Online Appendix 4A.

Analysis of the Global Health Cost Effectiveness Analysis Registry

Methods

1. Data Base

Chapter 4 used the Global Health Cost Effectiveness Analysis Registry to analyze the cost-effectiveness evidence of noncommunicable disease (NCD) preventions. The Registry comprises a comprehensive list of cost-effectiveness analysis studies, showing incremental cost-effectiveness ratio (ICER), or, more specifically, the cost per disability adjusted life years (DALY) averted, of included studies from all over the world.

We obtained a part of the database from the Center for Evaluation of Value and Risk in Health at Tufts Medical Center.[1] Our data was restricted to interventions that were either "cost-effective (ICER is less than per capita gross domestic product per DALY)" or "Best Buys (ICER is less than 100 international dollars)", which was sufficient given that our purpose was to list NCD preventive interventions that are "cost-effective" or "Best Buys".

2. Types of Intervention

From the database of health interventions in the Registry (with total 5,319 ICER values), we selected interventions for NCD prevention, grouping them into eight categories following the WHO's list of "Best Buys" interventions – namely: tobacco, alcohol, unhealthy diet, physical activity, cardiovascular disease, diabetes, cancer, and chronic respiratory diseases. Mental

[1] Center for Evaluation of Value and Risk in Health (CEVR). *Global Health Cost Effectiveness Analysis Registry* (Boston, MA: CEVR, Tufts Medical Center, 2019), http://healtheconomics.tuftsmedicalcenter.org/ghcearegistry/

health was added to this list as per an agreement amongst the group of experts who were involved in this book.

3. Search Terms

In selecting evidence from cost-effectiveness analysis of NCD preventive interventions in the Registry, we used the following search terms, outlined in Box 4A.1. We searched them in the columns named "Article Title", "Intervention Phase", "Intervention Paragraph", and "Target population" in the database.

Box 4A.1 Search terms for evidence of NCD preventive interventions by intervention type

Intervention type	**Search terms**
Reduce tobacco use	smoke / smoking / smoker / tobacco / cigarette / nicotine
Reduce harmful use of alcohol	drink / drinking / alcohol
Reduce unhealthy diet	diet / dietary / food / fat / salt / sodium / sugar / snack / fast food / junk food / vegetable / fruit / nutrition / gastric banding / obesity
Increase physical activity	physical activity / physical inactivity / public transport / walking / bicycle / open space / life style / obesity / exercise
Prevent cancer	cancer / neoplasm / PV / mammography / hepatitis B immunization
Prevent cardiovascular diseases	cardiovascular / heart disease / hypertension / atrial fibrillation / blood pressure / cholesterol / stroke
Prevent diabetes	diabetes
Prevent chronic respiratory disease	chronic respiratory / pulmonary / pneumoconiosis / asthma / lung
Prevent mental ill-health	mental / mental disorders / behavioral disorders / stress disorder / anxiety disorder / attention deficit hyperactivity disorder / bipolar disorder / panic disorder / use disorder / schizophrenia / depression / depressive / antidepressant / psychiatry / nervosa / conduct disorder / dysthymia / autism / Asperger / intellectual disability

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

4. Operational Definition of "NCD prevention"

We included any primary prevention, secondary prevention, and combinations of prevention, screening and treatment, but excluded tertiary prevention and treatment. We excluded any

health system/delivery reforms such as construction of new medical/health center, change in coverages of health insurance or improvements of hospital managements.

5. Screening

Once the term search was completed, one investigator (Arisa Shichijo) screened the interventions accordingly to the operational definition of NCD prevention. This process was conducted through consultation with another investigator (Tazeem Bhatia).

6. Presenting and reporting the results

Table 4A.1

Following the WHO's guidance on "Best Buy" interventions, an NCD prevention intervention is defined as "Best Buy" if the value of the incremental cost-effectiveness ratio (ICER) is less than 100 international US dollars as of 2017 per disability-adjusted life years (DALY) averted. An intervention is considered to be "cost-effective" if the ICER is less than a gross domestic product (GDP) per DALY averted or it is cost-saving thus generating a saving rather than cost per life year saved.

Some studies examine cost-effectiveness of combined interventions (e.g., tax alongside mass media campaign). In Table 4A.1, such interventions are double-counted in calculating the number ICERs in each interventional category.

An intervention type is located in the 'others' category if the total number of ICERs relating to the intervention type was less than three, and if WHO's list of "Best Buys" does not have that type of intervention.

The number of studies here is referred to as the number of incremental cost-effectiveness ratios (ICER) found in the Global Health CEA Registry database. Note that a single study may report multiple numbers of ICER values - the number of scientific research papers is presented in parenthesis next to the number of ICER values.

Table 4A.1: Number of studies by ICERs representing evidence of "Best Buy" NCD preventive policies

	Type of intervention	Cost Savings (Δcost < 0)	Best Buys (ICER < 100i$/DALY)	Cost Effective (ICER < 1*GDPpc/DALY)
Reduce tobacco use	Increase excise taxes and prices	1 (1)	10 (3)	34 (6)
	Graphic Health warnings on tobacco packages	1 (1)	2 (2)	8 (3)
	Ban of tobacco advertisement	0	6(1)	25 (5)
	Eliminate exposure to second-hand smoking in public/indoor areas	0	6(1)	28 (5)
	Mass media campaigns	1 (1)	8 (3)	14 (5)
	Tobacco cessation program	0	9 (1)	29 (9)
	Brief advice	0	5 (1)	7 (2)
	Others	1(1)	1 (1)	2(2)
	Total	4 (1)	30 (4)	85 (14)
Reduce the harmful use of alcohol	Taxation	7 (4)	8 (5)	75 (9)
	Regulation of alcohol advertisement	1 (1)	1 (1)	55 (5)
	Restrictions on availability of retailed alcohol (e.g. reducing hours of sales)	1 (1)	1 (1)	29 (5)
	Enforcement of drink-driving laws and roadside testing	0	1 (1)	14 (4)
	Physician's consultation	0	1 (1)	41 (4)
	Enforcement on minimum age for drinking	0	0	1 (1)
	Others	2 (2)	2 (2)	3 (2)
	Total	11 (5)	14 (7)	128 (10)

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

Table 4A.1 (*continued*): Number of studies by ICERs representing evidence of "Best Buy" NCD preventive policies

	Type of intervention	Cost Savings (Δcost < 0)	Best Buys (ICER < 100i$/DALY)	Cost Effective (ICER < 1*GDPpc/DALY)
Reduce unhealthy diet	Salt reduction	2 (2)	40 (5)	192 (7)
	Mass media campaign to encourage healthy diet	0	4 (1)	11 (4)
	Replace trans-fats through reformulation, labelling or legal limits	2 (1)	2 (1)	3 (1)
	Taxation on sugar-sweetened beverages	3 (3)	3 (3)	5 (4)
	Encourage to take more fruits and vegetables through program, labelling or discounted prices	1 (1)	1 (1)	8 (4)
	Implement nutrition labelling	1 (1)	1 (1)	1 (1)
	Education program based on family, school or community	0	0	4 (3)
	Targeted individual dietary advice or counselling	0	0	2 (1)
	Gastric banding	2 (2)	2 (2)	4 (3)
	Others	3 (2)	3 (2)	7 (4)
	Total	14 (8)	52 (11)	223 (20)
Increase physical activity	Community education and awareness campaign for physical activity	1 (1)	1 (1)	2 (2)
	Physician's consultation	0	0	2 (2)
	Improve the access to public transport	0	0	0
	Provide public open space to support walking	0	0	1 (1)
	Others	2 (2)	2 (2)	17 (6)
	Total	3 (2)	3 (2)	25 (9)

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

Table 4A.1 (*continued*): Number of studies by ICERs representing evidence of "Best Buy" NCD preventive policies

	Type of intervention	Cost Savings (Δcost < 0)	Best Buys (ICER < 100i$/DALY)	Cost Effective (ICER < 1*GDPpc/DALY)
Prevent cardiovascular diseases	Pharmacotherapies	12 (4)	22 (6)	146 (16)
	Screening through blood pressure measurement, cholesterol testing or genetically testing	1 (1)	1 (1)	12 (5)
	Education program	1 (1)	3 (2)	20 (4)
	Others	19 (2)	19 (2)	24 (3)
	Total	31 (6)	41 (8)	179 (19)
Prevent diabetes	Pharmacotherapies	0	0	5 (1)
	Screening	2 (1)	2 (1)	10 (4)
	Blood pressure, blod sugar or glycemic control	5 (1)	5 (1)	13 (2)
	Others	0	0	1 (1)
	Total	7 (2)	7 (2)	24 (7)
Prevent chronic respiratory disease	Prevention of exacerbations of COPD through influenza vaccine	0	0	3 (2)
	Total	0	0	3 (2)

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

Table 4A.1 (*continued*): Number of studies by ICERs representing evidence of "Best Buy" NCD preventive policies

	Type of intervention	Cost Savings (Δcost < 0)	Best Buys (ICER < 100i$/DALY)	Cost Effective (ICER < 1*GDPpc/DALY)
Prevent cancer	Cervical cancer: Vaccination against human papillomavirus	0	77 (6)	403 (15)
	Cervical cancer: Screening	0	1 (1)	38 (7)
	Breast Cancer: Screening with mammography	1 (1)	1 (1)	85 (7)
	Breast Cancer: The other types of screening includig clinical breast examination (CBE)	0	0	54 (5)
	Breast Cancer: Basic/Mass media awareness raising	0	0	11 (4)
	Liver cancer: Hepatitis B immunization	0	1 (1)	1 (1)
	Colorectal cancer: Screening	0	0	8 (2)
	Others	0	0	1 (1)
	Total	1 (1)	80 (9)	561 (27)
Improve mental health	Pharmacotherapies	11 (2)	11 (2)	319 (18)
	Talking therapies and psychotherapies	2 (2)	3 (3)	2 (17)
	Social support including family managements and case managements	3 (1)	4 (2)	3 (6)
	Screening	1 (1)	1 (1)	1 (4)
	Others	2 (2)	2 (2)	2 (2)
	Total	14 (5)	16 (7)	393 (28)

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

Note: In total, 5,319 ICERs were found in the Global Health CEA Registry. The total number of ICERs found in each NCD interventional categories – including "Best Buys", cost saving interventions, cost effective interventions, and other cost ineffective interventions – is as follows: 88 in "reduce tobacco use"; 129 in "reduce harmful use of alcohol"; 258 in "reduce unhealthy diet"; 33 in "increase physical activity"; 640 in "prevent cancer"; 202 in "prevent cardiovascular diseases"; 32 in "prevent diabetes"; 3 in "prevent chronic respiratory disease"; and 413 in "improve mental health". The number of scientific research papers is presented in parenthesis next to the number of ICER values.

Table 4A.2

In Table 4A.2, we summarize the number of studies of "Best Buys" interventions (i.e., the number of ICER values which are less than 100 international dollars) by country and region, to show the geographic distribution of evidence.

Table 4A.2: Number of ICER values with ICER <100i$ by country and region

Reduce tobacco use		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	Vietnam	13
	Tanzania	3
Regional	East Asia and Pacific	2
	Europe and Central Asia	2
	Sub-Saharan Africa	2
	Middle East and North Africa	2
	South Asia	2
	Latin America and Caribbean	1
Others*	LMICs	2
	world	1

Reduce the harmful use of alcohol		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	Australia, Denmark	5
	Netherlands, Mexico	1
Regional	WHO South East Asia D	2

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

Table 4A.2 (*continued*): Number of ICER values with ICER <100i$ by country and region

Reduce unhealthy diet		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	Australia	9
	Argentina, United States	2
	Central African Republic, Afghanistan, Cambodia, Congo, Dem. Rep., Cote d'Ivoire, Algeria, Egypt, Georgia, Haiti, Indonesia, Iran, Kyrgyz Republic, Lao PDR, Sri Lanka, Madagascar, Moldova, Mongolia, Myanmar, Nepal, Korea, Philippines, Syrian Arab Republic, Thailand, Tajikistan, Ukraine, Uzbekistan, Vietnam	1
Regional	WHO South East Asia D	4
	WHO Europe A	3
	WHO America B	3
	European Union	2

Increase Physical Activity		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	Australia	3

Prevent diabetes		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	India,	2
	Israel, China, Ghana, Mexico, South Africa	1

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

Table 4A.2 (*continued*): Number of ICER values with ICER <100i$ by country and region

Prevent cardiovascular diseases		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	United States	18
	Thailand	11
	Ethiopia	3
	Australia, Israel,	2
	Argentina	1
Regional	WHO South East Asia D	4
	WHO America B	1

Prevent cancer		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	India	4
	Armenia, Bangladesh, Bhutan, Cambodia, Myanmar, Nepal, Vietnam	3
	Angola, Benin, Bolivia, Burundi, Cameroon, Cote d'Ivoire, Ethiopia, Gambia, Ghana, Guinea-Bissau, Haiti, Kenya, Kyrgyz Republic, Madagascar, Papua New Guinea, Solomon Islands, Somalia, Tanzania, Togo, Zambia	2
	Belize, Brazil, Colombia, Comoros, Costa Rica, Cuba, Iran, Islamic Rep., Malawi, Mauritania, Paraguay, Sao Tome and Principe, Senegal, Ukraine, Venezuela, RB.	1
Regional	LIMCs	1

Improve mental health		Best Buys (ICER < 100i$/DALY or Cost Savings)
Country specific	Vietnam	10
	Australia	4
	Netherlands, Kenya	1

(Data source: The Global Health Cost Effectiveness Analysis Registry, 2019/03/23)

Note: No evidence of “Best Buys” for the interventional category “prevent chronic respiratory disease” was found in the Global Health CEA Registry.