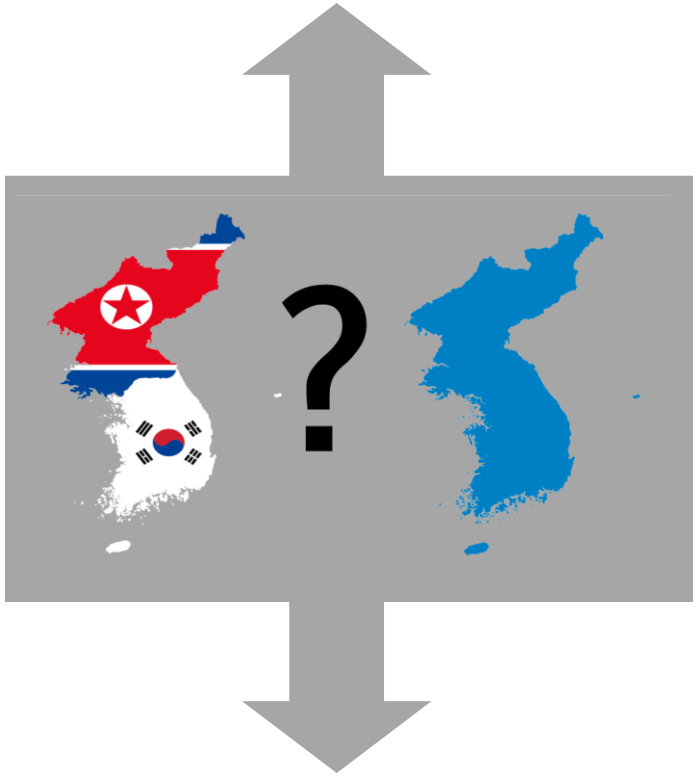


〈자료: 서울대학교 통일평화연구원 통일의식조사〉

https://m.go.seoul.co.kr/news/society/2023/08/18/20230818006010?cp=go

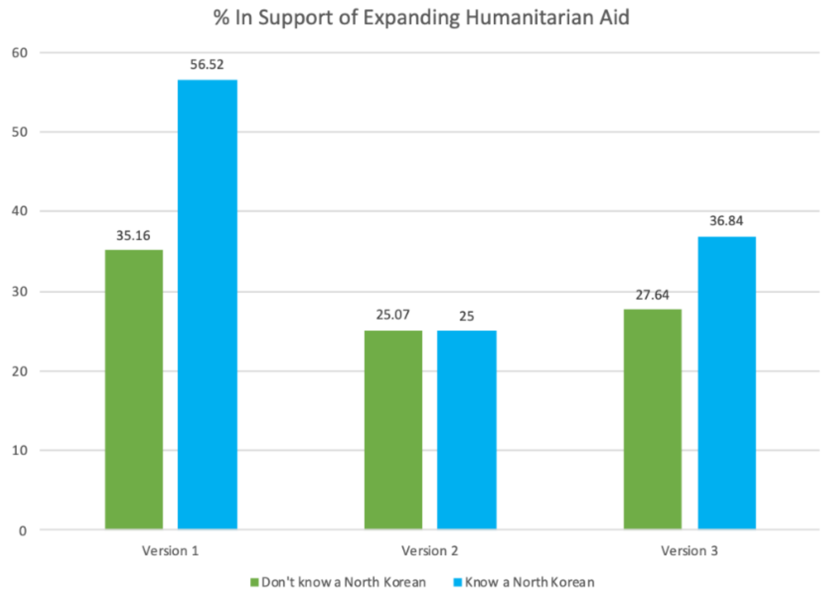
Declining hopes for unification

Planning as a unified country

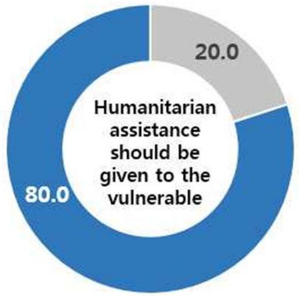


Planning as a two independent countries

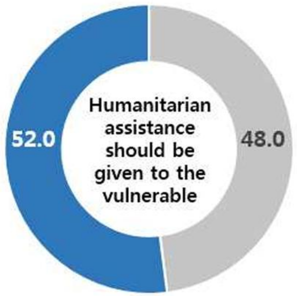
Current climate of humanitarian aid to N. Korea



https://www.38north.org/2020/07/trichepuhakka070220/



Humanitarian assistance is not equal to the violation of sanctions

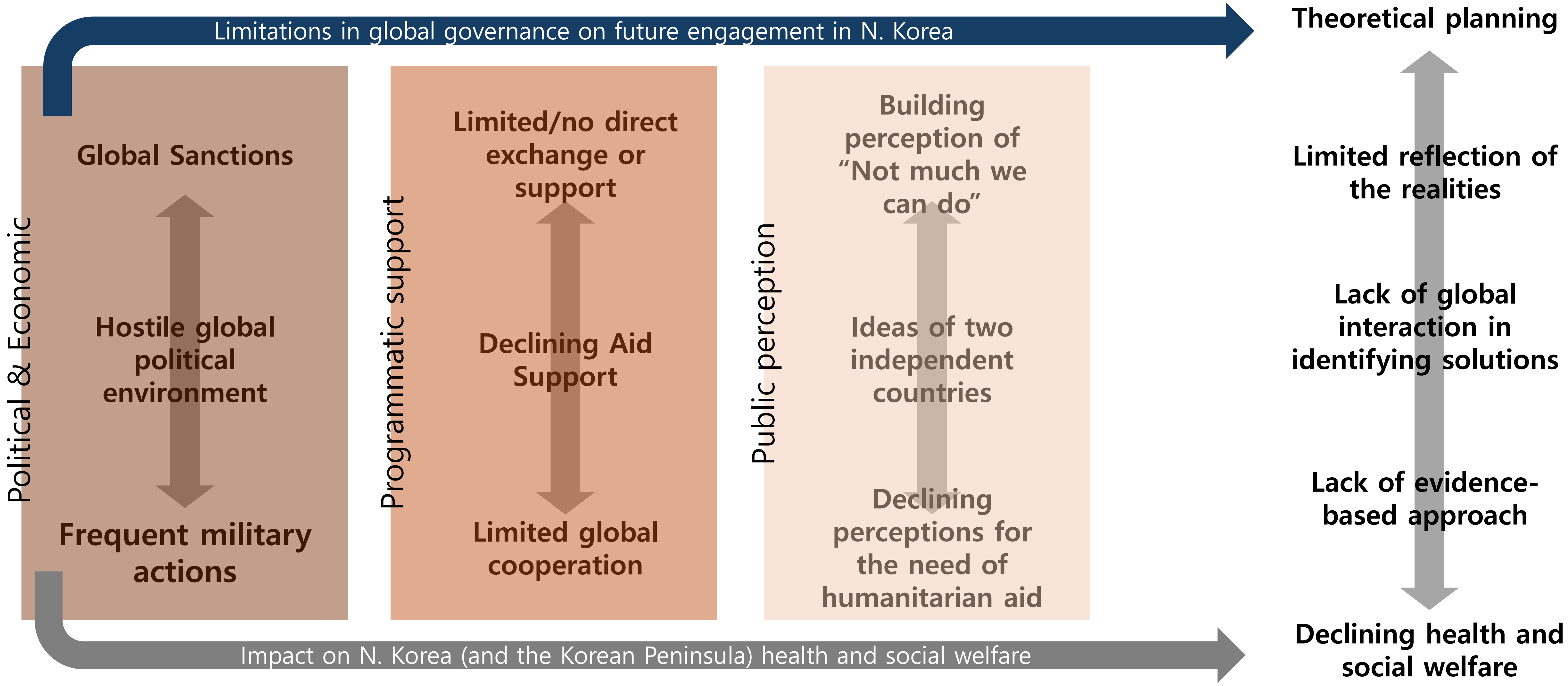


Humanitarian assistance is equal to the violation of sanctions

Park, JH 2019 "Nevertheless" Public Perceptions of Humanitarian Aid in South Korea, KINU Online Series

Barriers
In planning

Challenges in the paths to achieving the global governance on humanitarian & health in the Korean Peninsula



Limitations in global governance on future engagement in N. Korea

Political & Economic

Global Sanctions

Hostile global political environment

Frequent military actions

Programmatic support

Limited/no direct exchange or support

Declining Aid Support

Limited global cooperation

Public perception

Building perception of “Not much we can do”

Ideas of two independent countries

Declining perceptions for the need of humanitarian aid

Impact on N. Korea (and the Korean Peninsula) health and social welfare

Theoretical planning

Limited reflection of the realities

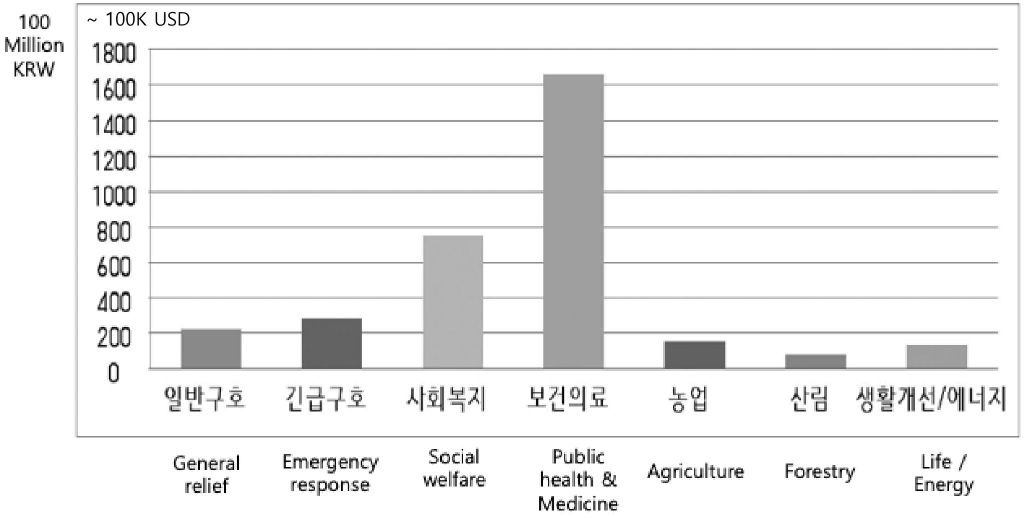
Lack of global interaction in identifying solutions

Lack of evidence-based approach

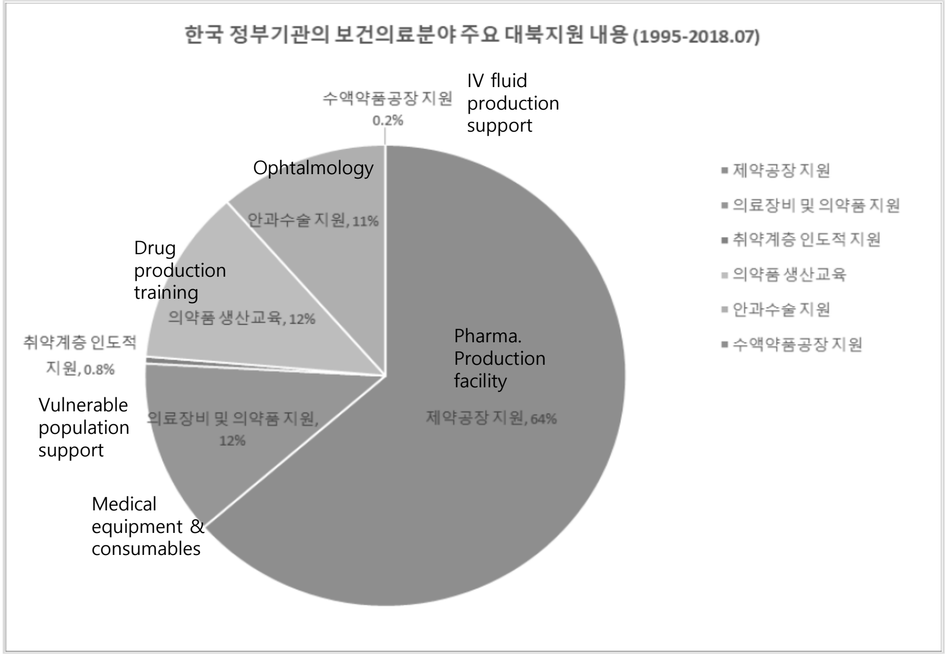
Declining health and social welfare

Trends in Health ODA support to N. Korea from S. Korea (2008-2017)

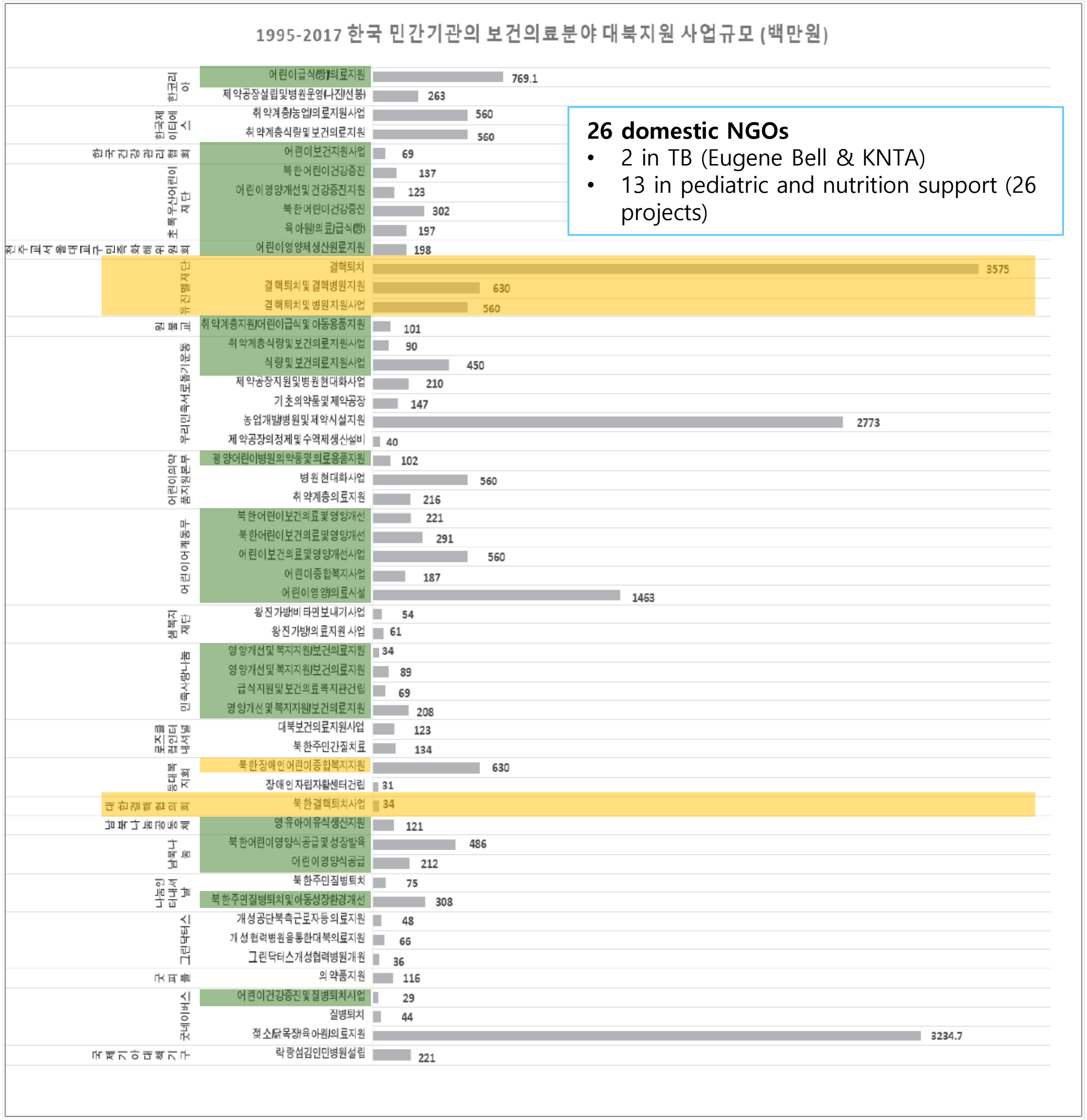
Cumulative ODA investment to N. Korea from S. Korea (2008-2017)



S. Korean government support to N. Korea in Public Health & Medicine



S. Korean NGO support to N. Korea in Public Health & Medicine

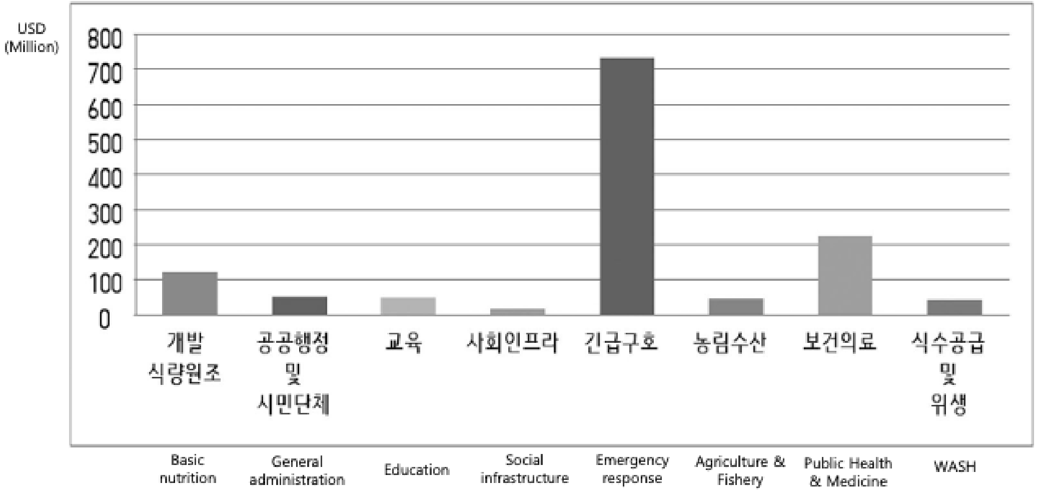


26 domestic NGOs

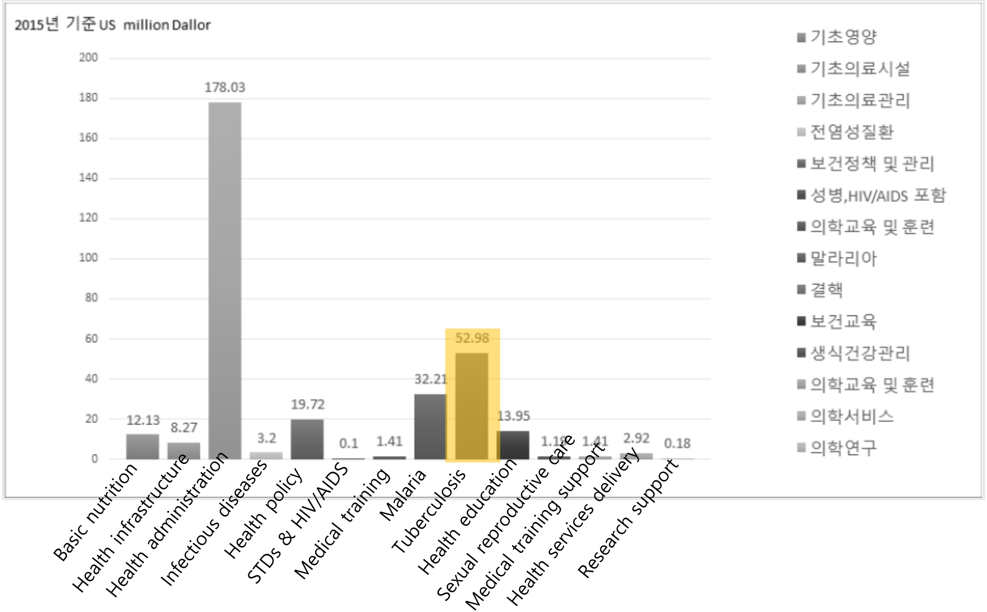
- 2 in TB (Eugene Bell & KNTA)
- 13 in pediatric and nutrition support (26 projects)

Trends in Health ODA support to N. Korea from other countries (2008-2017)

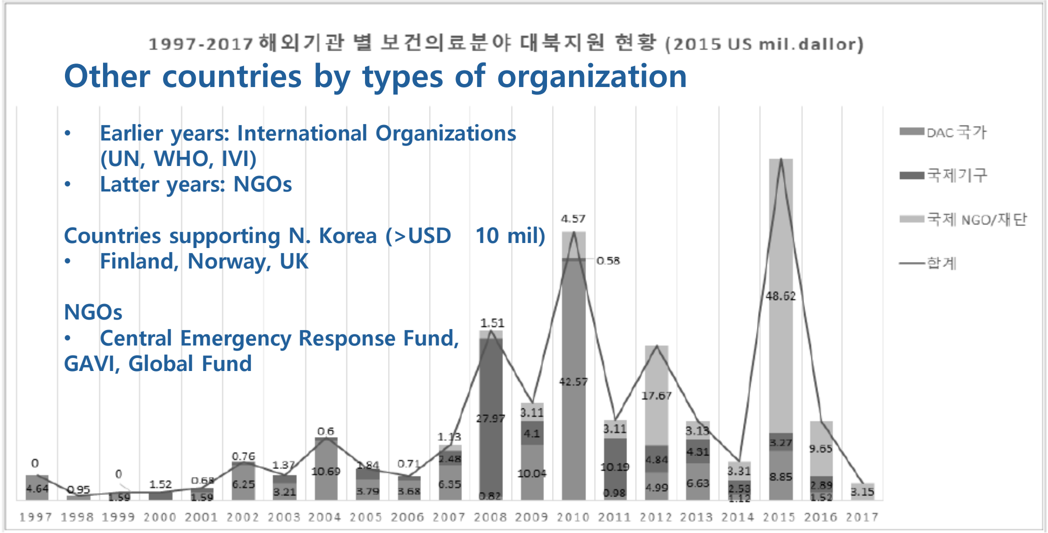
Cumulative ODA investment to N. Korea from other countries (2008-2017)



Cumulative ODA health investment by areas of support (2008-2017)



Health ODA support trend by year (other countries vs. S. Korea)

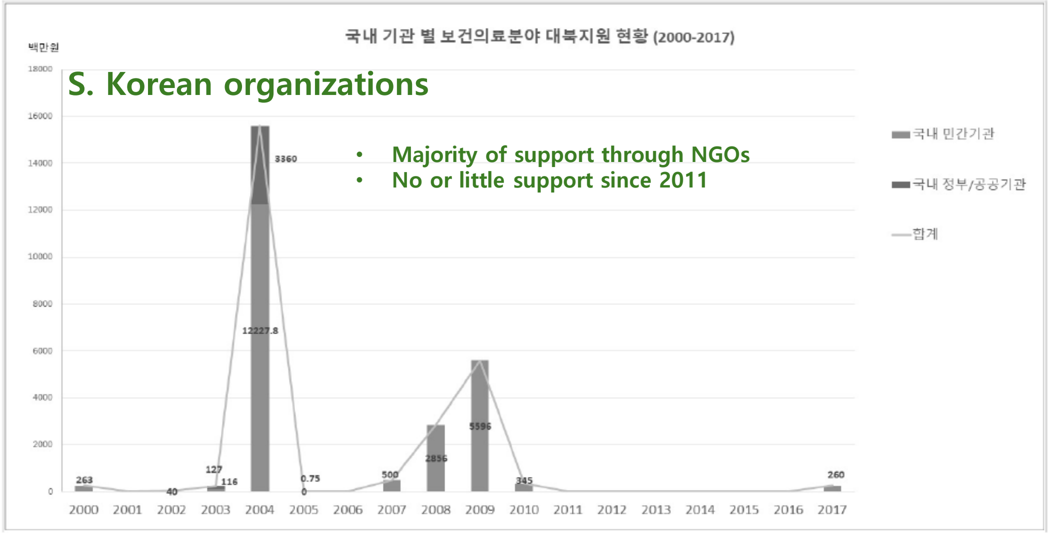


Other countries by types of organization

- Earlier years: International Organizations (UN, WHO, IVI)
- Latter years: NGOs

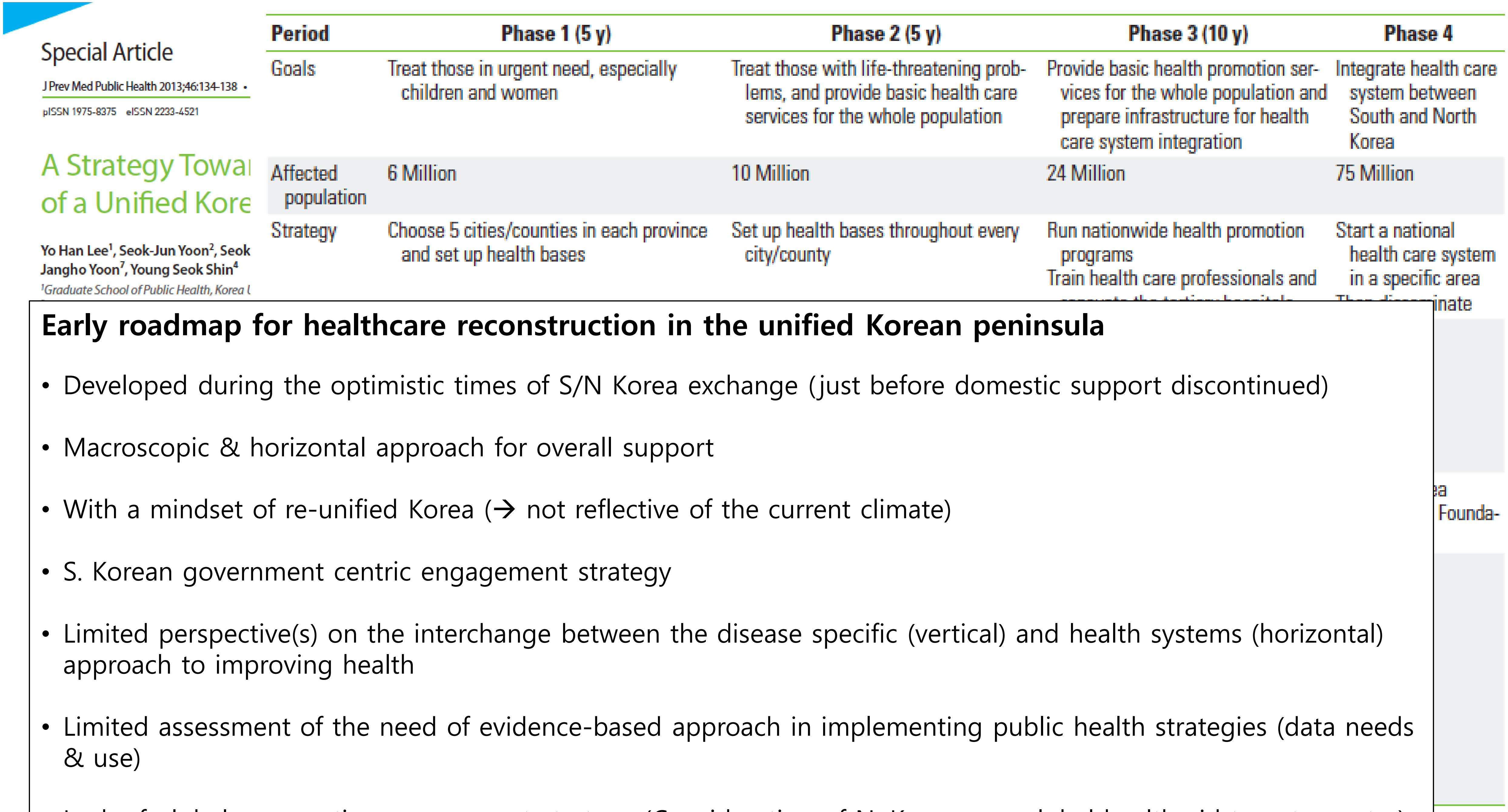
Countries supporting N. Korea (>USD 10 mil)
- Finland, Norway, UK

NGOs
- Central Emergency Response Fund, GAVI, Global Fund



S. Korean organizations

- Majority of support through NGOs
- No or little support since 2011



Special Article

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A Strategy Towa

of a Unified Kore

Yo Han Lee[1], Seok-Jun Yoon[2], Seok

Jangho Yoon[7], Young Seok Shin[4]

[1]Graduate School of Public Health, Korea

Period	Phase 1 (5 y)	Phase 2 (5 y)	Phase 3 (10 y)	Phase 4
Goals	Treat those in urgent need, especially children and women	Treat those with life-threatening problems, and provide basic health care services for the whole population	Provide basic health promotion services for the whole population and prepare infrastructure for health care system integration	Integrate health care system between South and North Korea
Affected population	6 Million	10 Million	24 Million	75 Million
Strategy	Choose 5 cities/counties in each province and set up health bases	Set up health bases throughout every city/county	Run nationwide health promotion programs Train health care professionals and	Start a national health care system in a specific area Then disseminate

ea

Founda-

Early roadmap for healthcare reconstruction in the unified Korean peninsula

- Developed during the optimistic times of S/N Korea exchange (just before domestic support discontinued)
- Macroscopic & horizontal approach for overall support
- With a mindset of re-unified Korea (→ not reflective of the current climate)
- S. Korean government centric engagement strategy
- Limited perspective(s) on the interchange between the disease specific (vertical) and health systems (horizontal) approach to improving health
- Limited assessment of the need of evidence-based approach in implementing public health strategies (data needs & use)
- Lack of global cooperative engagement strategy (Consideration of N. Korea as a global health aid target country)

Established 'domestic' expert networks in health for the Korean Peninsula

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eISSN 1598-6357·pISSN 1011-8934

JKMS

Special Article
Medicine General & Health Policy

Check for updates

Mid-Term Strategic Plan for the Public Health and Medical Care Cooperation in the Korean Peninsula

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[2]Division of Health Administration, College of Software and Digital Healthcare Convergence, Yonsei University, Wonju, Korea
[3]Department of Preventive Medicine, Korea University College of Medicine, Seoul, Korea
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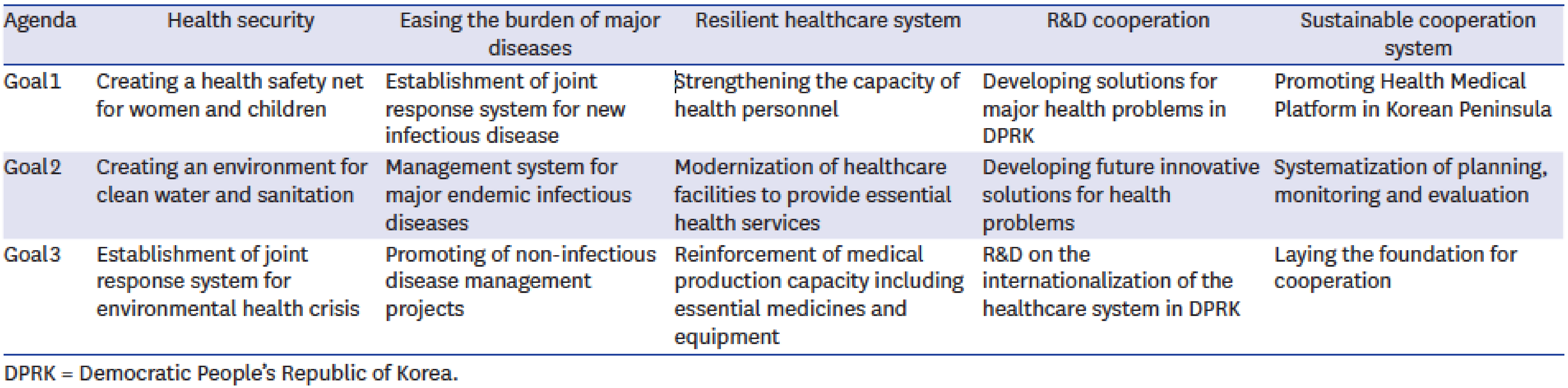
[5]Division of Endocrinology and Metabolism, Department of Internal Medicine, Korea University College of Medicine, Seoul, Korea

OPEN ACCESS

Areas of support	Contents
Medical infrastructure	Modernization of health facilities and infrastructure
Nutritional support	Assessment of nutritional status and selection of priority support items
Emergency response in disaster	Assessment of emergency response cases, development of models of engagement
Infectious disease support	Assessment of past support cases, development of models of engagement
Disability support	Assessment of disability status, facilities of disabilities care

Ministry of Unification (2018)



Agenda	Health security	Easing the burden of major diseases	Resilient healthcare system	R&D cooperation	Sustainable cooperation system
Goal1	Creating a health safety net for women and children	Establishment of joint response system for new infectious disease	Strengthening the capacity of health personnel	Developing solutions for major health problems in DPRK	Promoting Health Medical Platform in Korean Peninsula
Goal2	Creating an environment for clean water and sanitation	Management system for major endemic infectious diseases	Modernization of healthcare facilities to provide essential health services	Developing future innovative solutions for health problems	Systematization of planning, monitoring and evaluation
Goal3	Establishment of joint response system for environmental health crisis	Promoting of non-infectious disease management projects	Reinforcement of medical production capacity including essential medicines and equipment	R&D on the internationalization of the healthcare system in DPRK	Laying the foundation for cooperation

DPRK = Democratic People's Republic of Korea.

1. Established based on domestic expert collaboration groups → limited views and engagement of the global partners and experts
2. Lack of inter-connectivity across different health agenda → a need for prioritization of resources and development of integrated strategies

A Mid/Long-term N. Korea TB support plan (2015)

Not so different from other disciplines!

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용역-2-2015-6

북한 결핵관리지원
중장기 실행방안 수립

2015. 3.

보건복지부 KOFIH 사)세계결핵제로운동본부 북한어린이결핵퇴치본부
서울대학교 의과대학 통일의학센터 Institute for Health and Unification Studies 이종욱글로벌의학센터 결핵연구원

Key areas w/ strategic recommendation

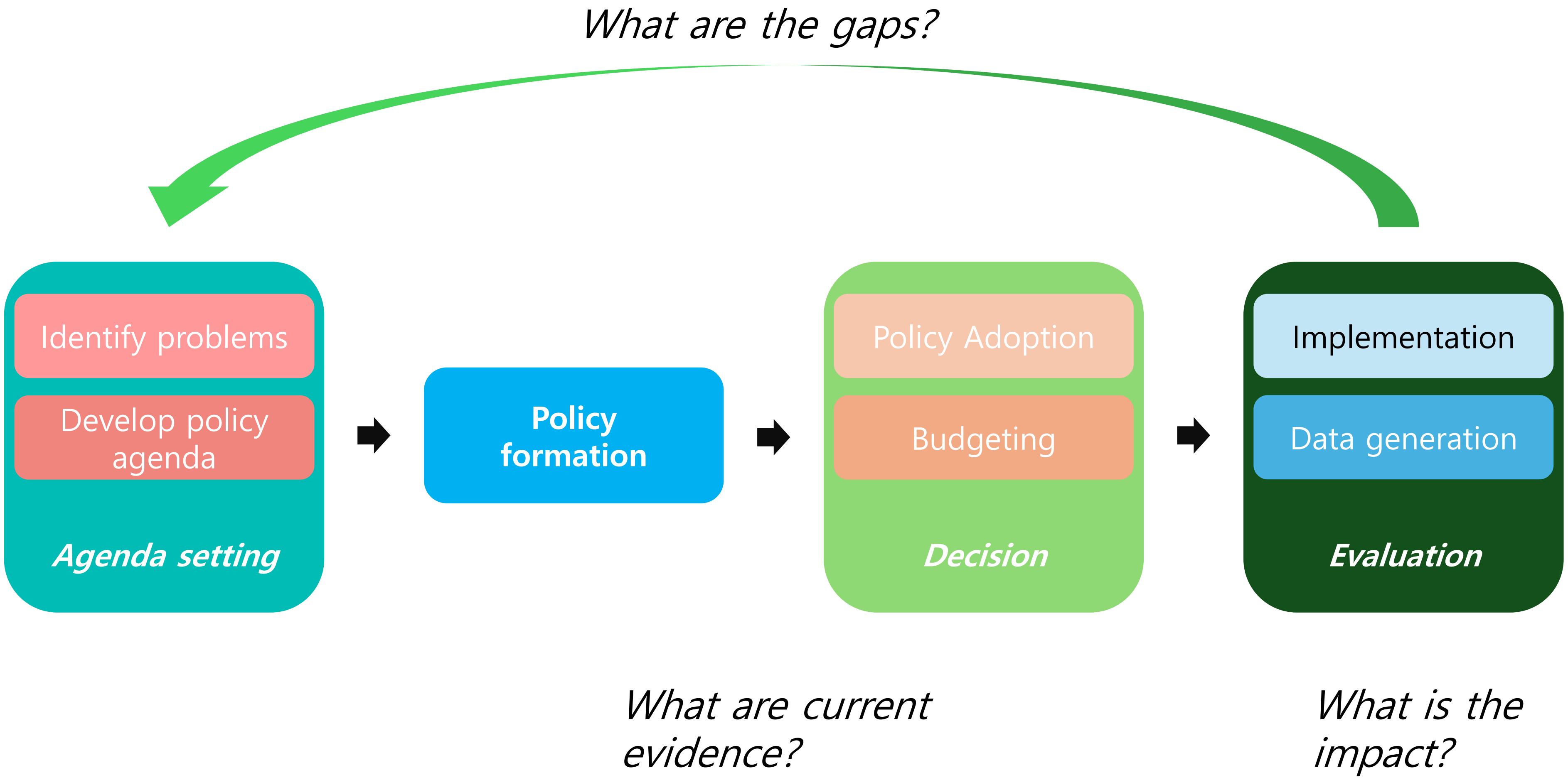
1. Key areas of support
   - Local TB service delivery and patient management strengthening
   - Normalization of TB sanitariums
   - National TB prevalence survey and steady supply of TB drugs

2. Direct support plan
   - TB Active Case Finding (ACF)
   - Strengthening of TB laboratories
   - Strengthening of TB patient management
   - TB Preventive Therapy
   - National TB prevalence survey

3. Strategy for mass influx of N. Korea refugee entry
   - Screening of the refugee camps
   - Bacteriologic testing using NAATs
   - Treatment initiation and management in quarantine

1. High-level, theoretical and simplified strategic assessment of the future engagement strategy
2. Lack of global and intra-disciplinary cooperative engagement strategy
3. Lack of evidence-based strategic development

The simplified process of formation of policies / strategies



What are the gaps?

Identify problems

Develop policy agenda

Agenda setting

Policy formation

Policy Adoption

Budgeting

Decision

Implementation

Data generation

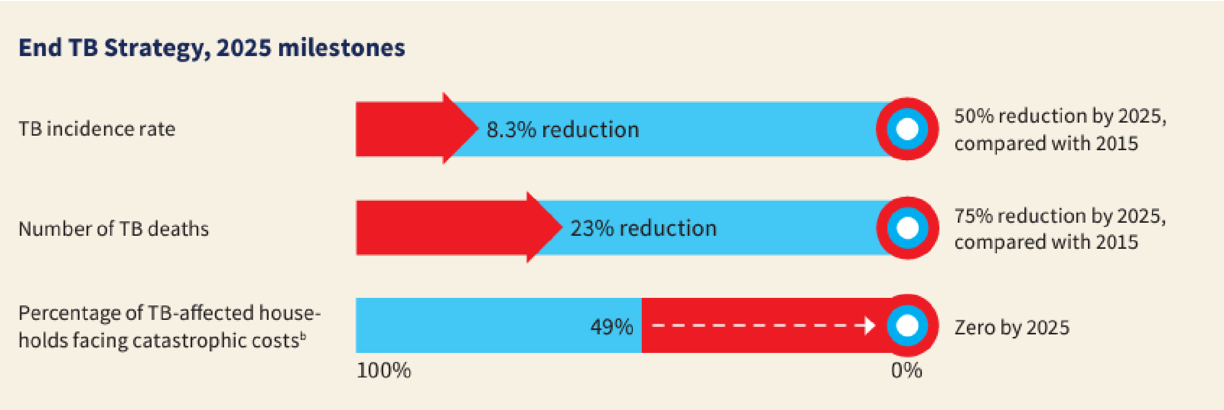
Evaluation

What are current evidence?

What is the impact?

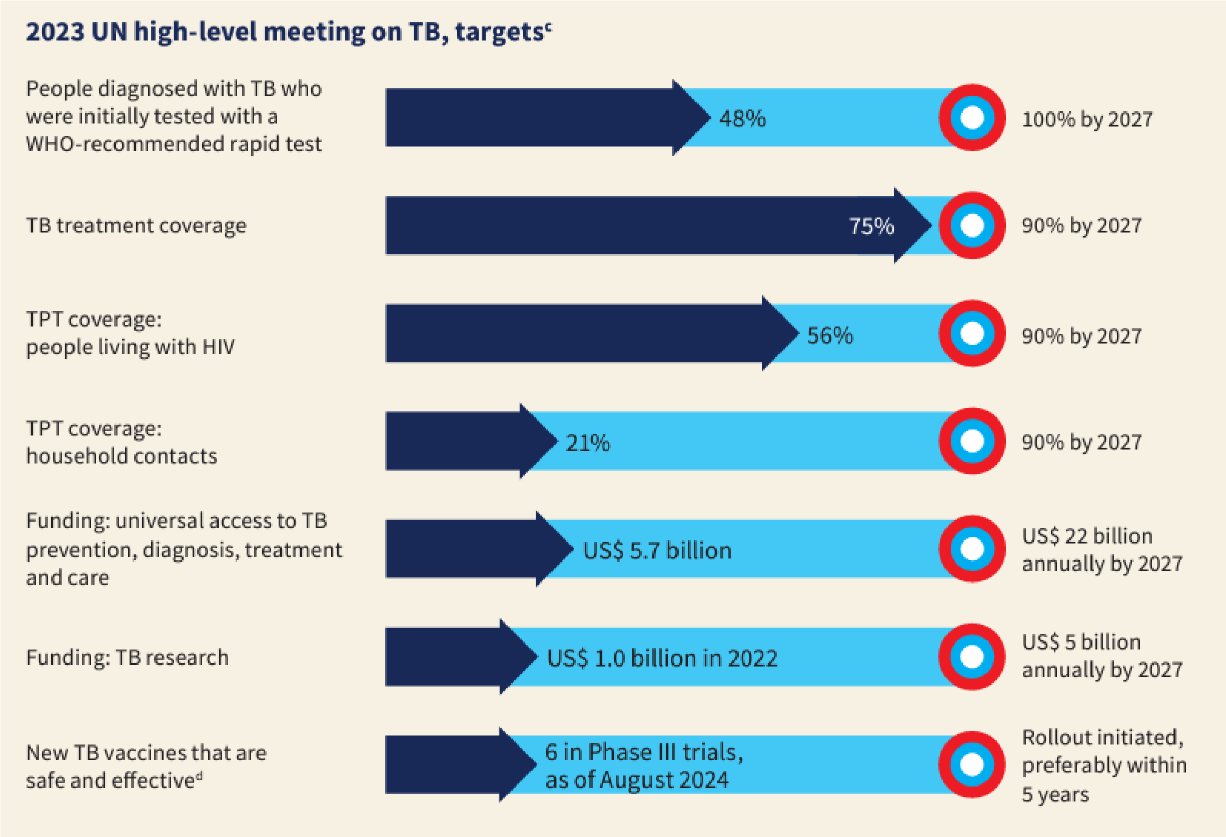
A cyclical and multi-disciplinary approach

Why should we focus on TB?



End TB Strategy, 2025 milestones

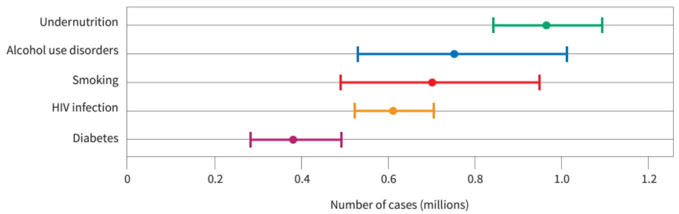
TB incidence rate	8.3% reduction	50% reduction by 2025, compared with 2015
Number of TB deaths	23% reduction	75% reduction by 2025, compared with 2015
Percentage of TB-affected households facing catastrophic costs[b]	49%	Zero by 2025



2023 UN high-level meeting on TB, targets[c]

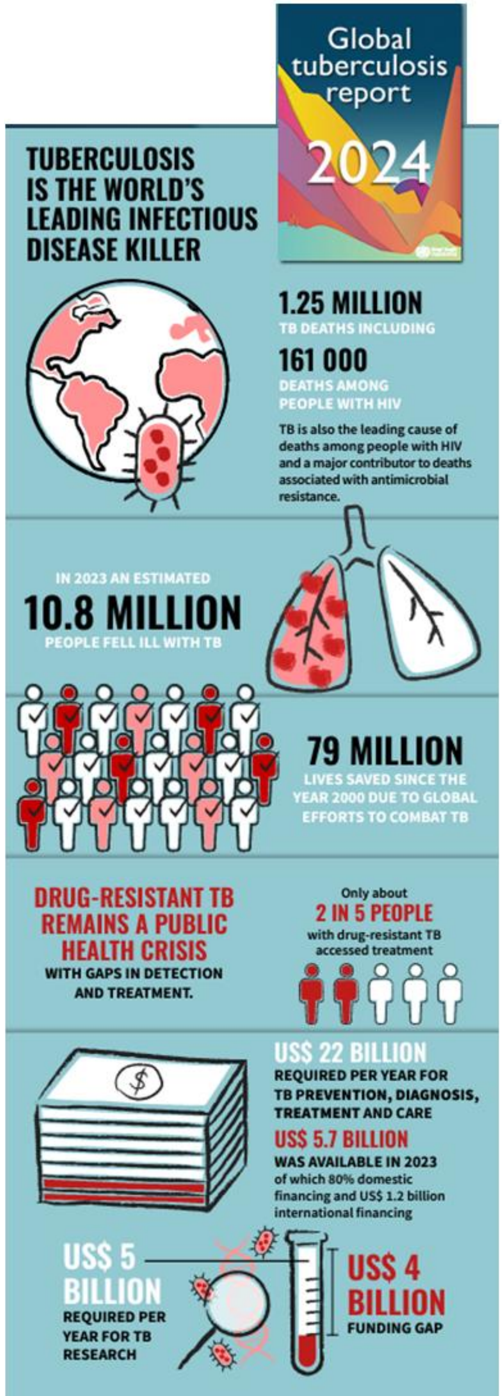
People diagnosed with TB who were initially tested with a WHO-recommended rapid test	48%	100% by 2027
TB treatment coverage	75%	90% by 2027
TPT coverage: people living with HIV	56%	90% by 2027
TPT coverage: household contacts	21%	90% by 2027
Funding: universal access to TB prevention, diagnosis, treatment and care	US$ 5.7 billion	US$ 22 billion annually by 2027
Funding: TB research	US$ 1.0 billion in 2022	US$ 5 billion annually by 2027
New TB vaccines that are safe and effective[d]	6 in Phase III trials, as of August 2024	Rollout initiated, preferably within 5 years

A global perspective



Key attributes for TB (except HIV) are major public health concern for N. Korea

A need for multi-disciplinary integrated & TB specific approach for TB control efforts



TUBERCULOSIS IS THE WORLD'S LEADING INFECTIOUS DISEASE KILLER

1.25 MILLION TB DEATHS INCLUDING 161 000 DEATHS AMONG PEOPLE WITH HIV

TB is also the leading cause of deaths among people with HIV and a major contributor to deaths associated with antimicrobial resistance.

IN 2023 AN ESTIMATED 10.8 MILLION PEOPLE FELL ILL WITH TB

79 MILLION LIVES SAVED SINCE THE YEAR 2000 DUE TO GLOBAL EFFORTS TO COMBAT TB

DRUG-RESISTANT TB REMAINS A PUBLIC HEALTH CRISIS WITH GAPS IN DETECTION AND TREATMENT.

Only about 2 IN 5 PEOPLE with drug-resistant TB accessed treatment

US$ 22 BILLION REQUIRED PER YEAR FOR TB PREVENTION, DIAGNOSIS, TREATMENT AND CARE

US$ 5.7 BILLION WAS AVAILABLE IN 2023 of which 80% domestic financing and US$ 1.2 billion international financing

US$ 5 BILLION REQUIRED PER YEAR FOR TB RESEARCH

US$ 4 BILLION FUNDING GAP

Why Korea?: Achievements in TB control in South Korea since 1930s

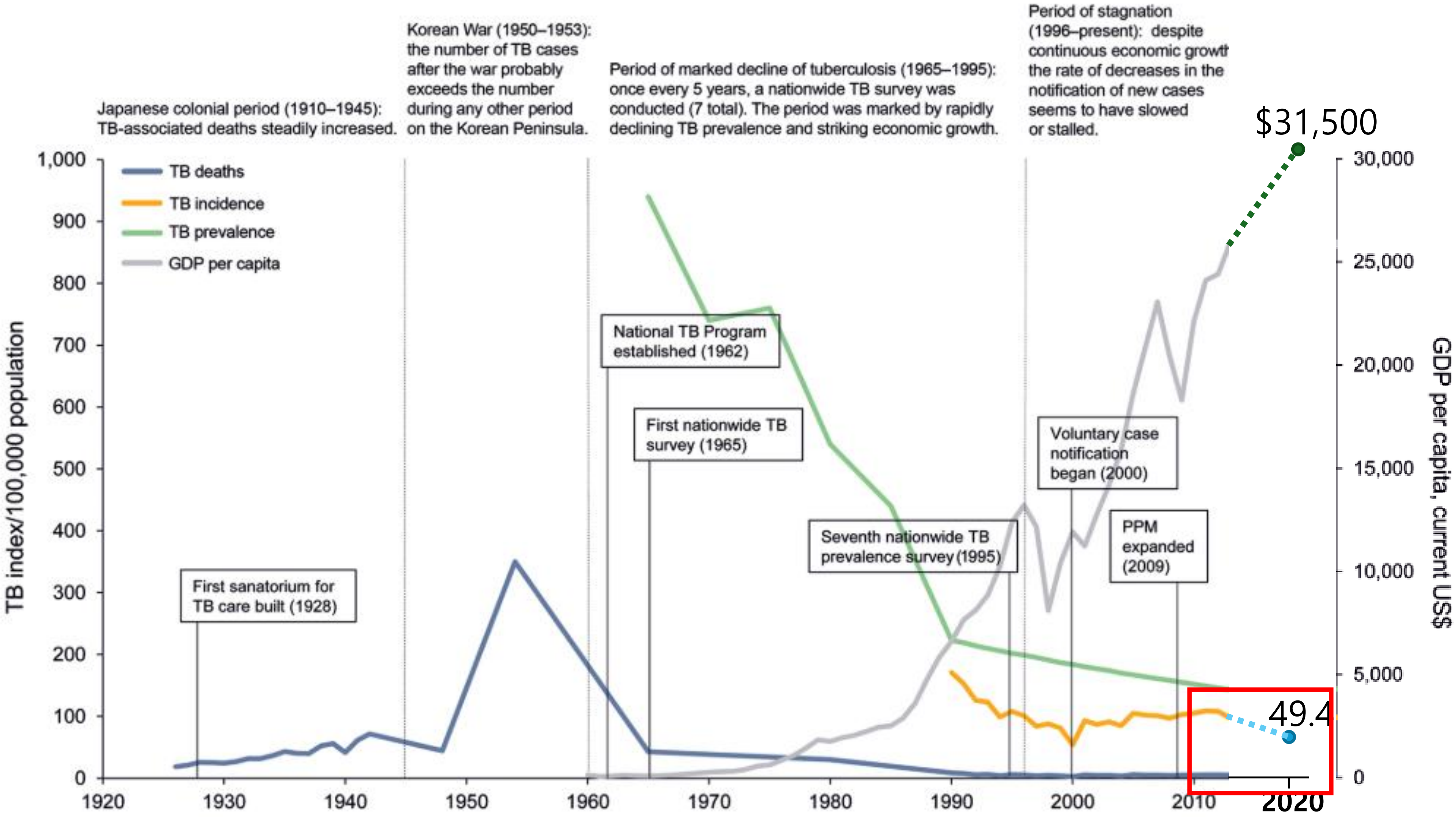


Figure 1. Number of tuberculosis (TB) cases per 100,000 population in South Korea, 1926–2013. Major periods are demarcated by dotted lines. Historical tuberculosis milestones for each period are briefly described. Notable tuberculosis control efforts are summarized in the boxes. GDP, gross domestic product; PPM, public–private mix. Sources: (*1*,*4*–*6*).

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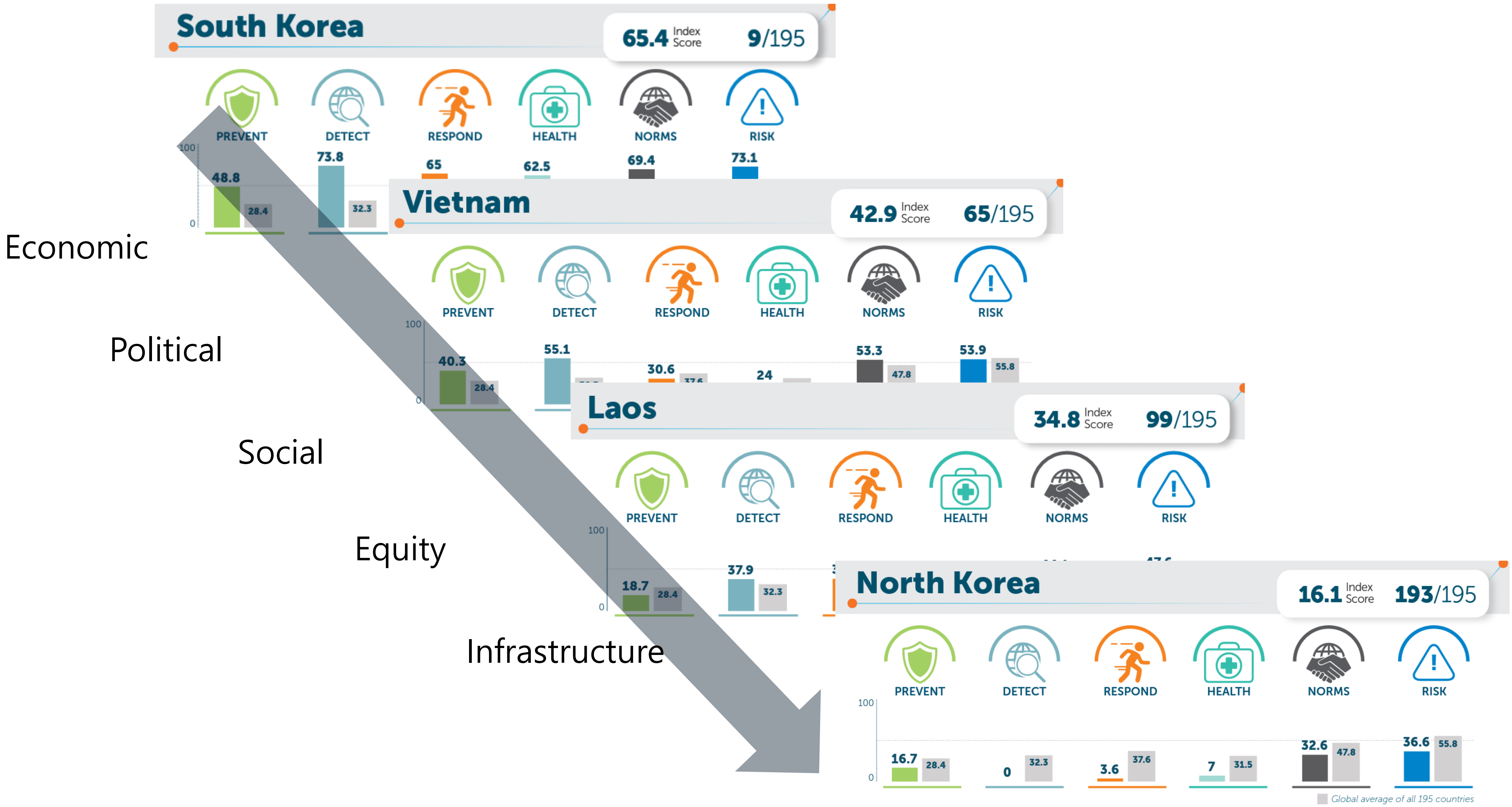
SEOUL NATIONAL UNIVERSITY

Kim and Yim, EID (2015)

Global Health Security (GHS) Index - 2021



Economic

Political

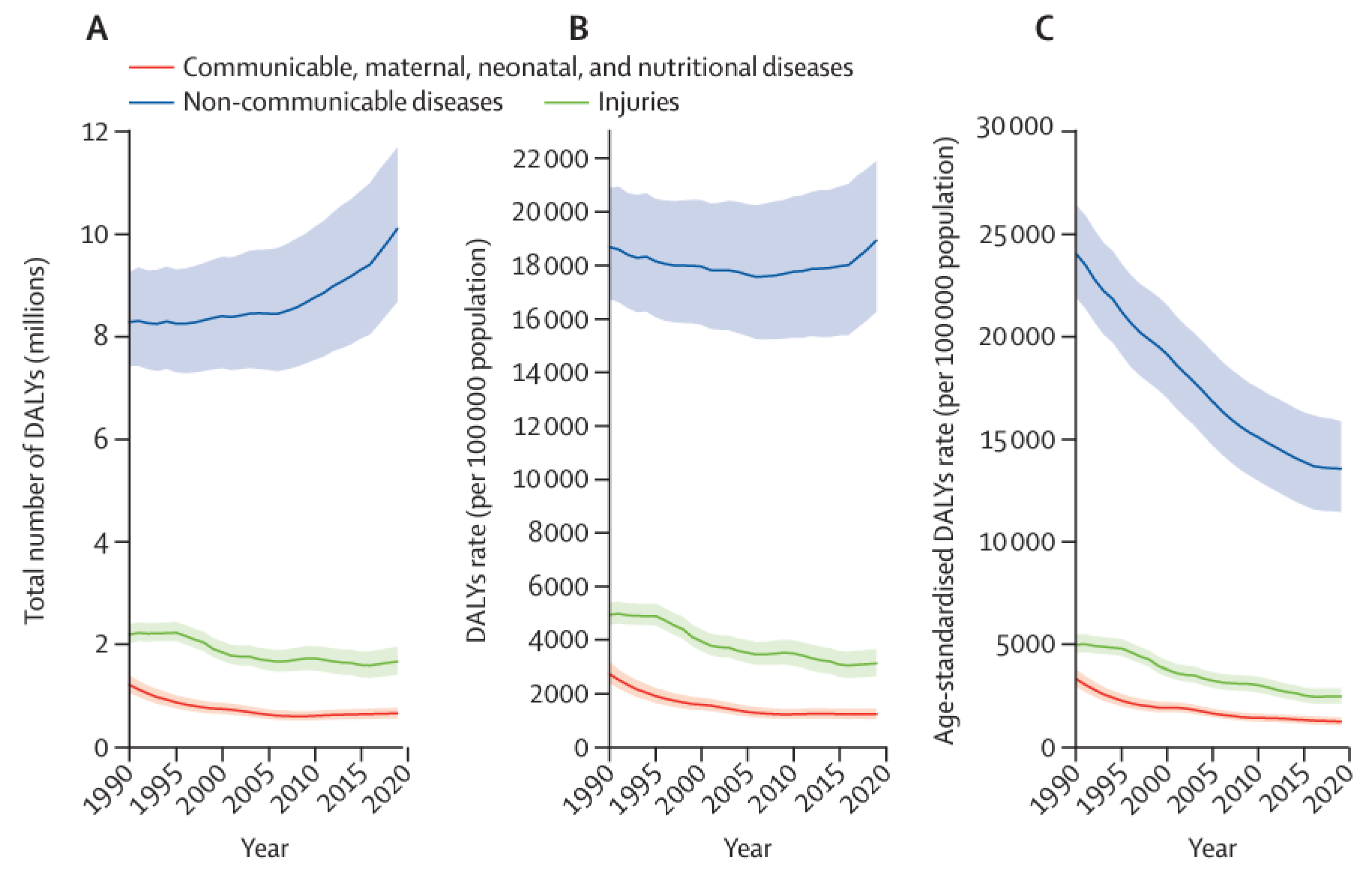
Social

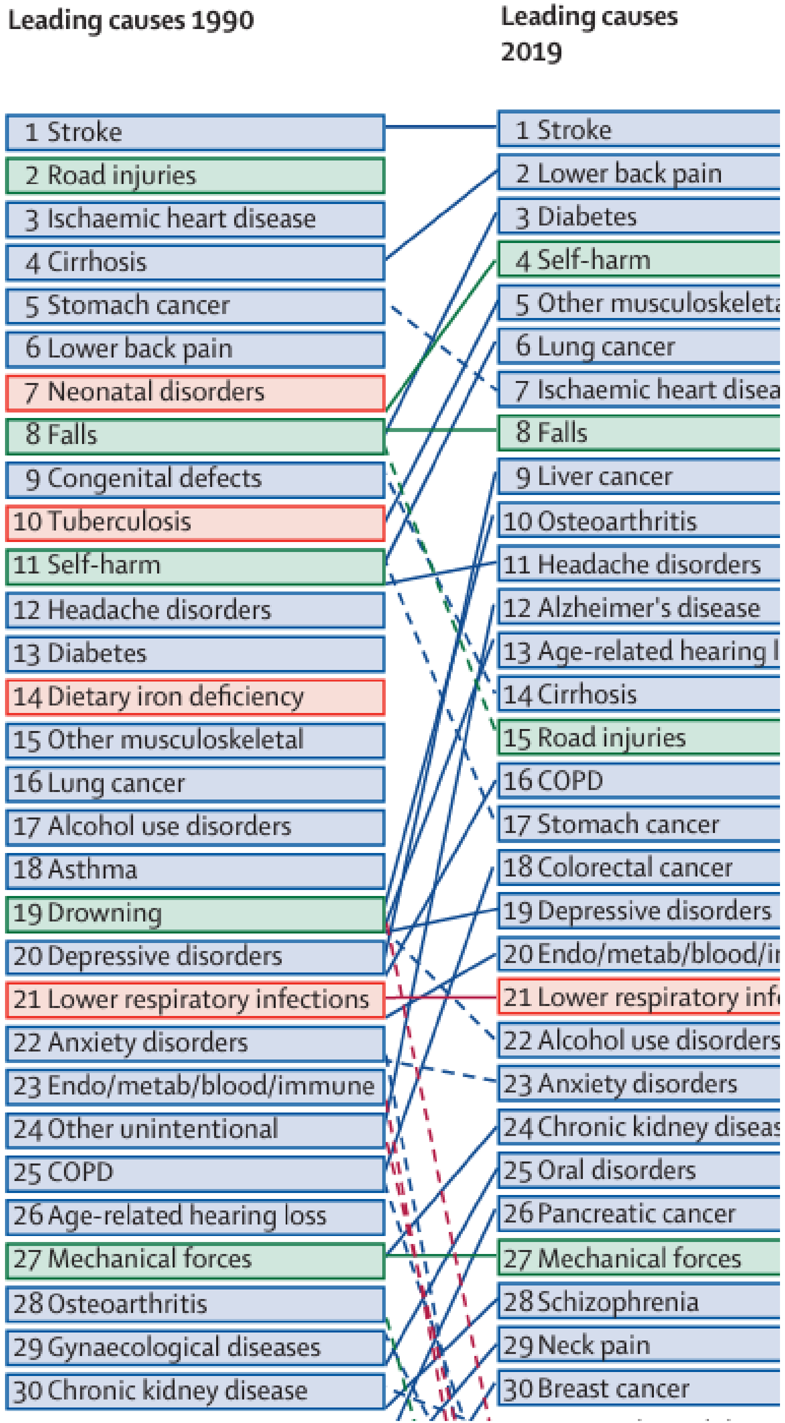
Equity

Infrastructure

Population health outcomes in South Korea 1990–2019, and projections up to 2040: a systematic analysis for the Global Burden of Disease Study 2019

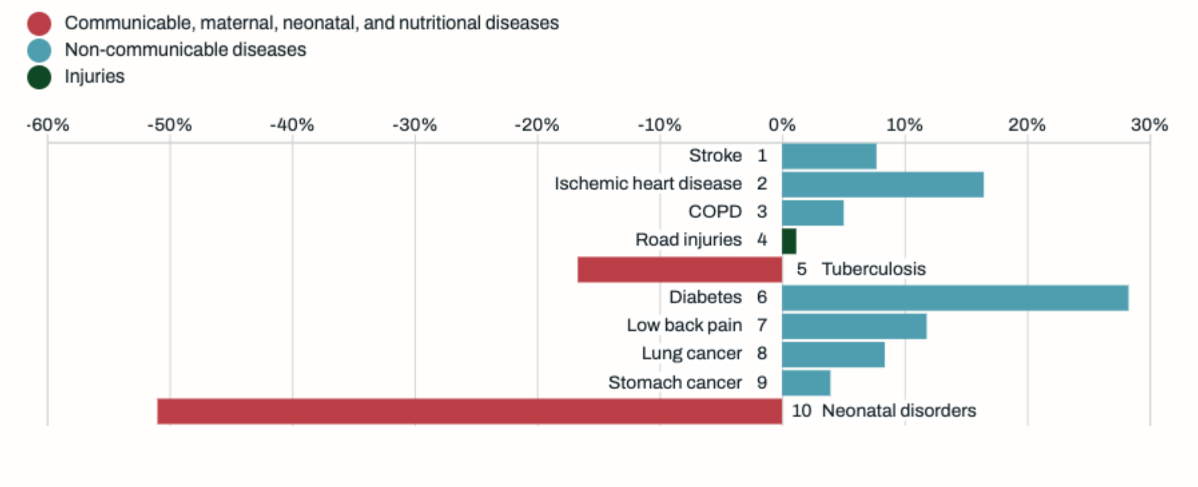
*GBD 2019 South Korea BoD Collaborators**

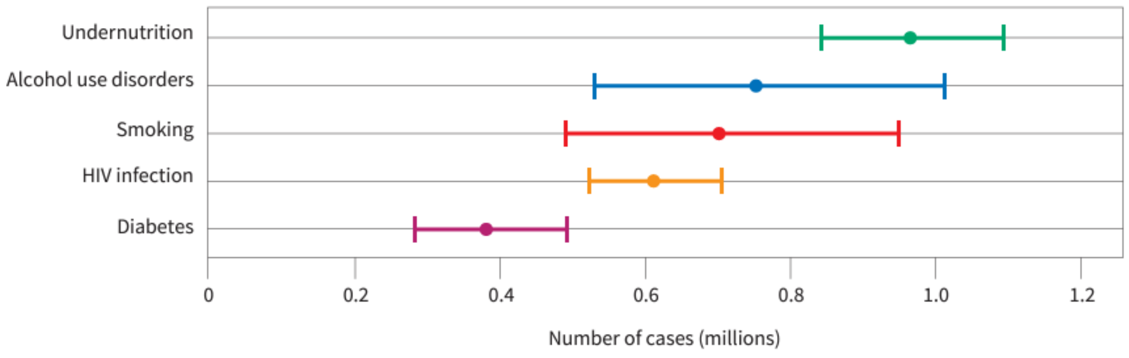


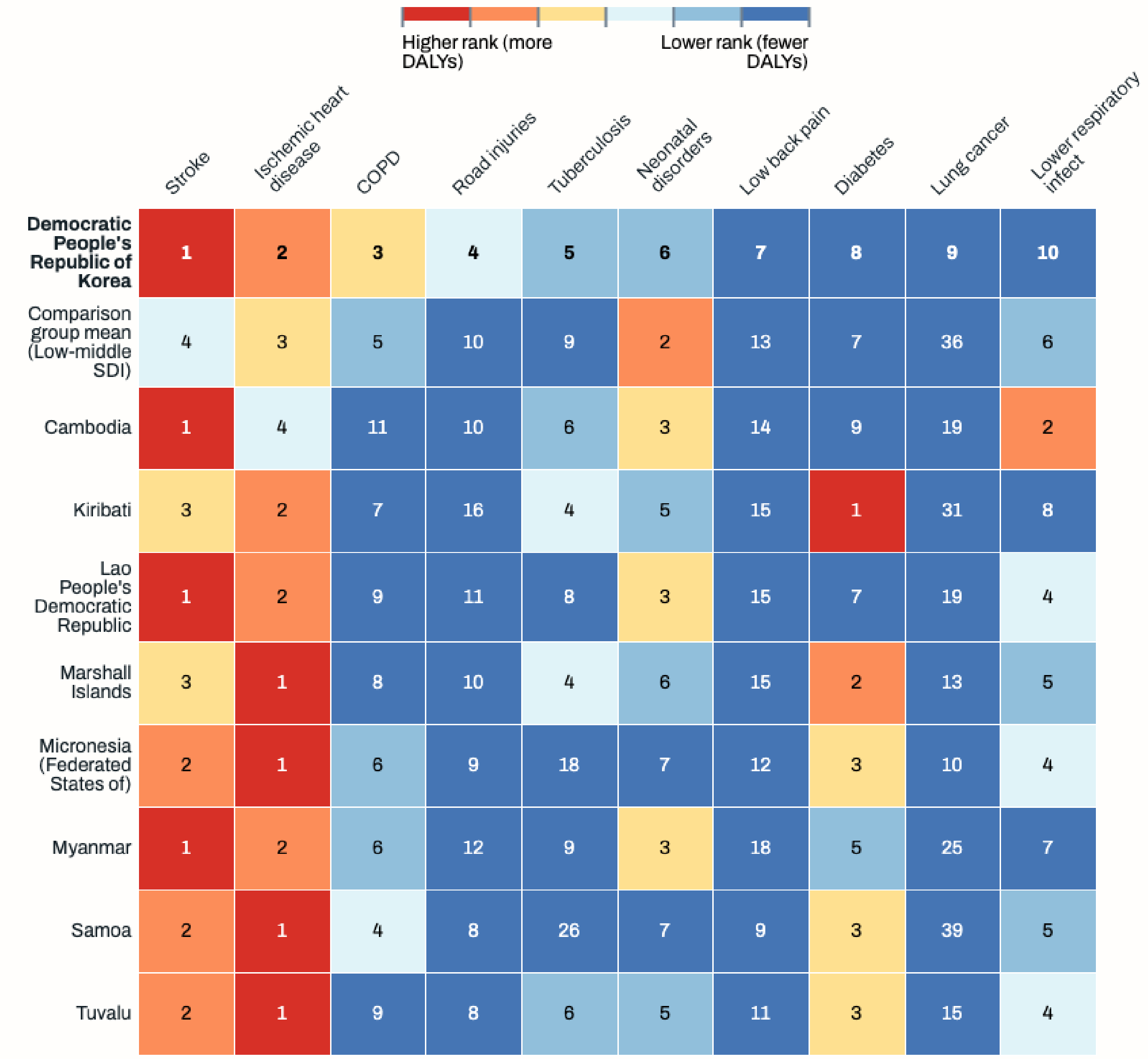


Leading causes 1990	Leading causes 2019
1 Stroke	1 Stroke
2 Road injuries	2 Lower back pain
3 Ischaemic heart disease	3 Diabetes
4 Cirrhosis	4 Self-harm
5 Stomach cancer	5 Other musculoskeleta
6 Lower back pain	6 Lung cancer
7 Neonatal disorders	7 Ischaemic heart disea
8 Falls	8 Falls
9 Congenital defects	9 Liver cancer
10 Tuberculosis	10 Osteoarthritis
11 Self-harm	11 Headache disorders
12 Headache disorders	12 Alzheimer's disease
13 Diabetes	13 Age-related hearing l
14 Dietary iron deficiency	14 Cirrhosis
15 Other musculoskeletal	15 Road injuries
16 Lung cancer	16 COPD
17 Alcohol use disorders	17 Stomach cancer
18 Asthma	18 Colorectal cancer
19 Drowning	19 Depressive disorders
20 Depressive disorders	20 Endo/metab/blood/ir
21 Lower respiratory infections	21 Lower respiratory infe
22 Anxiety disorders	22 Alcohol use disorders
23 Endo/metab/blood/immune	23 Anxiety disorders
24 Other unintentional	24 Chronic kidney diseas
25 COPD	25 Oral disorders
26 Age-related hearing loss	26 Pancreatic cancer
27 Mechanical forces	27 Mechanical forces
28 Osteoarthritis	28 Schizophrenia
29 Gynaecological diseases	29 Neck pain
30 Chronic kidney disease	30 Breast cancer

Disease Burden in DPR Korea





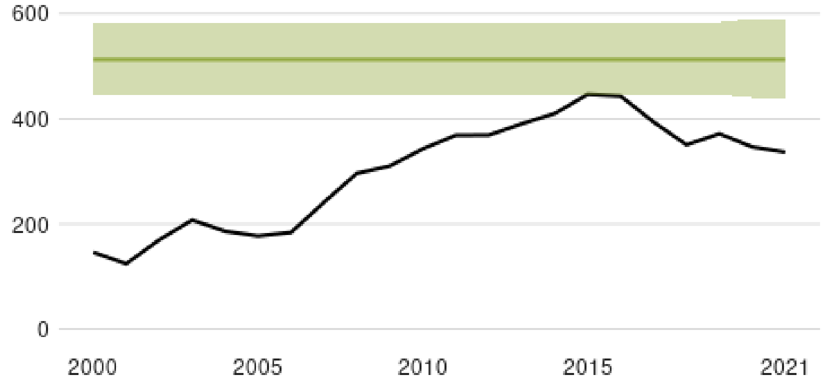

Higher rank (more DALYs)
Lower rank (fewer DALYs)

	Stroke	Ischemic heart disease	COPD	Road injuries	Tuberculosis	Neonatal disorders	Low back pain	Diabetes	Lung cancer	Lower respiratory infect
Democratic People's Republic of Korea	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Comparison group mean (Low-middle SDI)	4	3	5	10	9	2	13	7	36	6
Cambodia	1	4	11	10	6	3	14	9	19	2
Kiribati	3	2	7	16	4	5	15	1	31	8
Lao People's Democratic Republic	1	2	9	11	8	3	15	7	19	4
Marshall Islands	3	1	8	10	4	6	15	2	13	5
Micronesia (Federated States of)	2	1	6	9	18	7	12	3	10	4
Myanmar	1	2	6	12	9	3	18	5	25	7
Samoa	2	1	4	8	26	7	9	3	39	5
Tuvalu	2	1	9	8	6	5	11	3	15	4

북한의 결핵 문제

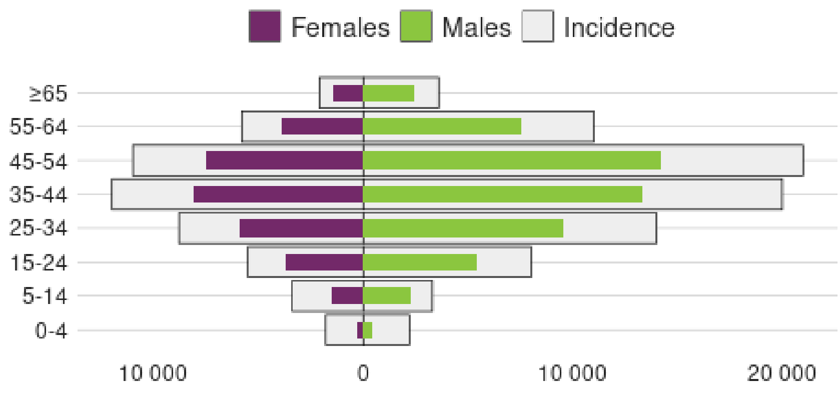
Incidence, New and relapse TB cases notified, HIV-positive TB incidence

(Rate per 100 000 population per year)



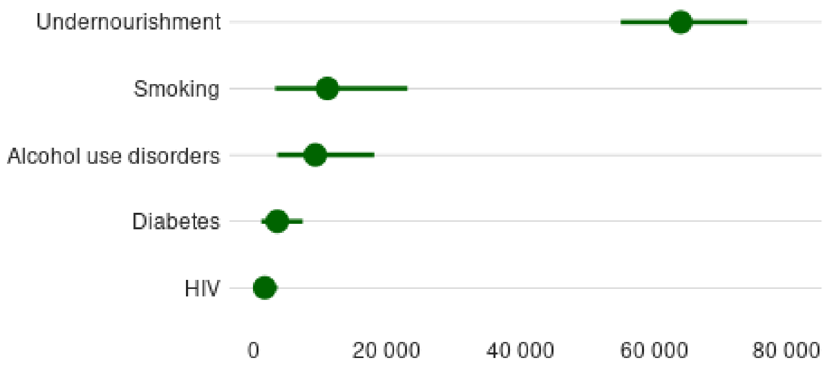
Incidence, Notified cases by age group and sex, 2021

(Number)



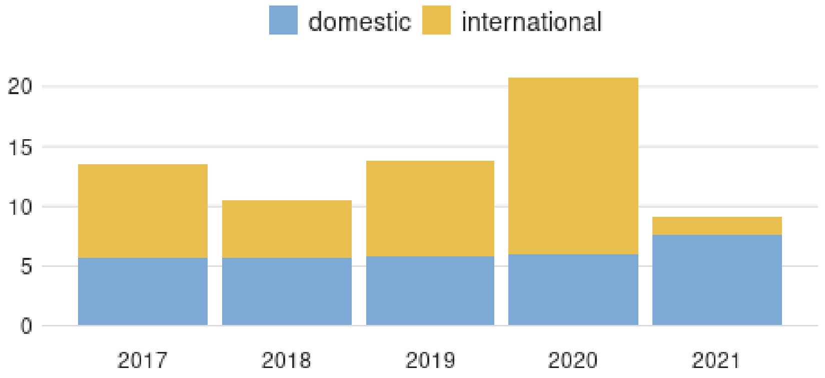
Cases attributable to five risk factors, 2021

(Number)



Funding for TB

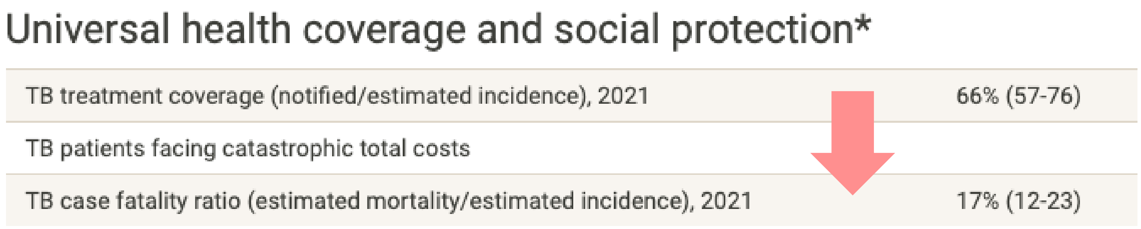
(US$ millions)



WHO TB Country Profile: https://worldhealthorg.shinyapps.io/tb_profiles/?_inputs_&entity_type=%22country%22&lan=%22EN%22&iso2=%22KP%22

TB-specific problems for N. Korea

진단과 치료의 coverage

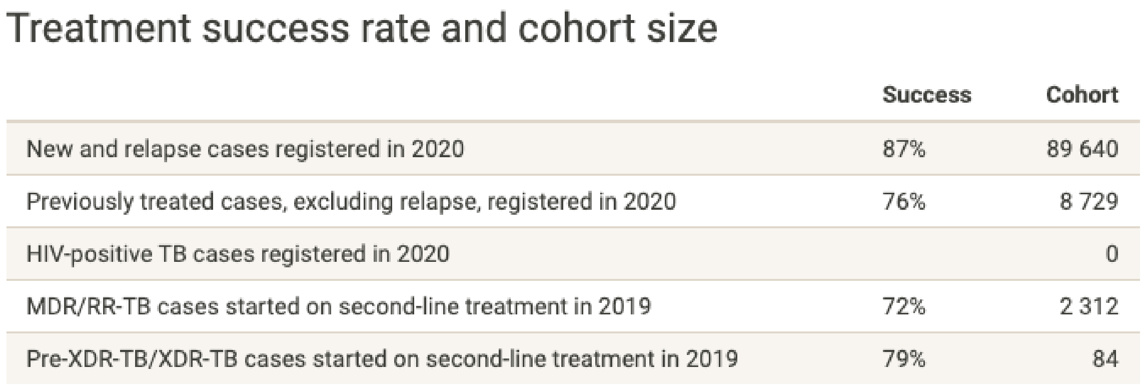


Universal health coverage and social protection*

TB treatment coverage (notified/estimated incidence), 2021	66% (57-76)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2021	17% (12-23)

Lower than most settings

결핵환자의 치료 결과

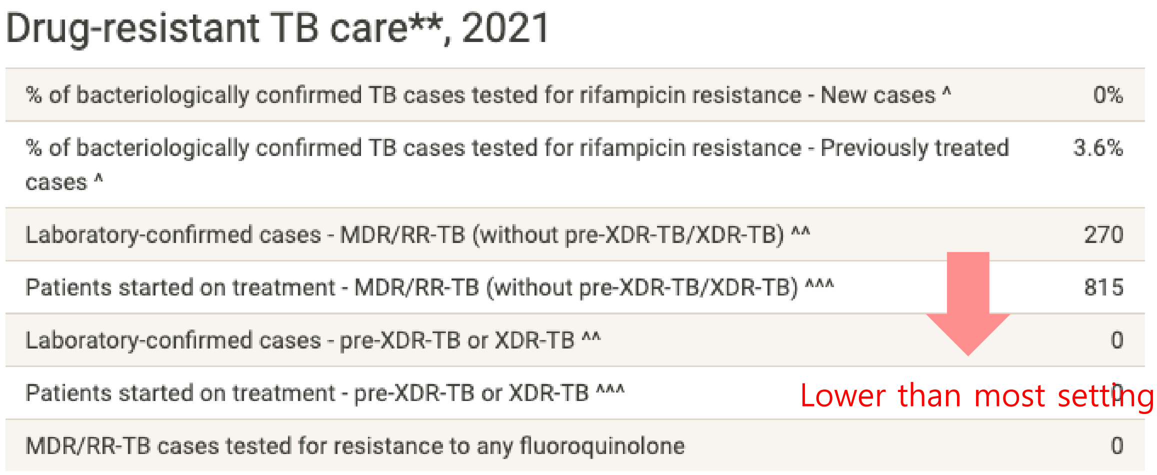


Treatment success rate and cohort size

	Success	Cohort
New and relapse cases registered in 2020	87%	89 640
Previously treated cases, excluding relapse, registered in 2020	76%	8 729
HIV-positive TB cases registered in 2020		0
MDR/RR-TB cases started on second-line treatment in 2019	72%	2 312
Pre-XDR-TB/XDR-TB cases started on second-line treatment in 2019	79%	84

Better or on-par vs. most settings

내성결핵의 진단과 치료



Drug-resistant TB care**, 2021

% of bacteriologically confirmed TB cases tested for rifampicin resistance - New cases ^	0%
% of bacteriologically confirmed TB cases tested for rifampicin resistance - Previously treated cases ^	3.6%
Laboratory-confirmed cases - MDR/RR-TB (without pre-XDR-TB/XDR-TB) ^^	270
Patients started on treatment - MDR/RR-TB (without pre-XDR-TB/XDR-TB) ^^^	815
Laboratory-confirmed cases - pre-XDR-TB or XDR-TB ^^	0
Patients started on treatment - pre-XDR-TB or XDR-TB ^^^	0
MDR/RR-TB cases tested for resistance to any fluoroquinolone	0

Lower than most settings

?????!!!!!

WHO TB Country Profile: https://worldhealthorg.shinyapps.io/tb_profiles/?_inputs_&entity_type=%22country%22&lan=%22EN%22&iso2=%22KP%22

TB-specific problems for N. Korea – Drug Resistant TB

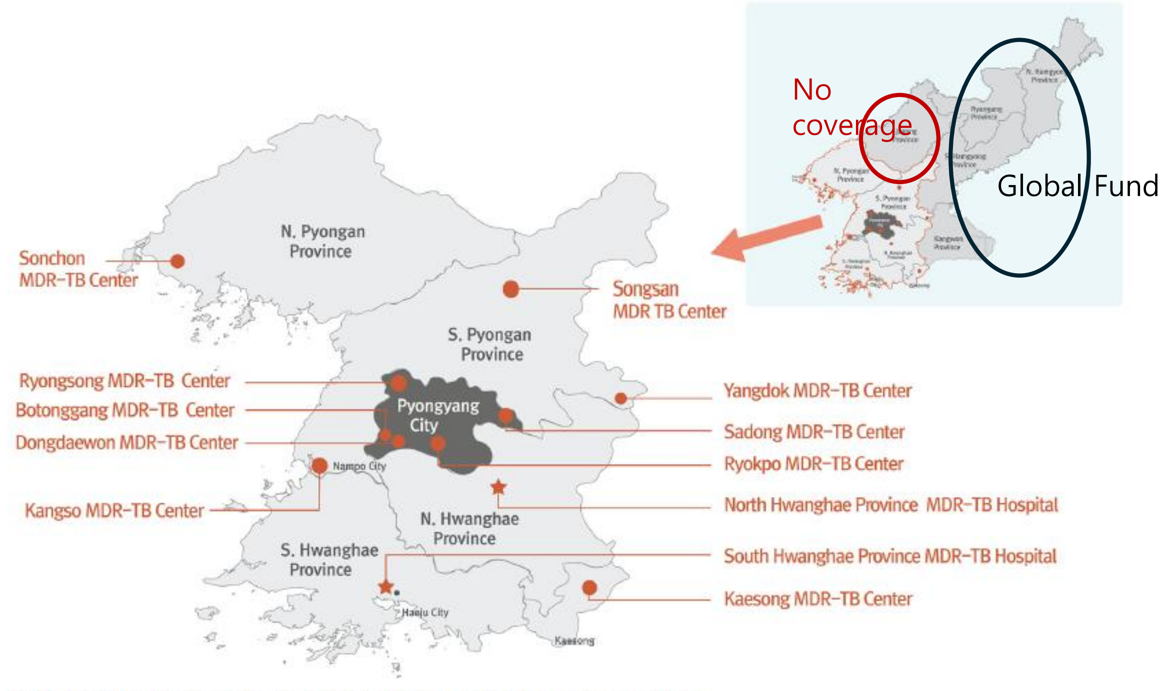

No coverage
Global Fund
Sonchon MDR-TB Center
N. Pyongan Province
Songsan MDR TB Center
S. Pyongan Province
Ryongsong MDR-TB Center
Botonggang MDR-TB Center
Dongdaewon MDR-TB Center
Pyongyang City
Yangdok MDR-TB Center
Sadong MDR-TB Center
Ryokpo MDR-TB Center
Nampo City
Kangso MDR-TB Center
North Hwanghae Province MDR-TB Hospital
N. Hwanghae Province
S. Hwanghae Province
South Hwanghae Province MDR-TB Hospital
Kaesong MDR-TB Center
Haeju City
Kaesong

Fig 1. DPRK MDR TB treatment centers supported by the Eugene Bell Foundation (2015).

Resistance pattern	2013 report	2016 report
MDR w/out second-line resistances	62%	68.6%
MDR w/ second-line DR (Pre-XDR)	22.8%	19.1%
MDR w/ second-line DR (XDR)	2%	6.7%

Seung & Linton (2013) and Seung, Franke & Linton (2016)

rGLC mission report (2018)

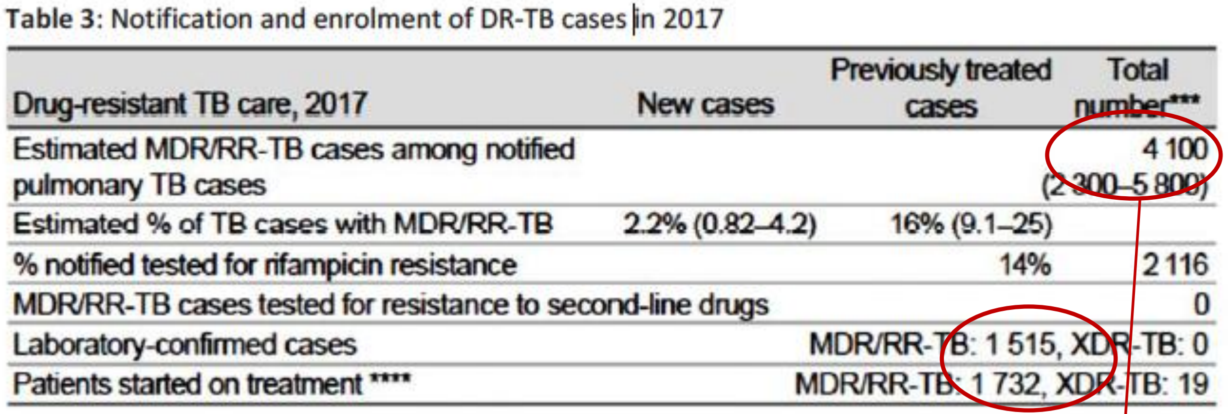
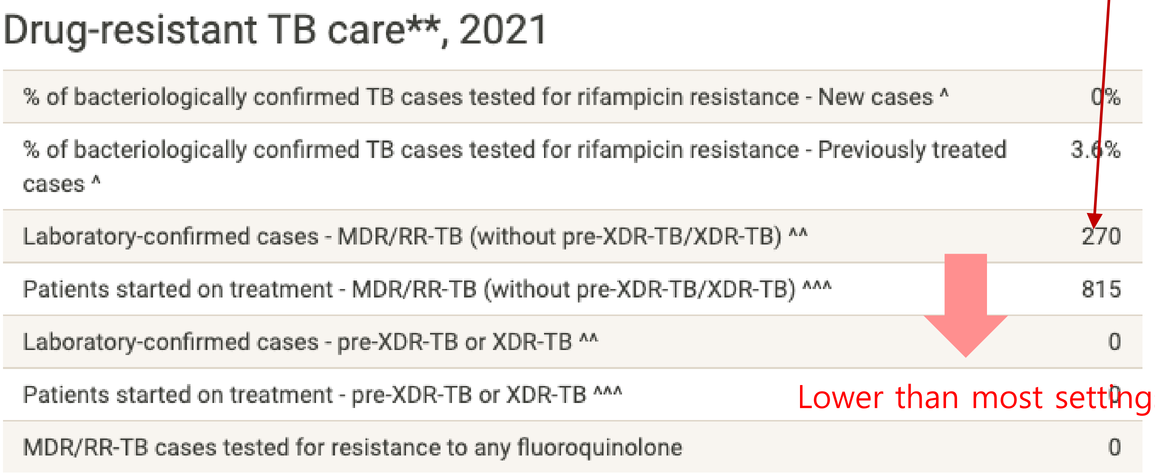


Table 3: Notification and enrolment of DR-TB cases in 2017

Drug-resistant TB care, 2017	New cases	Previously treated cases	Total number***
Estimated MDR/RR-TB cases among notified pulmonary TB cases			4 100 (2 300–5 800)
Estimated % of TB cases with MDR/RR-TB	2.2% (0.82–4.2)	16% (9.1–25)	
% notified tested for rifampicin resistance		14%	2 116
MDR/RR-TB cases tested for resistance to second-line drugs			0
Laboratory-confirmed cases			MDR/RR-TB: 1 515, XDR-TB: 0
Patients started on treatment ****			MDR/RR-TB: 1 732, XDR-TB: 19

Not a disease burden reduction



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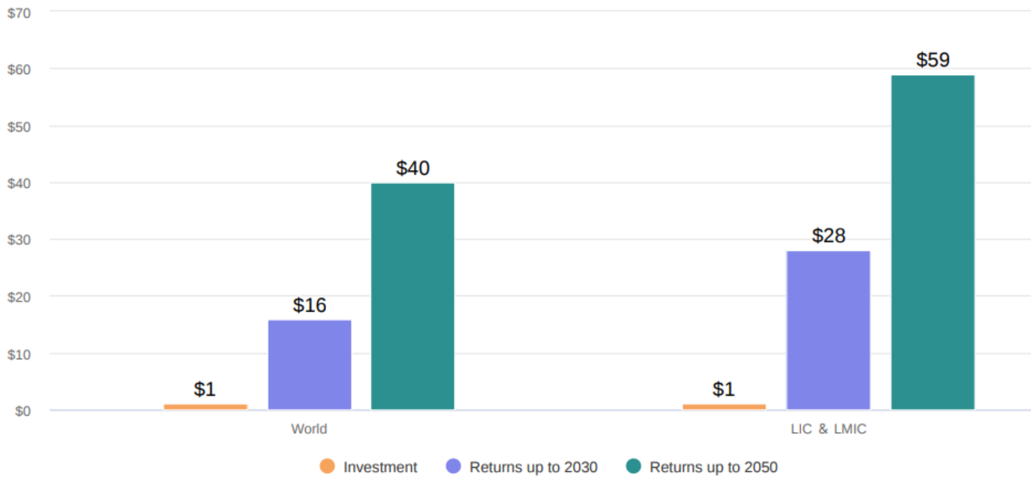
Patients started on treatment - pre-XDR-TB or XDR-TB ^^^	0
MDR/RR-TB cases tested for resistance to any fluoroquinolone	0

Lower than most settings

Investment case for TB and TB R&D



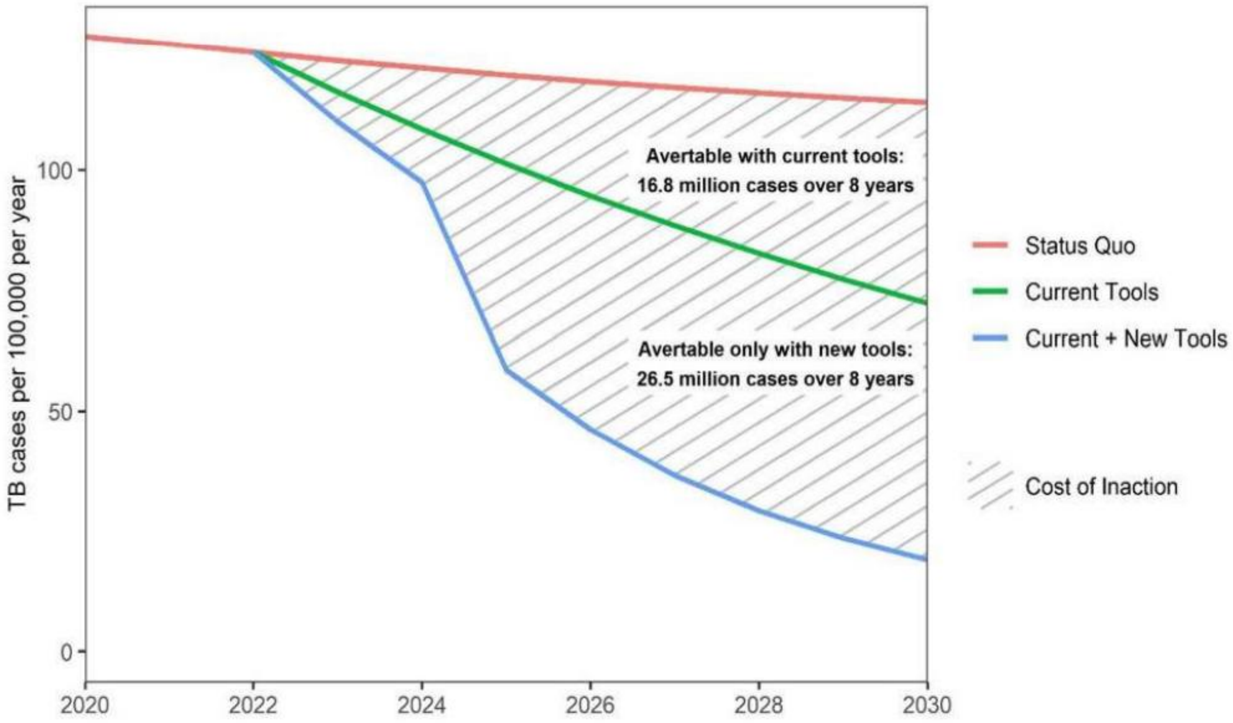
- Clear investment case for TB!
  - $40 return per $1 invested overall
  - $59 return per $1 invested for LIC & LMICs

VS (NCDs by 2030)

This investment yields a return of:

US$ 7

for each dollar invested

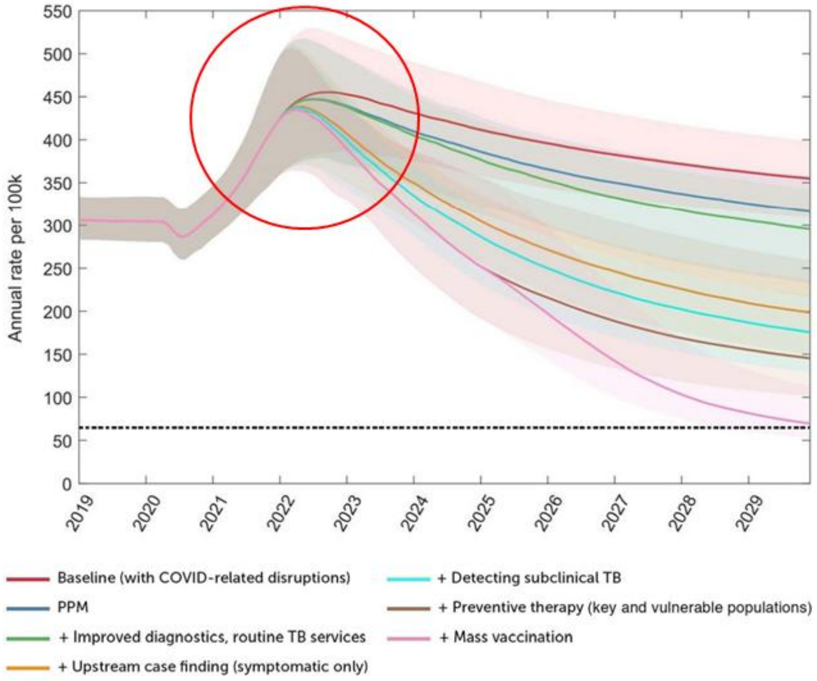


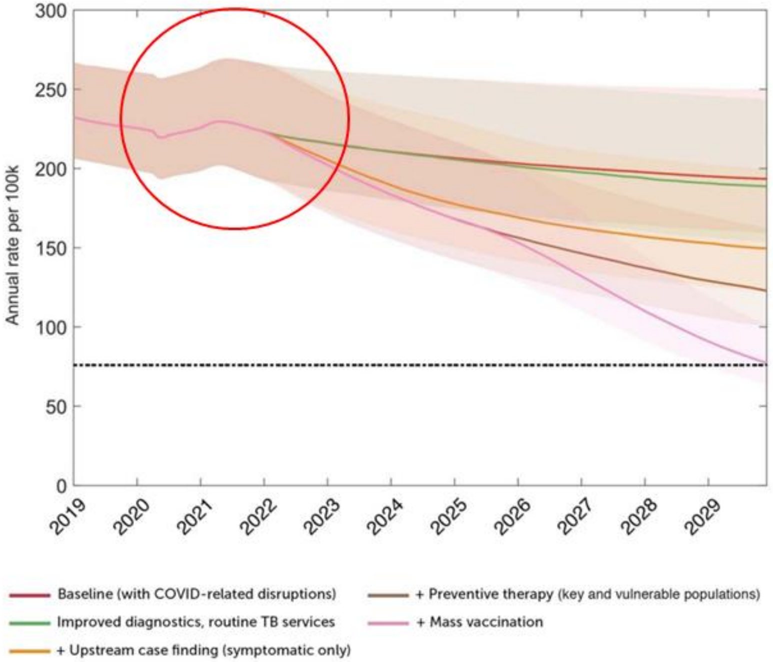
If we don’t deliver, then… (maintaining current levels of funding till 2030)

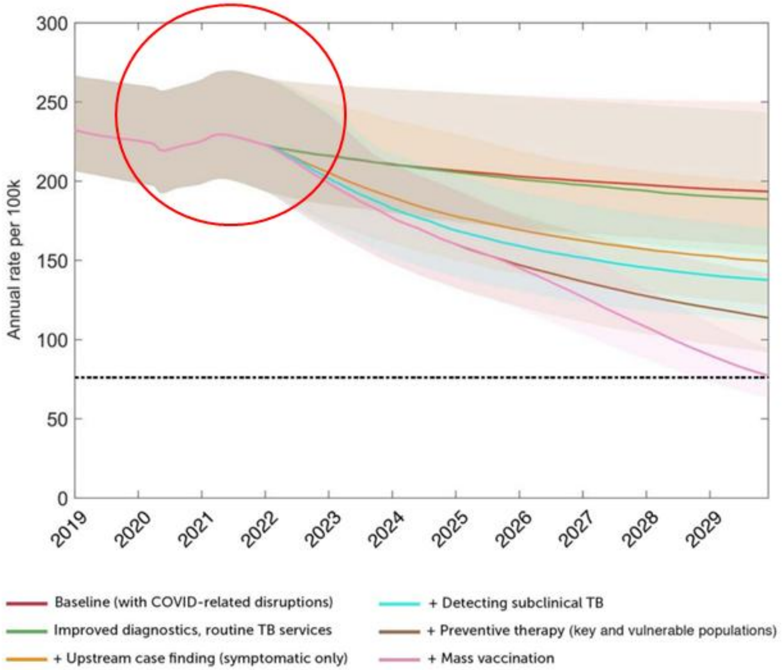
- 43 million will be infected
- 6.6 million will die of TB
- 234 million DALYs will arise
- 1 Trillion Dollars in lost due to losses in productivity

Using modeling to inform evidence-base strategies for TB

Post-2020 realities







Stop TB Partnership

THE GLOBAL PLAN TO END TB

Assessment of impact
scenarios for END-TB
global & country level plan

Guidance for
country-level
TB modelling

World Health Organization

TB Modelling and Analysis Consortium

Global and country
level decision making

The Global Fund

The Global Fund's New Funding Model

Global and country
level funding decisions

Key objectives and schematic of the global TB modeling consortium for the Korean Peninsula – a 5-year plan

Objective 1: Refined estimates of TB disease burden and long-term projection

Objective 2: Develop scenarios of required interventions to reach the End-TB goals (in both N. Korea and the Korean Peninsula)

Objective 3: TB cascade-specific (case-finding, patient management) strategic development and impact assessment

Objective 4: Assessment of budget and economic impact of TB control strategies in the Korean Peninsula

Objective 5: Use of consolidated model-based evidence to engage N. Korean and global stakeholders to develop engagement strategies for TB control and beyond

Six major building blocks of the global consortium

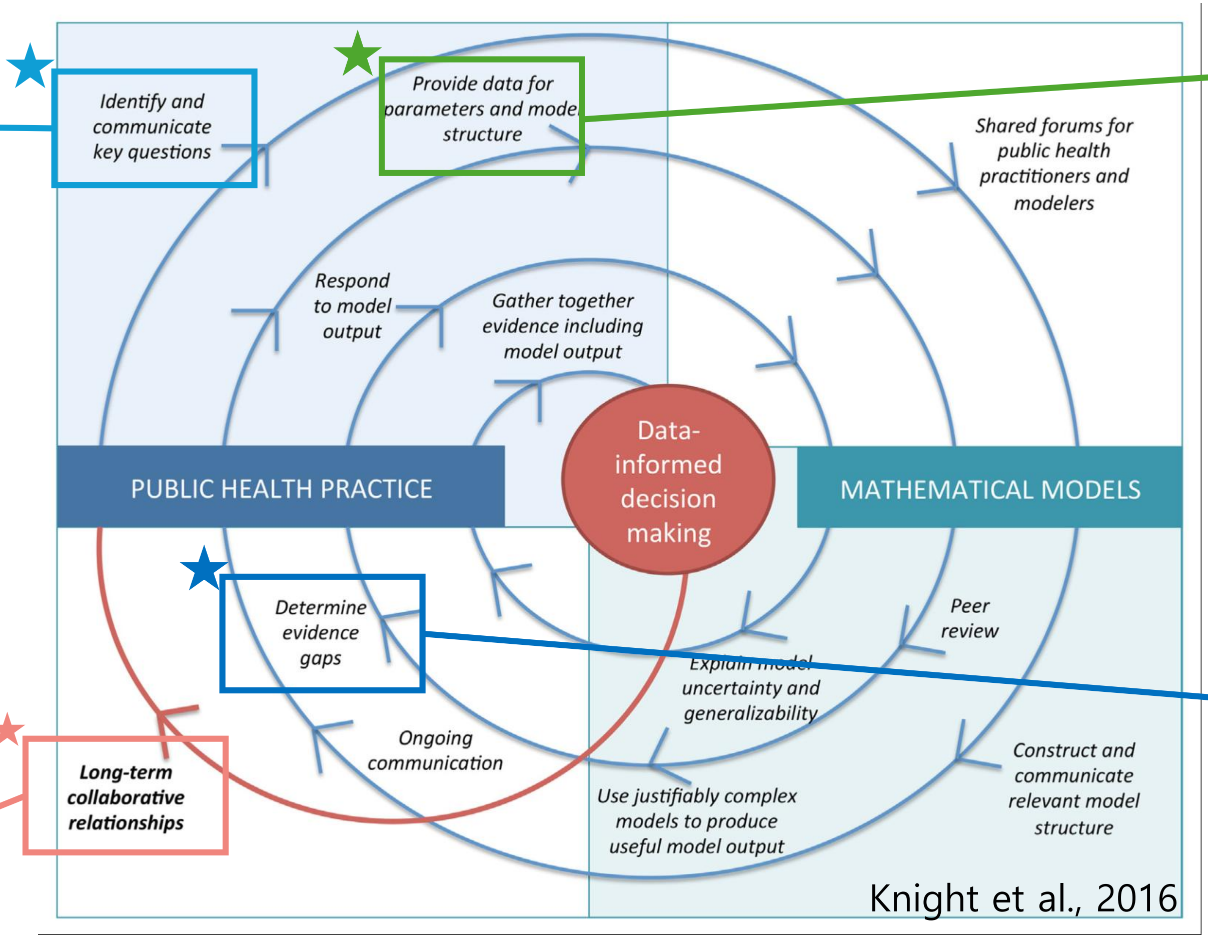
Agenda setting	Execution of RFP	Iterative and integrated modeling	Development of strategies	Engagement of key stakeholders	Refine and strategize
Develop TB modeling consortium	Invitation of multiple modeling groups	Refinement of modeling methods to address uncertainties	Establish evidence-based strategies for each objective	Dissemination of results and feedback	Iterative refinement of the model-based evidence

The policy process involving modeling…

A never-ending cycle of modeling to policy to implementation to modeling…

Models inform new policy → new data generated → models are reshaped/updated → new policy developed/updated

What policy decision need to be made?


Identify and communicate key questions
Provide data for parameters and model structure
Shared forums for public health practitioners and modelers
Respond to model output
Gather together evidence including model output
PUBLIC HEALTH PRACTICE
Data-informed decision making
MATHEMATICAL MODELS
Determine evidence gaps
Peer review
Explain model uncertainty and generalizability
Long-term collaborative relationships
Ongoing communication
Construct and communicate relevant model structure
Use justifiably complex models to produce useful model output

Knight et al., 2016

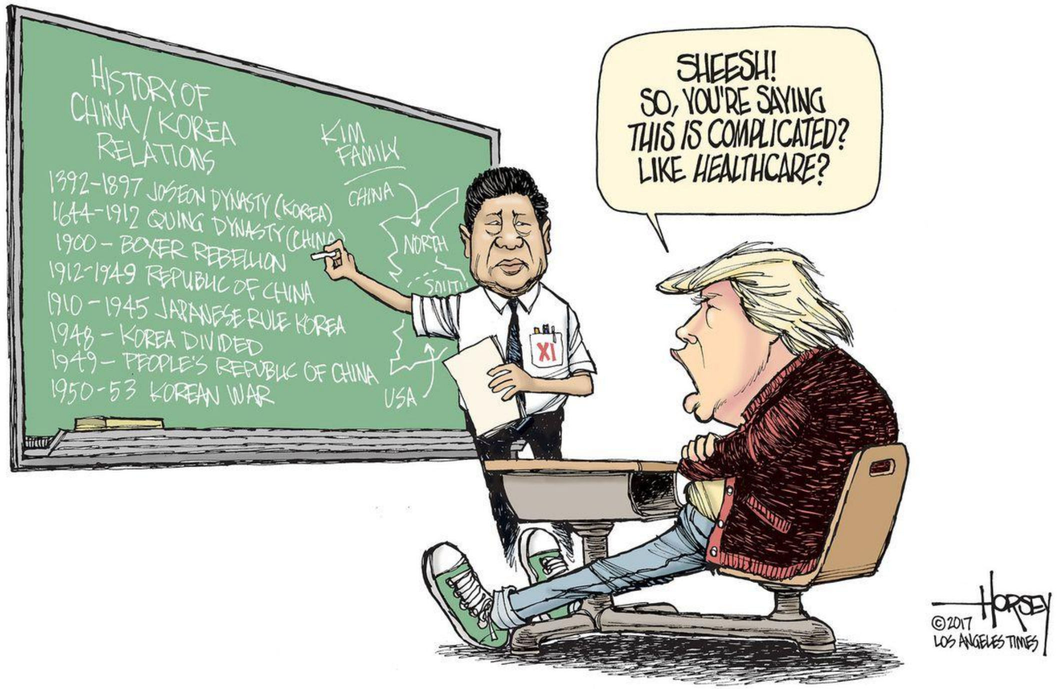
Published studies (RCT, cohort, case-control studies and systematic reviews & mata-analyses), routine data analyses, assumptions

Design new empiric studies, revise routine data reporting practices, innovate analyses methodologies

Establish team of modeling experts, health economist, epidemiologist, and policy makers

Criticisms of models

- Makes assumptions based on limited Data
  - Example: protective effect of prior latent TB infection / patient care-seeking behavior based on symptom levels
- Oversimplify the world
  - Example: homogeneous mixing
- Difficult to validate
  - Any evidence that predictions will c
- Difficult to understand
  - Too much of a "black box"


HISTORY OF CHINA / KOREA RELATIONS
1392-1897 JOSEON DYNASTY (KOREA)
1644-1912 QUING DYNASTY (CHINA)
1900 - BOXER REBELLION
1912-1949 REPUBLIC OF CHINA
1910 - 1945 JAPANESE RULE KOREA
1948 - KOREA DIVIDED
1949 - PEOPLE'S REPUBLIC OF CHINA
1950-53 KOREAN WAR
KIM FAMILY
CHINA
NORTH
SOUTH
USA
XI
SHEESH! SO, YOU'RE SAYING THIS IS COMPLICATED? LIKE HEALTHCARE?
HORSEY
©2017 LOS ANGELES TIMES

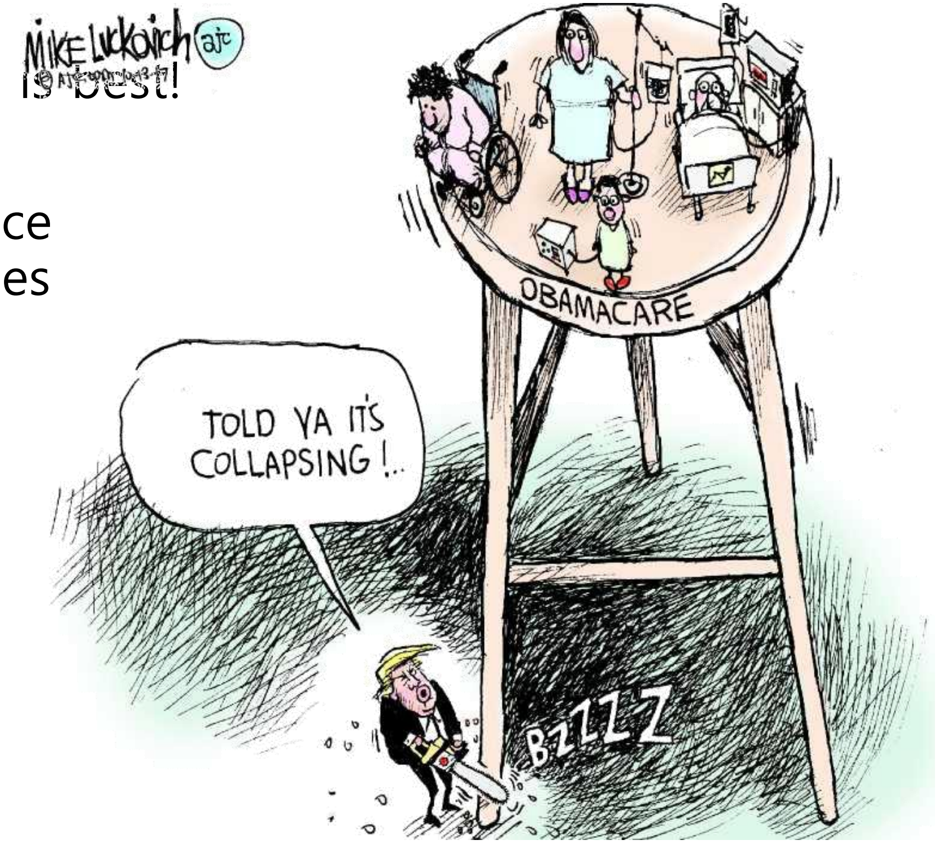
All are true… but is there an alternative?!

Decision-making w/out models?

- Expert opinion-based discussions
    - Experts create their own "mental models" of what is best!
- Predictable determinants of expert's view
    - Recent thought patterns/events, anecdotal evidence
    - Outspoken experts more influential than silent ones
    - Experts' own research and political agenda
    - Sound bites over substance

How does this compare to the criticisms of the models?

- **Assumptions vs. data?**
- **Oversimplify the world?**
- **Difficult to validate?**
- **Difficult to understand?**



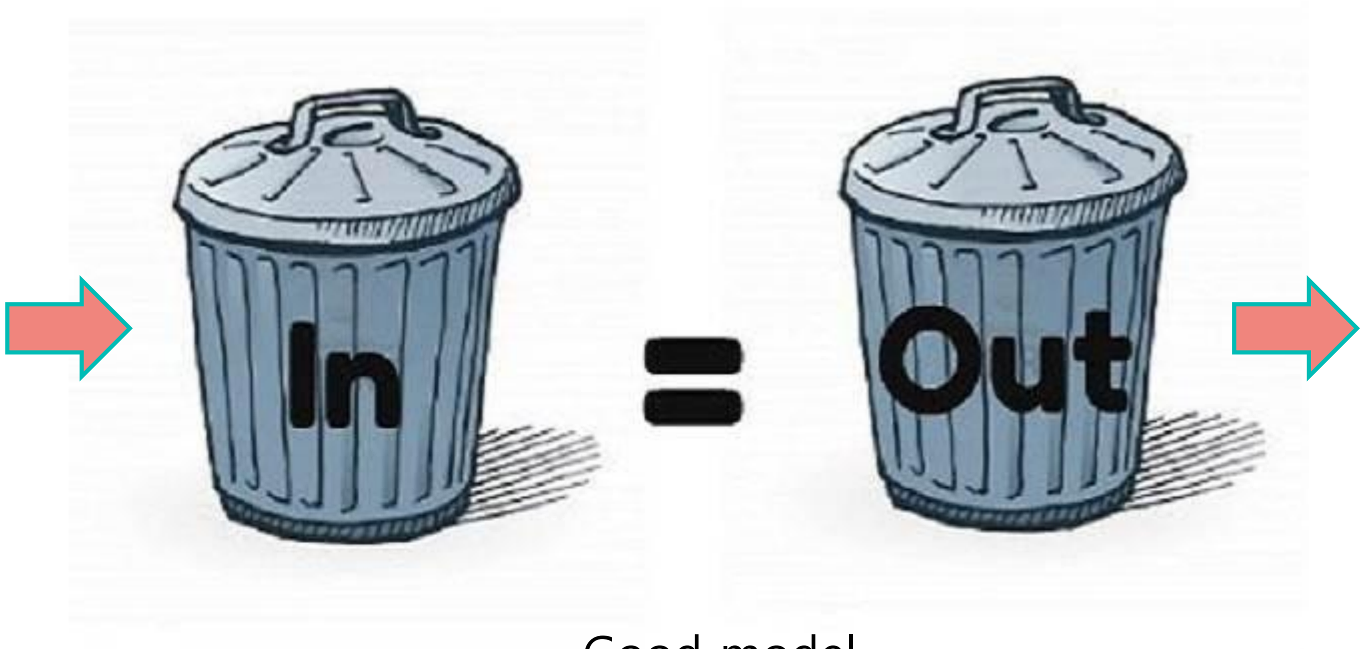
- Criticisms of models are generally criticisms of the messy nature of decision-making, not models themselves

"Garbage in, Garbage out"

Bad model
(e.g. too simple or inadequate representation)

Good empiric data

Poor/Garbage data



Garbage Results

Good model

Understanding the support priorities (first 5 years)

- Establishment of the global TB modeling consortium to develop End-TB strategy in the Korean Peninsula
- Development and execution of key evidence generation agenda for developing engagement for TB in N. Korea
- Iterative consortium meetings & global stakeholder engagement in the strategic development

Initial Engagement (year 6-10)

- [Where Possible] N. Korean stakeholder engagement in the initial scale-up planning for evidence-based implementation
- Call for an action – recruitment of global implementing partners (w/ experience in TB) to executive specific components of the evidence-based TB engagement strategy for N. Korea
- Execution of TB model-based TB control strategy through rapid scale-up key strategies (mobile solutions for community-based interventions alongside of infrastructural development)
- Generate implementation evidence and update TB modeling to inform longer strategies

Mid/Long-term Engagement (year 11 and beyond)

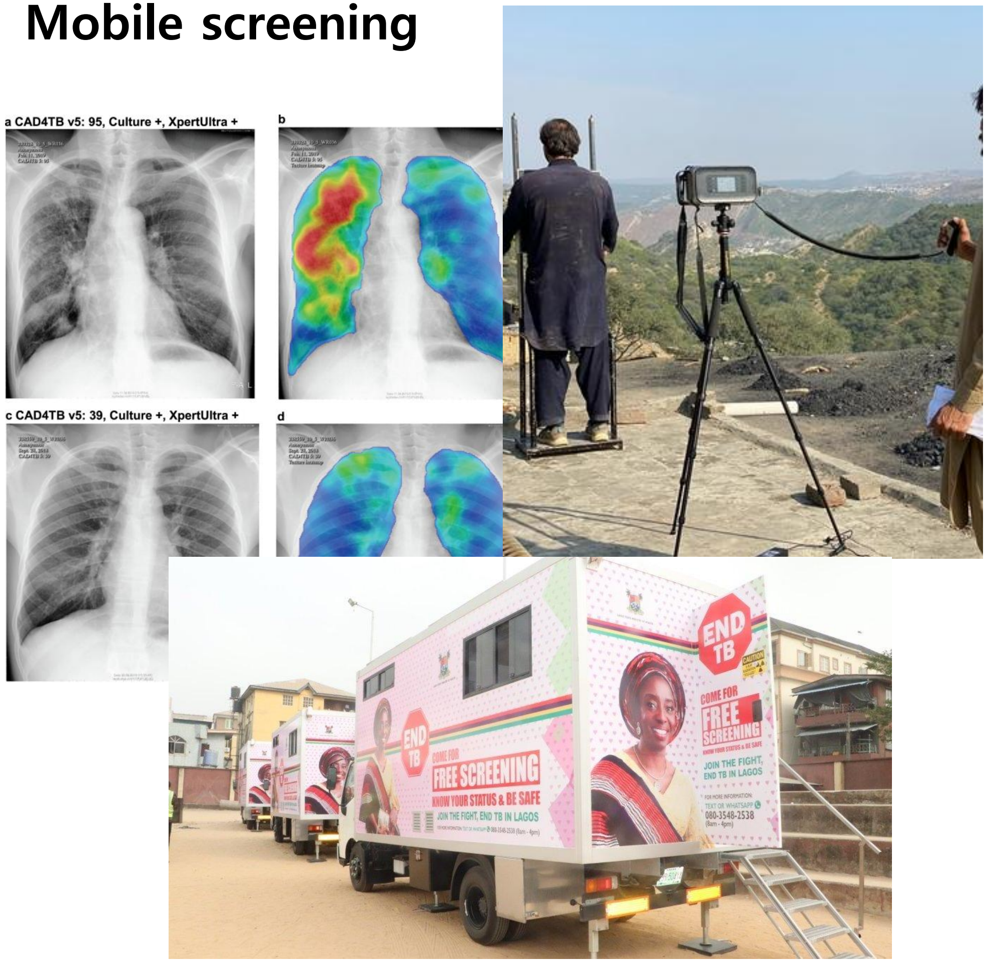
- Review and re-strategize long-term TB control policy and efforts for N. Korea
- Optimize TB case finding and service delivery through operational research
- Optimization of TB service integration alongside modernization of health systems
- Reassessment of TB care service delivery gaps and inclusion of post-TB care
- Improved research cooperation and identify research opportunities to improve TB disease burden and health systems components relevant for TB
- Develop longer term 'TB free' Korean Peninsula strategy alongside the health systems strengthening
- Strengthen the global engagement in the Korean Peninsula

Development, Adoption & Implementation of Evidence-based Policy and Program Delivery

Some food for thought

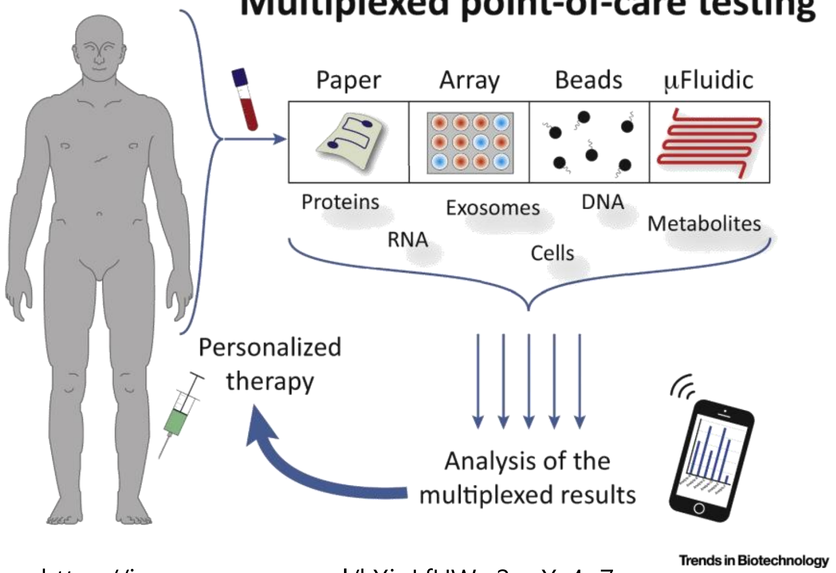
Strengthening laboratory system through vertical vs. horizontal approach

Mobile screening


a CAD4TB v5: 95, Culture +, XpertUltra +
b
c CAD4TB v5: 39, Culture +, XpertUltra +
d
END TB
COME FOR FREE SCREENING
KNOW YOUR STATUS & BE SAFE
JOIN THE FIGHT, END TB IN LAGOS

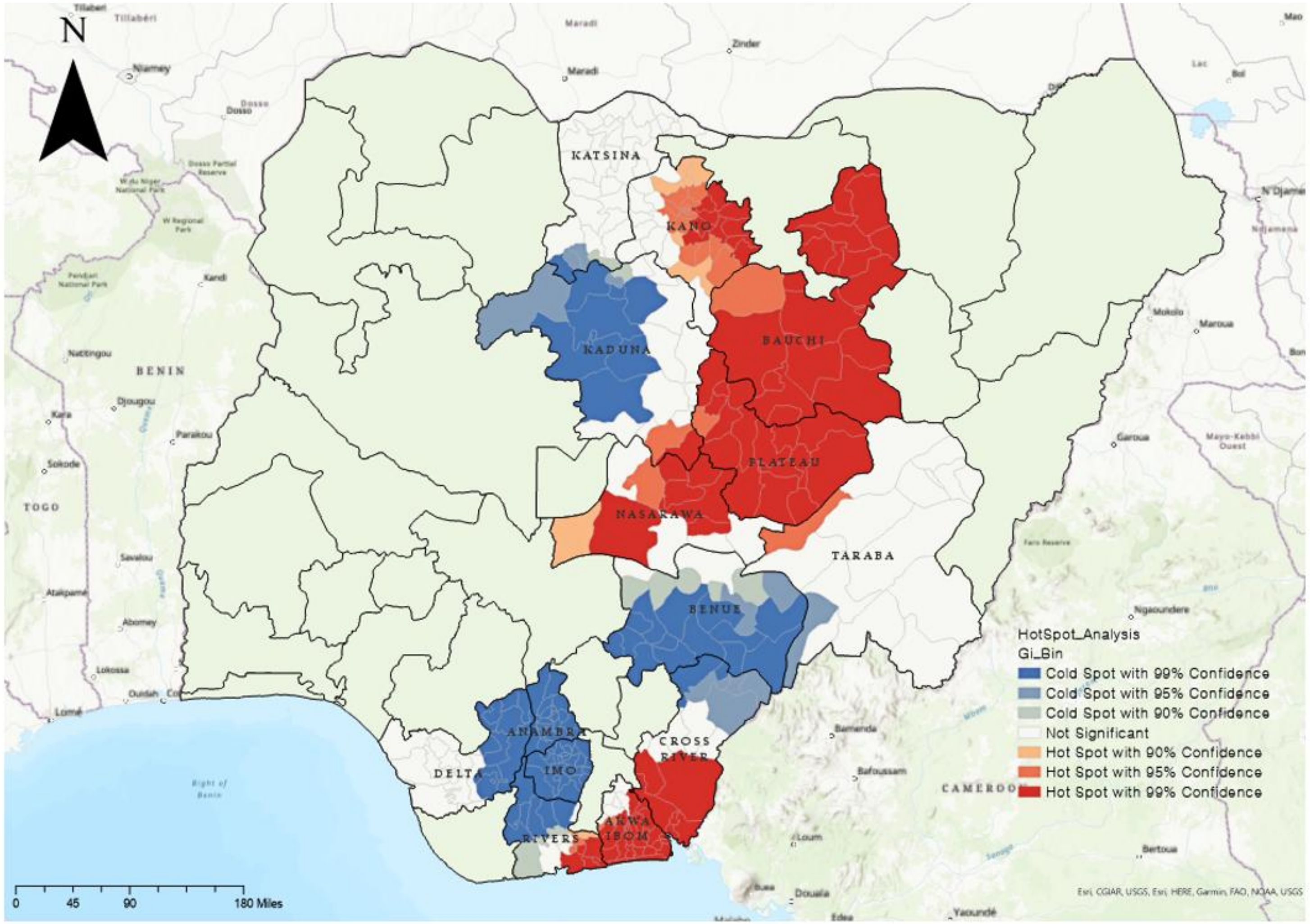
Initially for TB, but extendable to other diagnoses

BIONEER
M10


Multiplexed point-of-care testing
Paper
Array
Beads
µFluidic
Proteins
RNA
Exosomes
Cells
DNA
Metabolites
Personalized therapy
Analysis of the multiplexed results
Trends in Biotechnology

https://images.app.goo.gl/kXjqLfUWw2egXz4p7

AI-Hotspot mapping


N
KATSINA
KANO
KADUNA
BAUCHI
PLATEAU
NASARAWA
TARABA
BENUE
ANAMBRA
IMO
DELTA
RIVERS
AKWA IBOM
CROSS RIVER
BENIN
TOGO
CAMEROON
HotSpot_Analysis
Gi_Bin
Cold Spot with 99% Confidence
Cold Spot with 95% Confidence
Cold Spot with 90% Confidence
Not Significant
Hot Spot with 90% Confidence
Hot Spot with 95% Confidence
Hot Spot with 99% Confidence
0
45
90
180 Miles
Esri, CGIAR, USGS, Esri, HERE, Garmin, FAO, NOAA, USGS

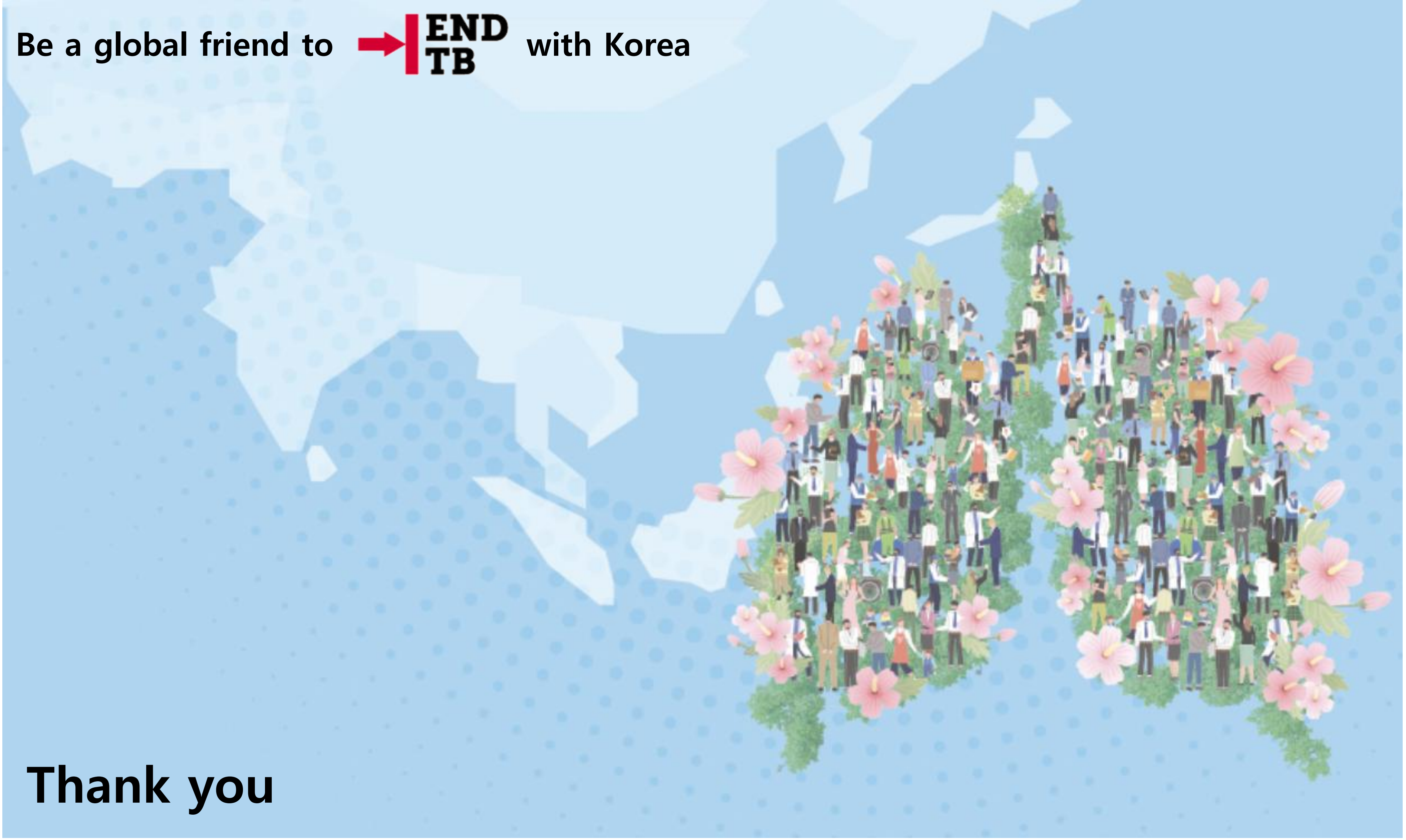
Benefits in TB ACF

1. Improved operational efficiency
2. Improve program yields (in case finding)
3. Improved cost-efficiency & effectiveness
4. Improved decision in prioritizing areas for TB service network strengthening

Potential challenges and limitations

1. Data availability (reliance on routine data – disease surveillance infrastructure level dependent)
2. Methods used to assess 'hot' spots (spatial homogeneity → patient movement not reflected)
3. Screening success depends on patient and community acceptance → outreach should always include community programs to reduce disease stigma, education for awareness & risk communication

Ogbudebe C, Jeong D, Odume B, Chukwuogo O, Dim C, Useni S, Okuzu O, Malolan C, Kim D, Nwariaku F, Nwokoye N, Gande S, Nongo D, Eneogu R, Odusote T, Oyelaran S, Chijioke-Akaniro O, Nihalani N, Anyaike C, Gidado M
Identifying Hot Spots of Tuberculosis in Nigeria Using an Early Warning Outbreak Recognition System: Retrospective Analysis of Implications for Active Case Finding Interventions
JMIR Public Health Surveill 2023;9:e40311



Be a global friend to END TB with Korea

Thank you